

International Journal of Computational and Engineering

JUNE 2020 VOLUME5 NUMBER2

Publisher: ACADEMIC PUBLISHING HOUSE
Address: Quastisky Building, Road Town, Tortola, British Virgin Islands
UK Postal Code: VG1110

E-mail: editorial@ij-ce.com
www.ij-ce.com



ACADEMIC PUBLISHING HOUSE

CONTENTS

ANALYSIS ON THE LOOPHOLES AND COUNTERMEASURES OF COMPUTER NETWORK SECURITY UNDER THE BACKGROUND OF "INTERNET+"	1
APPLICATION ANALYSIS OF AUTOMATIC GENERATION CONTROL TECHNOLOGY IN NEW ENERGY GRID CONNECTION.....	4
BIOGEOGRAPHIC DISTRIBUTION MODULE WITHIN THE NATIONAL SPECIAL BIOLOGICAL RESOURCES MONITORING AND TRACING SYSTEM.....	7
CONTROL SYSTEM DESIGN OF 15 TON ALUMINUM LIQUID REFINING FURNACE BASED ON PLC.....	12
QUANTUM WATERMARKING SCHEME BASED ON SELECTIVE QUBIT EMBEDDING.....	15
RESEARCH ON ENERGY SAVING IN THE OPERATION OF CENTRAL AIR CONDITIONING SYSTEM.....	19
VIRTUAL SIMULATION DESIGN OF ROBOT PALLETIZING WORKSTATION BASED ON ROBOT STUDIO.....	22
APPLICATION OF NEURAL NETWORK BASED ON PYRAMID MODULE IN IMAGE SEMANTIC SEGMENTATION.....	25
FABRICATION OF WO ₃ NANOFILMS BY W-ION IMPLANTATION AND SUBSEQUENT THERMAL ANNEALING.....	30
THE RESEARCH ABOUT DIFFERENT VARIETIES OF MUSHROOMS' EFFECTS ON THE ABSORPTION OR ENRICHMENT OF THREE KINDS OF HEAVY METALS AND THE SAFETY LIMIT VALUE.....	33
AN EMPIRICAL ANALYSIS OF THE EFFECT OF RURAL INDUSTRIAL STRUCTURE TRANSFORMATION ON IMPROVING RURAL ISSUES.....	37
AN EMPIRICAL ANALYSIS OF THE EFFECTIVENESS OF CHINA'S MONETARY POLICY TRANSMISSION MECHANISM BASED ON VAR MODEL.....	43
ANALYSIS OF CHINESE RETAIL PRICE CHARACTERISTICS AND SHORT-TERM FORECAST BASED ON ARMA MODEL.....	49
ANALYSIS OF THE RELATIONSHIP BETWEEN SPORTS AND ACADEMIC PERFORMANCE BASED ON DECISION TREE CLASSIFICATION.....	54
COAL PRICE PREDICTION MODEL BASED ON PRINCIPAL COMPONENT ANALYSIS AND NEURAL NETWORK.....	60
COMPARISON OF PREDICTION OF TIME SERIES DATA BY STEPWISE REGRESSION AND HOLT LINEAR TREND.....	65
EVALUATION OF SUSTAINABLE DEVELOPMENT IN ANHUI PROVINCE BY TOPSIS-DEA METHOD BASED ON ENTROPY WEIGHT IMPROVEMENT.....	70
QUANTITATIVE ANALYSIS OF GARBAGE CLASSIFICATION BASED ON LEAST SQUARE METHOD.....	77
QUANTITATIVE ANALYSIS OF WASTE CLOTHING RECYCLING BASED ON THE PERSPECTIVE OF RECYCLING BOX.....	82
QUANTITATIVE ANALYSIS ON THE DEVELOPMENT POTENTIAL OF RURAL COMMERCIAL PENSION INSURANCE IN SIX PROVINCES OF CENTRAL CHINA.....	87
RESEARCH ON ANHUI PROVINCE CPI INDEX BASED ON RIDGE REGRESSION ANALYSIS.....	92
THE EFFECT OF ACCELERATED DEPRECIATION POLICY OF FIXED ASSETS ON CORPORATE VALUE.....	97

THE FITTING OF NATIONAL DEBT TERM STRUCTURE BASED ON THE CHANGES OF NS AND NSS MODELS.....	103
THE IMPACT OF FOREIGN DIRECT INVESTMENT ON THE UPGRADING OF CHINA'S INDUSTRIAL STRUCTURE BASED ON THE VAR MODEL.....	109
VOLATILITY ANALYSIS OF SMALL AND MEDIUM BOARD MARKET BASED ON ARMA-EGRACH MODEL.....	116
METROLOGICAL ANALYSIS OF FACTORS AFFECTING ALLERGIC DISEASES BASED ON LOGISTIC REGRESSION.....	121
RESEARCH ON THE RELATIONSHIP BETWEEN PHYSICAL EXERCISE AND ACADEMIC PERFORMANCE BASED ON REGRESSION MODEL.....	128
APPLICATION OF INTELLIGENT TECHNOLOGY IN MECHANICAL ENGINEERING AUTOMATION.....	135
ANALYSIS OF THE CURRENT SITUATION OF FAULT PATTERN RECOGNITION FOR ROLLING BEARING.....	137
ANALYSIS OF THE INFLUENCE OF DIGITAL SIGNAL PROCESSING ON ELECTRONIC MEASUREMENT AND INSTRUMENT.....	140
APPLICATION OF ARTIFICIAL INTELLIGENCE IN MECHANICAL DESIGN AND MANUFACTURE.....	143
ON THE STRUCTURAL DESIGN AND CONSTRUCTION FRAMEWORK OF POST CAST STRIP IN CONSTRUCTION ENGINEERING.....	146
ANALYSIS OF THE VIRTUAL CHARACTERISTICS OF THREE-DIMENSIONAL ANIMATION CREATION ELEMENTS.....	149
CNKI-BASED VISUALIZATION ANALYSIS OF RESEARCH LITERATURE OF MY COUNTRY INDUSTRIAL COLLEGE.....	152
RESEARCH ON YOGA CORRECTION SYSTEM BASED ON DEEPPOST POSE ATTITUDE PREDICTION RECOGNITION ALGORITHMS.....	155
THE FULL CHARACTERIZATION OF THE GRAPHS WITH A LAPLACIAN EIGENVALUE OF MULTIPLICITY $N - 3$	158
A STUDY ON THE FORMATIVE ASSESSMENT REFORM OF COMPREHENSIVE ENGLISH UNDER THE NETWORK LEARNING SPACE.....	163
RESEARCH AND APPLICATION OF VR SITUATIONAL NARRATIVE TECHNIQUES IN HISTORY, SCIENCE EDUCATION, MYTHOLOGY CARTOONS.....	167
APPLICATION OF MODEL-BASED REINFORCEMENT LEARNING IN ADAPTIVE SOFTWARE SYSTEM PLANNING.....	171
THE TEACHING DESIGN AND TEACHING EFFECT OF SPOC IN COLLEGES AND UNIVERSITIES IN CHINA.....	174
RESEARCH ON FAULT DIAGNOSIS AND ANALYSIS OF SF6 GAS-INSULATED TRANSFORMERS	176
RESEARCH ON EDP PROBLEMS.....	178
KEY TECHNOLOGY DESIGN OF LBS APPLICATION BASED ON ANDROID PLATFORM.....	181
ENUMERATION FORMULAS FOR THE STANDARD YOUNG TABLEAUX OF APPROXIMATE 4 AND H SHAPES.....	184
RESEARCH ON THE USE AND DISSEMINATION OF INTERNET + PUBLIC WELFARE MODEL IN CHINA.....	189
REVIEW AND PROSPECT OF GREEN ROAD RESEARCH AT HOME AND ABROAD.....	192
ANALYSIS ON THE RISK OF MONEY LAUNDERING AND ITS COUNTERMEASURES UNDER P2P NETWORK LENDING MODE.....	195
THE APPLICATION OF PRIVATE CLOUD IN THE INFORMATION CONSTRUCTION OF UNIVERSITIES.....	199

PREDICTION ANALYSIS OF COAL PRICE IN QINHUANGDAO PORT BASED ON REGRESSION METHOD.....	203
RESEARCH ON THE COST CONTROL OF MANUFACTURING ENTERPRISES UNDER THE BACKGROUND OF EPIDEMIC PREVENTION AND CONTROL NORMALIZATION.....	206
RESEARCH ON FINANCIAL AGGLOMERATION DEGREE BASED ON ENTROPY WEIGHT TOPPSIS METHOD: TAKING 101 COUNTIES IN HEBEI PROVINCE AS EXAMPLE.....	210
USING REMOTE SENSING FOR CLASSIFYING PLANTING AREA AND AREA EXTRACTION..	217
COMPARISON OF REDUCTION OF ILMENITE CONCENTRATE WITH HYDROGEN AND CARBON MONOXIDE.....	220
A NEW BELIEF INTERVAL-VALUED SOFT SET THEORETIC APPROACH TO DECISION MAKING PROBLEMS.....	226
RESEARCH ON QUALITY MANAGEMENT OF NEW ENERGY VEHICLE DEVELOPMENT PROCESS.....	233
DISCUSSION ON THE DEVELOPMENT DIRECTION OF COMPUTER MANAGEMENT INFORMATION SYSTEM.....	235
APPLICATION OF 3D ANIMATION TECHNOLOGY IN VIRTUAL REALITY PROJECT.....	238
BOOK MANAGEMENT OF APPLIED CHEMISTRY MAJOR IN THE BACKGROUND OF NEW ENGINEERING.....	240
RESEARCH ON THE TEACHING STRATEGY OF CHEMICAL ENGINEERING PRINCIPLE EXPERIMENT UNDER THE CONCEPT OF NEW ENGINEERING.....	242
RESEARCH ON THE RURAL TOURISM TARGETED POVERTY ALLEVIATION MODEL FROM THE PERSPECTIVE OF AGRICULTURAL TOURISM INTEGRATION.....	245
HOW TO ADAPT COLLEGE PHYSICAL EDUCATION TO THE DEVELOPMENT OF THE NETWORK AGE.....	247
PROGRESS MANAGEMENT SYSTEM OF LARGE BUILDING BASED ON BIM TECHNOLOGY	249
PROBLEMS AND COUNTERMEASURES OF WATER FERTILIZER INTEGRATION TECHNOLOGY IN PRACTICAL APPLICATION.....	251
RESEARCH ON THE LOCATION AND CAPACITY OF DISTRIBUTED POWER SUPPLY IN MICROGRID.....	253
ON THE EDUCATIONAL PATH OF INTEGRATING RED CULTURE INTO COLLEGE STUDENTS' SOCIALIST CORE VALUES.....	255
HEAVY METAL CONTAMINATION AND REMOVAL STRATEGY IN SOLAR GRADE SILICON WAFER PROCESSING.....	257
THE INFLUENCE OF MUSIC EDUCATION ON THE QUALITY EDUCATION OF COLLEGE STUDENTS.....	261
RESEARCH ON THE CONSTRUCTION OF THE CURRICULUM SYSTEM OF NETWORK AND NEW MEDIA MAJOR IN LOCAL COLLEGES AND UNIVERSITIES.....	263
RESEARCH ON CAN BUS FOR AUTOMOTIVE DRIVING CONTROL BASED ON SAEJ1939 PROTOCOL.....	266
DESIGN OF REMOTE AIR COMPRESSOR SAFETY MONITORING BASED ON INTERNET OF THINGS.....	268
RESEARCH ON HYBRID COMPUTING INTELLIGENCE METHOD FOR SOLVING NONLINEAR EQUATIONS.....	270
THE ROLE OF GOVERNMENT IN THE GROWTH OF SMALL AND MEDIUM-SIZED ENTERPRISE CLUSTER ACTIVITIES.....	272
THE CURRENT SITUATION OF COMPUTER INFORMATION NETWORK SECURITY AND ITS COUNTERMEASURES.....	274
RESEARCH ON THE LIFELONG TALENT TRAINING MODEL OF INTERNET AND CONTINUING EDUCATION.....	276

DESIGN BASIS AND APPLICATION OF PASSIVE ULTRA LOW ENERGY CONSUMPTION BUILDING.....	278
THE ENLIGHTENMENT OF ENTERPRISE PARTICIPATING IN THE TRAINING MODE OF ACCOUNTING INFORMATION TALENTS.....	281
HOW TO GIVE FULL PLAY TO THE ROLE OF ENTERPRISES IN SCHOOL ENTERPRISE COOPERATION.....	284
RESEARCH AND DESIGN OF STARCH MOISTURE CONTENT ON-LINE MEASUREMENT SYSTEM.....	286
EFFECT OF OXYGEN VACANCY ON PHYSICAL PROPERTIES OF ORDERED POROUS METAL OXIDE FILMS.....	289
ANALYSIS OF JOINT SPACE-TIME GNSS ANTI-JAMMING ALGORITHM BASED ON SUBSPACE TRACKING.....	291
RESEARCH ON THE REFORM OF COMPUTER EDUCATION COURSE IN COLLEGES AND UNIVERSITIES.....	293
ANALYSIS OF THE CONSTRUCTION OF COMPUTER DATA PROCESSING MODE IN THE AGE OF BIG DATA.....	295
THE ART CHARACTERISTICS OF WANGKOU ANCIENT VILLAGE ANCESTRAL TEMPLE ARCHITECTURE.....	297
CONSTRUCTION TECHNOLOGY OF EXPANSION JOINT IN MICRO EXPLORATION ROAD AND BRIDGE CONSTRUCTION.....	300
DISCUSSION ON THE RECYCLING SYSTEM OF RECYCLED WATER IN CONCENTRATOR... 303	
RESEARCH AND DESIGN ANALYSIS OF COMPUTER HARDWARE VIRTUAL SIMULATION SYSTEM.....	306
APPLICATION OF MULTIMEDIA TECHNOLOGY IN ANIMATION DESIGN.....	308
ENVIRONMENTAL PROTECTION PERFORMANCE AND DEVELOPMENT TREND OF INORGANIC NONMETAL BUILDING MATERIALS.....	310
THE DEVELOPMENT AND APPLICATION OF COMPUTER ARTIFICIAL INTELLIGENCE TECHNOLOGY.....	313
RESEARCH ON THE APPLICATION OF BIG DATA AND INTERNET OF THINGS TECHNOLOGY IN SMART CITY.....	315
APPLICATION OF BLOCKCHAIN TECHNOLOGY IN CROSS-BORDER E-COMMERCE.....	319
ON THE CULTIVATION OF CREATIVE THINKING IN THE COURSE OF VISUAL COMMUNICATION DESIGN.....	321
TECHNICAL SCHEME AND RELIABILITY ANALYSIS OF POWER SUPPLY AND DISTRIBUTION FOR HIGH-RISE BUILDINGS.....	323
ANALYSIS OF THE APPLICATION OF DMAIC CYCLE IN THE COURSE TEACHING REFORM OF "SHIP MANAGEMENT" IN TURBINE ENGINEERING.....	325
RESEARCH PROGRESS AND APPLICATION ANALYSIS OF COMPUTER ARTIFICIAL INTELLIGENCE TECHNOLOGY.....	327
RESEARCH ON THE ECOLOGICAL EVALUATION OF TRADITIONAL VILLAGES IN THE PEARL RIVER DELTA.....	329
STUDY ON COMPETENCY OF MASS BASKETBALL COACHES.....	331
RESEARCH ON THE APPLICATION PROSPECT OF INTELLIGENT LOGISTICS UNDER INTERNET PLUS.....	335
APPLICATION OF AUTOMATIC FOAM DELIQUIFICATION TECHNOLOGY IN NATURAL GAS WELLS.....	337
ANALYSIS ON THREE WOMEN'S FATE IN ABSALOM, ABSALOM! FROM THE PERSPECTIVE OF PATRIARCHAL CULTURE.....	341

Analysis on the Loopholes and Countermeasures of Computer Network Security under the Background of "Internet+"

Bing Wang

Zibo Vocational Institute, Zibo, Shandong, China

Abstract: As the most cutting-edge emerging technology, the popularization and promotion of "Internet +" has changed our working style and living habits, and the convenient sharing of information has enriched our horizons and improved our work efficiency. However, computer network security loopholes pose a serious threat to the stability of the network system and the protection of important information. A little carelessness will cause heavy losses to our work and life. Therefore, we should pay attention to the computer network security loopholes and actively adopt countermeasures, and solve the hidden dangers by improving the computer protection system, establishing the hacker defense system, building the automatic network security platform, and doing a good job in data disaster recovery and backup system to solve security risks and ensure the normal and stable operation of the system.

Keywords: Computer virus; Computer network security; Hacker defense mechanism

1. INTRODUCTION

Since the 1990s, computer has been widely used for more than 30 years, and its technical level and scope of application have developed by leaps and bounds. Especially under the background of "Internet +", computers have brought sweeping changes to our life and work. While people enjoy the convenience of information sharing, the stability of the system and the protection of information also highlight the importance. How to ensure the network security of personal and unit information, to avoid information leakage or even threats, we need to recognize and prevent potential network security vulnerabilities from the source, to solve the security problems existing in them.

2. TYPES AND INFLUENCING FACTORS OF COMPUTER NETWORK SECURITY VULNERABILITIES UNDER THE BACKGROUND OF "INTERNET+"

2.1 Computer Virus

Computer virus has a variety of characteristics and modes of transmission, but it is essentially a string of malicious code, which makes use of loopholes in computer software and hardware systems to spread and self-copy crazily, and constantly updates and changes with the development of computer technology. The viruses may destroy the system or

steal the user's information, causing serious damage to the user's work and life. In the big data era of the "Internet+", the ways in which computer viruses spread are more diverse and faster, and it is easy to cause a fatal blow to computer network security.

2.2 Malicious Attacks on the Network

There are always loopholes in the system, and the problem of hacker attacks has been accompanied by the use and development of computers. In the context of the "Internet+", with the rapid expansion of the scale and scope of computer network use, a variety of potential system and program vulnerabilities have been discovered and attacked by computer hackers. In the face of high-level hacker attacks, the existing network security identification technology of the computer can not resist, which poses a serious threat to the computer.

2.3 Network Resource Sharing

In the context of the "Internet+", the sharing of information brings great convenience to our lives. Where there is a network, there is information. However, information sharing is a "double-edged sword". While it brings convenience to us, it also has the potential risk of exposing unit and personal information. Either due to system defects or vulnerabilities being exploited by hackers, or because of personal improper settings or operational errors, the information will be released to the public, which will seriously affect people's normal life.

3. THE PROTECTIVE STRATEGY OF COMPUTER NETWORK SECURITY UNDER THE BACKGROUND OF "INTERNET+"

3.1 Perfecting the Computer Hardware and Software Protection System

System protection is the first protection barrier of network security [1]. It is composed of network information encryption technology, system update and setting, and firewall technology, which can effectively prevent viruses and malicious software from invading and destroying the network system. Among them, encryption technology is the core of network information security technology. Under the background of "Internet+", by encrypting network database and VPN, it can protect the core secrets of units and individuals, improve the strength of network security protection, and reduce the potential risk of network security; system updates and settings can fill system loopholes to the maximum extent and

effectively prevent the installation of malicious software and illegal operation of files. According to the security norms set in advance, the firewall technology filters and screens all the information, quickly identifies harmful information and blocks it out of the system, thus effectively resisting the invasion and destruction of the vast majority of network viruses to the system.

3.2 Strengthening Loophole Scanning and Establishing Hacker Defense Mechanism

At present, hackers take advantage of potential loopholes in the system to launch attacks, which cause the greatest damage to computer network security [2]. Therefore, it is particularly important to strengthen vulnerability scanning and establish a hacker defense mechanism. First of all, strengthen the construction of hacker intrusion risk detection system, through loophole scanning technology, use various network detection means to intelligently investigate unreasonable behaviors and loopholes in computer network systems, and then find and fill loopholes through intelligent protection and automatic monitoring to achieve the partition of hacker intrusion and play an effective role in protection. At the same time, the hacker attack plan should be established, and the specific issues that may happen after the hacker invasion should be analyzed one by one to form a specific response strategy. By improving the understanding of the hacker attack technology, the system security should be strongly guaranteed.

3.3 Building an Automated Network Security Platform

With the rapid development of computer network, the corresponding operation program is becoming more and more complex. It is inevitable that human brain will make mistakes in complex operation, which will affect system safety. Therefore, for conventional network attacks, it is necessary to build an automated network security platform to manage and resist. First of all, by selecting powerful antivirus software and setting reasonable security management programs, we can automatically trigger the defense against conventional network attacks and ensure the security of the computer network; secondly, we should strengthen the optimal setting of access rights, strengthen the identification of operators through operations such as secret key intervention, and carry out intelligent monitoring of the network environment to avoid illegal intrusion by hackers. Third, by regularly locking and controlling the computer programs with hidden dangers, we should do a good job in the maintenance and inspection of the network ports to effectively prevent the hidden dangers of the computer network.

3.4 Strengthening the Training of Technicians and the Supervision of Computer Systems

Computer network security practitioners must strengthen the training of security awareness, form a good awareness of loophole investigation, standardize

their own behavior when operating the computer system, and ensure the security of the computer network with the help of intelligent security system. First of all, in the face of the rapid updating of computer knowledge and the ever-changing risks, network security practitioners must continue to train and learn in order to be competent for the post; secondly, in order to avoid the loss caused by human error, in addition to establishing an automatic network security platform, a post responsibility system should also be established to make technicians more cautious in the operating system. Thirdly, combining with the background of the "Internet+" era, it is necessary to research and formulate the supervision system in the field of computer network security [3], so as to have a higher supervision ability as possible and build a control mechanism for the input program of computer equipment.

3.5 Make a Data Backup and Disaster Recovery System

When the computer network system is facing disaster due to virus intrusion, hacker attack, power outage, network failure, human error operation and other reasons, the data backup disaster recovery system will become the last barrier to protect user data. The traditional backup is to back up the data manually, but its disadvantage is that it can not dynamically and quickly respond to the loss of data. Under the background of "Internet+", the data backup method of cloud computing can be adopted, which is characterized by the interconnection of servers through the Internet and the scattered storage of data in various data centers, which has the characteristics of automatic data backup and real-time sharing.

4. EXAMPLES OF COMPLETE SAFETY PRECAUTIONS

Generally speaking, a complete set of security precautions from top to bottom should include the following five levels:

4.1 Security Control at the Network Level

The network level security control includes: the user level authority guard, who has access to what content; user identity authentication to identify any unauthorized or accidental access to the intruder; authorization guarantee, which guarantees that only authorized communication can establish a link between the client and the server. The primary precaution at this level is the firewall.

4.2 Security Protection at the System Level

System level security protection is to ensure that the entire system is not subject to external invasion. The contents of system-level security control mainly include: who can access the server or what visitors can do; prevention of virus invasion; detecting intruders who intentionally or accidentally break into the system; conducting risk assessment to find defects in system security configuration and the security vulnerabilities. At present, the security measures adopted for the operating system platform include:

using the operating system with higher security intensity; security configuration of the operating system; using security scanning system to check the vulnerability of operating system; strengthening the self-security check ability of legitimate users within the network; improving the technical level of managers.

4.3 Security Precautions at the User Level

The common means of illegal users is to make use of the fragility and omission of the user authentication system to obtain certain rights to realize the illegal authorized access to the target system. Therefore, user-level security is mainly achieved by managing user accounts. The specific way is to set the user function when the user gets the access privilege, or to restrict the user account when their access privilege is no longer valid. At the same time, users' awareness of security should be improved.

4.4 Security Control at the Application Level

Application-level security control mainly refers to the management of password and authorization of application client and server, which is usually realized with the help of professional data access control tools. Data access control tools not only allow users to have appropriate access to their commonly used information bases, but also restrict users to delete, modify or copy information files at will. At the same time, the system administrator can also track the activities of users in the network, discover and reject the intrusion of hackers in time.

4.5 Security Protection at the Data Level

For the network, data security is the most important,

data-level security prevention mainly refers to the protection of data confidentiality and integrity, it is generally achieved through professional data encryption tools such as SHTTP, SHEN, SSL and so on. At the same time, through the establishment of data disaster recovery backup system to ensure the security and recovery of data in extreme cases.

5. CONCLUSIONS

Under the background of "Internet+", computer network security has developed into a comprehensive problem involving many aspects of high technology. Only by understanding the root causes of network security vulnerabilities, can we formulate corresponding countermeasures, take corresponding preventive measures, and finally protect the computer network at different levels, constantly improve the operation ability of technicians, strengthen vulnerability detection technology, and effectively block the intrusion of hackers.

REFERENCES

- [1]Y. Ji, Computer network information security and protection, Computer Products and Circulation, 2020, 07: 29.
- [2]Y. F. Wang and W. Wang, Computer network security issues and countermeasures in the context of big data, Ke Ji Feng, 2020, 15: 110.
- [3]X. H. Ge, Research on the current situation and countermeasures of "Internet +" network information security, Network Security Technology and Application, 2020, 05: 1-2.

Application Analysis of Automatic Generation Control Technology in New Energy Grid Connection

Fei Ma

Department of Electronic and Electrical Engineering, Zibo Vocational College, Zibo, Shandong, China

Abstract: As the penetration rate of new energy sources continues to increase, the installed capacity increases year by year. Based on the specific control methods and control principles of the automatic generation control system (AGC), this paper analyzes the solution to the stable operation of the power system after the new energy is connected to the grid. **Keywords:** New energy; Automatic generation control technology; AGC.

1. INTRODUCTION

In recent years, with the rapid development of the national economy, our power generation is getting larger and larger, and the share of new energy power generation is also increasing, mainly wind power and photovoltaic power generation. Due to the volatility and intermittency of the active power output of wind power and photovoltaic power generation, the grid-connected operation of new energy brings great challenges to the frequency safety of the power grid and has a greater impact on the power system. This requires us to continuously accelerate the development of power system automation to adapt to the challenges brought about by the connection of new energy. At present, the power system is constantly moving towards dispatch automation and intelligence. The power system automation realizes the automatic control, scheduling and management of electric energy production, transmission and management. The automatic power generation control technology combines remote monitoring technology, execution distribution device, and generator set automation device to form an overall closed-loop control system. Through the real-time monitoring and rapid adjustment of the power system frequency, the automatic control of the power output of the generator is realized. At present, the development trend of automatic power generation control in foreign developed countries mainly includes scattered power generation prediction and tracking. Through the automatic power generation control system, the output of the generator set is changed with the change of the load to achieve the purpose of safe and stable operation of the power system. Ensure that the power of the power system can be balanced in real time [1].

2. PRINCIPLE OF AUTOMATIC POWER GENERATION CONTROL SYSTEM

During the operation of the automatic generation

control system (AGC), it is necessary to collect and process the parameters in the control area of the entire power system in real time, including the real-time load change curve, power generation curve and power network situation. At present, the purpose of automatic power generation control invested in power system automation is mainly to solve the problems of power system operation frequency adjustment and load distribution, and to meet the power system power exchange requirements. The power supply frequency is one of the important parameters for the normal operation of the power system. When the total output power of the system power supply and the power consumption are relatively balanced, the power supply frequency remains constant. In the modern automatic power generation control system, it is mainly composed of an energy management system, a remote terminal mechanism, and a unit coordinated control system. It uses a variety of technical means including computer programs, communication technologies, and automatic control technologies to control the entire power generation. The process realizes closed-loop management and control. At the same time, it can accurately execute the dispatching control instructions of the generator set issued by the dispatching control center to accurately control the output of the generator set. The realization of automatic power generation control needs to adjust the output of the generator set by changing the speed of the generator set. Specifically, it can be divided into primary frequency modulation, secondary frequency modulation and tertiary frequency modulation. In different frequency modulation, the adjustment method adopted by the generator set is also different. The primary frequency adjustment is mainly achieved by the governor in the generator set, and the control time scale is relatively short, also known as differential frequency modulation. In the second frequency modulation, the time scale is extended, and the load change from several minutes to more than ten minutes can be controlled, and at the same time, the frequency modulation can be achieved without any difference. In the third frequency modulation, it involves the allocation of specific power generation tasks to each grid-connected generator set according to a certain rule, to ensure the optimization of the system's operation, and can control load changes for half an hour or more [2].

3. APPLICATION OF AUTOMATIC POWER GENERATION CONTROL SYSTEM (AGC)

The automatic power generation control system (AGC) has been widely used, and the application scenarios in new energy grid connection are mainly wind power grid connection and photovoltaic grid connection. Since the output characteristics of photovoltaic power generation are relatively stable, there will be no obvious sharp points or serrated output curves like wind power. You can choose whether to install an automatic power generation control system according to the actual situation. Generally, the installed capacity is large. The photovoltaic power station also needs to configure an automatic power generation control system to ensure the stability of the power grid operation. Compared with photovoltaics, wind power has greater uncertainty, so when a wind farm is connected to the grid, the requirements for the automatic power generation control system need to be higher. Only the wind farms equipped with the automatic power generation control system can be allowed to be integrated into the large in the power grid. Taking the operation of grid-connected large and medium-sized photovoltaic power plants as an example, large and medium-sized photovoltaic power plants should be equipped with active power control systems and have the ability to regulate active power. The photovoltaic power plant AGC system can automatically perform specific logical discrimination according to the active power control instructions issued by the grid dispatching agency or locally set and generate the optimal adjustment strategy, and issue control commands to the inverter for active power adjustment through the communication network. To achieve the closed-loop control of the grid-connected active power of the photovoltaic power plant, to meet the control requirements of dispatch. In general, in the actual application process, because the adjustment speed of the new energy generator set is fast, and the use of the new energy power station's frequency modulation capability can greatly reduce the conventional frequency modulation reserve capacity, it is a good practice for the new energy power station to deeply participate in the frequency regulation of the power grid select. Around the new energy power station to participate in a frequency modulation, there have been many research and practice projects. Among them, there is the use of additional energy storage to enhance the frequency modulation capability, and the use of wind turbines, inverters and other new energy power plants' own power generation equipment to provide primary frequency modulation capability. Energy storage can respond quickly, track accurately, and has good frequency modulation characteristics, but it is difficult to be widely promoted due to its high price. The research of using the new energy power plant's own power generation equipment to participate in frequency modulation focuses on wind turbines. The

main methods are virtual inertia control, droop control and rotor speed control. However, there are few researches on grid frequency modulation in photovoltaic power generation systems, and the focus is on micro. In the field of power grids and distributed power generation systems, most of the distributed control methods are used to achieve active-frequency droop characteristics on the photovoltaic inverter side. However, in engineering applications, the large number of inverters and independent frequency sampling lead to difficulties in unified coordination. The station-level frequency modulation control of grid-connected photovoltaic power plants needs to be further studied and applied. This paper focuses on the direction of large-scale grid-connected photovoltaic power plants participating in the primary frequency modulation control of the power grid. On the basis of the power plant AGC system, the active power-frequency droop control feature of the photovoltaic power plant is added. Relying on the mature and reliable AGC communication network and parallel delivery mechanism, all inverters of the whole station are realized on the basis of giving full play to the rapid adjustment performance of the inverter. The active and fast control of the generator ensures the rapid adjustment of the active power of the photovoltaic power station and the response performance of one-time frequency modulation [3].

4. OPERATION ANALYSIS

In the application process of automatic generation control system (AGC), the control of the generator set determines the stability of the power system. First, the power balance of the power system must be ensured. Only by maintaining the power balance state can the power system be guaranteed to be stable, and the system to ensure. For power balance, an automatic power generation control system must be used. In the regional power grid, if there is a new energy power generation project connected to the grid, it is necessary to readjust the automatic power generation control system. The generation of new energy is fluctuating, and the amount of power generation is an unstable curve. It usually changes with the natural wind speed or the intensity of the sun. At this time, the automatic power generation control system can play a key regulatory role by monitoring the generation of new energy. Real-time generation data of the unit to balance the changes between the power supply side and the load side in the power system. The new energy active control system needs to collect the operating data information on various sections of the power system and monitor these data information, the load curve predicted by the date, the output curve of wind power or photovoltaic, and the output prediction curve of the conventional generator set. Wait for the power balance calculation of the entire network, and intelligently control the output of photovoltaic or wind power in the entire network according to actual needs [4]. Generally, when the

capacity of grid-connected wind power or photovoltaic is relatively large, it is necessary for the conventional generating units to free up more generating space for new energy, so as to reduce the amount of wind energy or photovoltaic energy abandoned by new energy and improve the economic efficiency of new energy power generation enterprises. At the same time, it can also achieve the purpose of using new energy to the greatest extent.

5. CONCLUSIONS

The rapid development of new energy grid connection will inevitably bring challenges to the stable operation of the power grid, and the main work of the automatic generation control system (AGC) is the frequency adjustment and load distribution of the power system, which can quickly and real-time reduce the deviation of supply and demand, and complete the timely The power exchange between adjacent power systems according to regulations can effectively improve the stability of new energy grid-connected operation, at the same time reduce the power balance adjustment pressure in the system and improve the economics of

system operation. Automatic power generation control technology builds an optimized control system for grid frequency and power flow, which is of great significance for improving the automation level of new energy grid connection.

REFERENCES

- [1]Y. H. Fang, Y. Z. Sun, P. Li, and G. J. Liu, Technology development trend of photovoltaic grid connected power generation system, *Electrical Appliances and Energy Efficiency Management Technology*, 2016.
- [2]A. Y. Qu, Y. B. Yuan, H. Y. Chen, Z. W. Hou, and S. Q. Chang, Application and realization of AGC and AVC in photovoltaic power station, *Electrical technology*, 2016, 06.
- [3]L. Sun and Y. Wang, Development process and trend of AGC control technology, *Journal of Jinan University (NATURAL SCIENCE EDITION)*, 2007.
- [4]Q. W. Mu, Application of automatic generation control system in power plant, *Electronic Technology and Software Engineering*, 2016.

Biogeographic Distribution Module within the National Special Biological Resources Monitoring and Tracing System

Ri-Gui Zhou¹, Yi-Shi Zhao^{2,*}, Xiong Wan³

¹ College of Information Engineering, Shanghai Maritime University, Shanghai 201306, China

² Research Center of Intelligent Information Processing and Quantum Intelligent Computing, Shanghai 201306, China

³ Key Laboratory of Space Active Opto-electronics Technology, Shanghai Institute of Technical Physics, Chinese Academy of Sciences, 500 Yutian Road, Shanghai 200083, China

Abstract: As the number of imported and exported animals and plants gradually increases, research on the protection of special strategic biological resources and the origin tracing technology is imminent. In order to achieve this purpose, the National Special Biological Resources Monitoring and Tracing System (NSBRMTS) was researched and produced, which can detect and trace the special biological samples that have been entered into the national key project. In addition, this article also describes the geographical distribution module of species in the system. In order to enable the staff using the system to understand the distribution of the organisms entered in the national key specific biological directory, the module implements an integrated framework to display the biogeographic distribution.

Keywords: Special biological; Protection of special biological resources; The software system; The national key special biological directory; Biogeographic distribution; Zoom

1. INTRODUCTION

The animal and plant quarantine service of the United States department of agriculture issued a notice, except livestock, breeding eggs, animal genetic material, animal semen, blood samples, excreta and embryos and other animal genetic material prohibited entry. In recent years, the number of animals and plants exported from China has been increasing year by year. The Internet of things monitoring and tracing platform and the rapid detection and automatic identification software system have not been developed. Human genetic resources, including organs, tissues, cells, blood and other genetic materials containing human genome, have been monitored as important strategic resources in many developed countries. At present, China adopts the credit system for the import and export of all kinds of human genetic resources, but the authenticity of such materials can not be directly detected. Therefore, it is imperative to strengthen the protection of special strategic biological resources and the research of provenance tracing technology, as well as the development of non-contact detection technology for

all kinds of genetic resource samples.

At present, however, the monitoring of biological resources is facing a great dilemma. Now China's customs ports, etc for a particular biological monitoring mainly through artificial (man-made out visual inspection) tell the bag is opened, this way of checking is not only time-consuming, and may not be accurate there is a big comprehensive inspection to the smuggling of some special biological resources, thus caused the biological resources loss increasing year by year. On the other hand, in the detection and traceability study of special organisms, it is necessary to understand the geographical distribution of special organisms listed in the national key project. However, at present, the geographical distribution data of species in China are not perfect, and the distribution map is usually shown in pictures and thermal maps (such as China rare and endangered plant information network, whose geographical distribution is thermal maps), so it is impossible to understand the distribution area and specific number of a certain organism in China in more detail.

Based on the above background and reasons, special biological resources monitoring and tracing technology research came into being (that is, the national key project: special biological resources monitoring and tracing technology research). The National Special Biological Resources Monitoring and Tracing System (NSBRMTS) is a sub-part of the key special subject 5. Its role is to develop a tracing and monitoring management platform for customs personnel aiming at special biological resources. In addition to the necessary detection and management functions, the system also includes the geographical distribution module.

This article mainly introduces the construction method and key technology of the biogeographic distribution module in the NSBRMTS. The structure of the article is as follows: the second part introduces the functional requirements and making process of geographical distribution module; The third part introduces the concrete realization of geographical distribution module. The fourth part introduces the algorithm of map zoom. The fifth part is the

conclusion of this article. The sixth part is Acknowledgments; The seventh part is the references.

2. FUNCTIONAL REQUIREMENTS AND MAKING PROCESS OF GEOGRAPHICAL DISTRIBUTION MODULE

2.1 Functional Requirements

In order to facilitate researchers' access to biogeographic information, the geographic distribution module needs to contain the following functions:

- (1) Display the distribution of organisms in the country in the form of a map.
- (2) You can look at the specific distribution of organisms in a particular location.
- (3) Display the distribution maps dynamically (the map can be zoomed and dragged to see information about a location) rather than just displaying it in the form of pictures.
- (4) The geographical distribution map is beautiful in style and clear in display.

2.2 Making Process

The process of making the geographical distribution module is as follows:

- (1) Collect the biological data needed to make the geographical distribution module.
- (2) Perform unified processing on the collected data and add it to the database.
- (3) Identify a tool that can implement the required by the geographic distribution module.
- (4) Make the geographical distribution module.
- (5) Embed the completed geographical distribution module into the NSBRMTS.

Figure 1 is the flow chart of making the geographical distribution module.

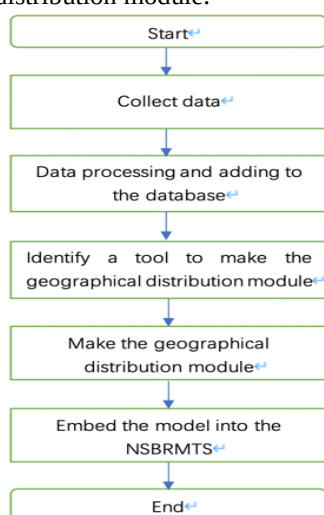


Figure 1 The flow chart of making geographical distribution module

3. THE CONCRETE REALIZATION OF GEOGRAPHICAL DISTRIBUTION MODULE

3.1 Collecting and Processing Data

(1) Collecting data

In order to implement the geographical distribution module, a lot of data needs to be collected and

processed.

First, it is necessary to determine the contents of the national key specific biological directory. Second, we need to collect data on the distribution of each species in the directory across the country.

Part of the research was carried out by the special research group 1, Nanjing Agricultural University [1-3]. At present, there are 85 kinds of species have been included in the national key special biological directory, and the geographical distribution information of some of them has been collected and stored. This part of the work is still in progress, and the geographical distribution of biological information is not yet complete.

The currently identified special biological directory is the content of this national key project. With the development of research in the future, the special biological directory may change.

(2) Processing data

The species distribution data obtained from the research group 1 are not standardized enough. For example, for the same organism, some coordinates are named at the provincial level and some are named at the county level. Therefore, it is necessary to unify the data. The geographical names are unified to the county level according to the latitude and longitude values of the given coordinate points.

For the realization of the NSBRMTS, researchers have created a relational database (mysql), and created a biogeographic distribution data table in the database. The table contains the fields: biological name, geographical location (latitude and longitude), and quantity. Information will be entered into the data table after integration.

3.2 Technical Support

The NSBRMTS is completed using python+PyQt5. Python's simple and easy-to-learn syntax and huge library make system development faster and more convenient [4-6]. The geographic distribution module is implemented using pyecharts. Pyecharts is a class library for generating Echarts charts. It has up to 400+ map files and native baidu map, providing strong support for the visualization of geographical data [7-9].

There are three types of geographic charts in Pyecharts: Geo, Map, and Bmap. Both Geo and Bmap can add points with latitude and longitude through 'add_add_coordinate()' or 'add_coordinate_json()', but Bmap has rich colors and beautiful interface, so choose Bmap [7-9].

3.3 The Implementation Process

The following is a brief introduction to the implementation process of geographical distribution module:

- (1) When the user chooses to view an organism, it first searches the database for all the geographical distribution data of the organism, and then puts the geographical name and its latitude and longitude coordinates in "{ 'place name ': [longitude, latitude],

place name ':[longitude, latitude]... } “generate json_file; Place geographical name and distribution quantity by “data_pair = [(' place name ', quantity), 'place name', quantity)...” “generate “list()” array.

(2) In the created Bmap instance, the “add_coordinate_json(json_file)” method is used to add the new coordinate point, and the “add(data_pair=data_pair)” method is used to display the point (note that the order of the two steps cannot be reversed, otherwise it cannot be displayed). In order to let the user intuitive to see the change of the species, the chart of ‘VisualMapOpts’ (visual reference configuration items) mapping type is set to ‘color’, depending on the number displayed in a different color in this map location logo, color is divided into four levels, according to the number of how many were displayed as red (#8B0000), slightly red (#CD0000), red (#EE0000), pale red (#FF4500); In order to make the user more detailed look at distribution, placed at the upper right of the map ‘BMapNavigationControlOpts’ translation zoom control (map), the user can drag the map, also can click on the control to the map to zoom in; At the same time, when the user places the mouse on the location, the number of points distributed will appear.

(3) Considering that users can scale the system according to the requirements, the map is designed to adapt the interface size; To make the map look better, you need to remove the gaps that are automatically generated. This functionality is implemented using ‘javascript’.

(4) Generate the map as an HTML file and import it into the widget that needs to display the geographical distribution.

Figure 2 is the flow chart of the realization process of the geographical distribution module.

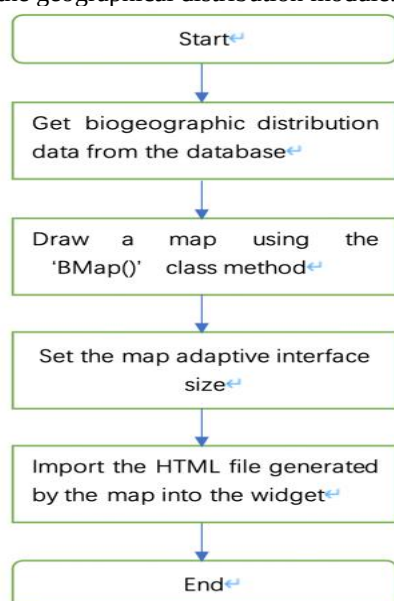


Figure 2 The flow chart of the realization process of the geographical distribution module

4. THE ALGORITHM OF MAP ZOOM

When making a map, you need to set the zoom of the map [10,11]. The scale of baidu map ranges from 3-19 to 17, and the specific division is shown in figure 3.

3 - Continent area	//For example, show Asia, Europe, Africa
4 - The international	//For example, China, plus the capital of China: Beijing
5 - The provincial capital	//The capital of each province , and add black traffic routes
6 - The city	//Shows the urban areas of each province , and add yellow traffic routes
7 - The city	//Only enlarged at level 6, the map looks more comfortable
8 - City and county	//Add state road display
9 - District and county	//Rough display , and there are counties and cities not shown
10 - District and county	//Districts and counties are all displayed
11 - District, county, town, township, street name	
	//Town, street and township names are not fully displayed
12 - District, county, town, township, street name, place name	
	//Airport and university level (icon) names are displayed, place names are not fully displayed
13 - District, county, town, township, street name, place name	
	//Increase the place name
14 - District, county, town, township, street name, place name, small place name, small street	
	//Add land name, outline display, land name coloring and area hiding
15 - District, county, town, township, street name, place name, small place name, small street	
	//Adding residential roads
16 - District, county, town, township, street name, place name, small place name, small street, small shop	
	//Add small store coloring
17 - District, county, town, township, street name, place name, small place name, small street, small store, super small store	
	//Subway crossing level display
18 - District, county, town, township, street name, place name, small place name, small street, small store, super small store	
	//Add the outline of the subminiature area to the 3d image display
19 - District, county, town, township, street name, place name, small place name, small street, small store, super small store	
	//Enlarged from level 18, no increase

Figure 3 The Baidu map zoom

This module sets the minimum zoom of the map to 5, the highest zoom to 10, and skip zoom 8. When the zoom is 5, the map covers the whole of China. However, when the zoom is greater than 10, the distribution of species within a certain range is difficult to see because the actual location is too specific. When the zoom is 8, more national road signs are added to the map, which weakens the display effect of town identification information and reduces the aesthetics of the map. As shown in figure 4, when the zoom is 8, the green mark is national road and the red dot is town. It can be seen that the display of town information is not obvious.



Figure 4 Geographical distribution map with zoom is 8

4.1 The Traditional Way of Dividing the Zoom

Among the existing methods for dividing the zoom of the map, the most commonly used method is to calculate the distance between the two endpoints (upper left and lower right or lower left and upper right) of the coordinate region, and divide the zoom according to table 1. (x is the distance between the two endpoints).

Table 1 Traditional division zoom table

Zoom	Distance Range

5	$x > 2000000$
6	$1000000 < x < 2000000$
7	$500000 < x < 1000000$
8	$200000 < x < 500000$
9	$100000 < x < 200000$
10	$x < 100000$

After setting zoom according to this standard, it was found that the geographical distribution of many species was not displayed well. The specific performance is that the maps with poor display are all with a small zoom, and the display range is too large. After adjusting the zoom, the display effect is better. For example, the following figure shows the geographical distribution of the *Luehdorfia chinensis*. Figure 5 shows the geographical distribution of the *Luehdorfia chinensis* when zoom is 5. Figure 6 shows the geographical distribution of the *Luehdorfia chinensis* when zoom is 6.



Figure 5 The geographical distribution of the *Luehdorfia chinensis* when zoom is 5



Figure 6 The geographical distribution of the *Luehdorfia chinensis* when zoom is 6

The distance between the endpoints of the *Luehdorfia chinensis* is 2008010.699308756. According to the traditional standard, the zoom of its geographical distribution should be 5. However, when the zoom is set to 6, the display effect is obviously better.

In view of this, we plan to adjust zoom according to the actual situation of this project.

4.2 The Adjustive Way of Dividing the Zoom

The geographic distribution information of 47 species is currently in the database. We intend to adjust the

geographical distribution of these 47 species and develop zoom algorithm according to the optimal zoom presented by them. The zooms of new species added later followed this algorithm.

After manually adjusting the optimal zoom of 47 species (see accessory 1 for specific comparison information), the distance interval between the endpoints is compared with the traditional division method, as shown in table 2(as mentioned above, the system has skipped zoom = 8).

Table 2 Two kinds of division zoom contrast table

Zoom	Old Distance Range	New Distance Range
5	$x > 2000000$	$3469633 < x < 3107700$
6	$1000000 < x < 2000000$	$1299722 < x < 2563689$
7	$500000 < x < 1000000$	$272235 < x < 1204624$
8	$200000 < x < 500000$	
9	$100000 < x < 200000$	$110700 < x < 269910$
10	$x < 100000$	$58250 < x < 79976$

After integrating the range range of zoom obtained in this project with the traditional range range, the zoom division of the map applicable to the geographical distribution of species in this system is obtained as shown in table 3.

Table 3 This system's division zoom table

Zoom	Distance Range
5	$x > 2600000$
6	$1210000 < x < 2600000$ or $x = 0$
7	$270000 < x < 1210000$
9	$100000 < x < 270000$
10	$x < 100000$

As the biogeographic distribution information is still being collected, there is only one coordinate in the geographic distribution map of some organisms, so the endpoint distance is 0. At this time, zoom is set to 6.

5. CONCLUSIONS

As can be seen from the above, in order to enable users to check and understand the specific geographical distribution information of the organisms entered in the NSBRMTS, and to provide assistance for the next step of origin traceability, the author made the biogeographic distribution module in the system.

The geographical distribution module shows the distribution of organisms in China in the form of a map. Users can drag and drop, click to move and zoom the geographical distribution to see the geographic information they need to know. In addition, in order to make the geographical distribution map better display the geographical distribution area of organisms, the author optimized the existing zoom algorithm of the map to make the zoom of the generated map more in line with the project.

ACKNOWLEDGMENT

This work is supported by the National Key R&D Plan under Grant No. 2018YFC1200200 and 2018YFC1200205.

REFERENCES

[1]F. Yang, F. Chen, Y. Cai, et al, Three novel players: PTK2B, SYK and TNFRSF21 were identified to be involved in the regulation of bovine mastitis susceptibility via GWAS and post-transcriptional analysis, *Front. Immunol*, 2019, 10: 1579.

[2]F. Chen, C. Xing, W. Zhang, J. Li, T. Hu, L. Li, H. Li and Y. Cai, Salubrinal, a novel inhibitor of Eif-2 α dephosphorylation, promotes erythropoiesis at early stage targeted by ufm1ylation pathway, *J Cell Physiol*, 2019, 234: 18560-18570.

[3]J. Chen, C. Xing, L. Yan, Y. Wang, H. Wang, Z. Zhang, D. Yu, J. Li, H. Li, J. Li, and Y. Cai, Transcriptome profiling reveals the role of ZBTB38 knock-down in human neuroblastoma, *PeerJ*, 2019, 7: e6352.

[4]E. Travis, oliphant, python for scientific computing, *Computing in Science & Engineering*, 2007, 9(3): 10-20.

[5]K. Jarrod Millman and M. Aivazis, Python for scientists and engineers, *Computing in Science &*

Engineering, 2011, 13(2): 9-12.

[6]P. Fernando and E. G. Brian, IPython: A system for interactive scientific computing, *Computing in Science & Engineering*, 2007, 9(3): 21-29.

[7]Z. Yang and S. X. Cao, Job information crawling, visualization and clustering of job search websites, 2019 IEEE 4th Advanced Information Technology, Electronic and Automation Control Conference (IAEAC), 2019.

[8]S. C. Geng, H. Luo, Y. J. Liu, C. Chen, W. C. Xu, Y. L. Chen, X. L. Li and W. H. Fang, Prevalence of porcine circovirus type 3 in pigs in the southeastern Chinese province of Zhejiang, *BMC Veterinary Research*, 2019, 15: 244.

[9]W. J. Wei, D. Q. Miao and Y. X. Li, A bibliometric profile of research on rough sets, *International Joint Conference on Rough Sets*, 2019, 11499: 534-548.

[10]M. L. You, C. W. Chen, H. F. Liu and H. Lin, A usability evaluation of web map zoom and pan functions, *International Journal of Design*, 2007, 1(1): 15-25.

[11]A. M. Nivala, S. Brewster and T. L. Sarjakoski, Usability evaluation of web mapping sites, *The Cartographic Journal*, 2008, 45(2): 129-138.

Control System Design of 15 Ton Aluminum Liquid Refining Furnace based on PLC

Shisheng Zhang

Zibo Vocational Institute, Zibo, Shandong, 255314, China

Abstract: Based on the 10th line of 15 tons, the design requirements and control methods of aluminum liquid on-line refining electrical controller system were introduced. By PLC controlling heater, the temperature requirements of degasser and deep bed filter furnace were met. And the touch screen was used for operation control. The system had three working modes: manual, automatic and heat preservation, which could realize temperature acquisition, transformation, PID control, rotor speed, maximum temperature of the aluminum liquid and working parameter setting.

Keywords: PLC; Aluminum liquid; Touch screen; Heater

1. BASIC STRUCTURE OF THE PRODUCTION LINE FOR ALUMINUM COIL

The online refining system of aluminium liquid is a part of the aluminium coil production line. An aluminum coil production line is composed by 6 parts: melting furnace, holding furnace, feeding machine, degasser furnace, filter furnace, casting and rolling machine.

Aluminum melting furnace is the common equipment in aluminum processing and casting industry, which is used to melt recycled aluminum, aluminum ingots and other materials, to remove preliminary slag, and to prepare for heat preservation treatment. The total weight of the heat preservation furnace after adding aluminum water will reach more than 300 tons. Both the safe, stable tilting and the flow rate of aluminum water should be guaranteed in casting production to provide aluminum liquid for the degasser. The wire feeder could add the titanium boron wire in the flow groove. By rotating the rotor, evenly dispersing is made to remove hydrogen, change the inclusion form and fine-tuning composition. Air sources include gas, compressed air, nitrogen, etc. Compressed air is used for rotor cooling, furnace cleaning, kiln roasting, etc. Nitrogen is used for removing hydrogen in liquid aluminum. Gas is used for chute heating, emergency auxiliary heating, etc. Degassing furnace is used to remove hydrogen in the aluminum liquid and refine aluminum alloy. The filter furnace is used to remove impurities from the aluminum liquid and provide pure constant-temperature aluminum liquid for the casting and rolling machine. Casting and rolling machine is used to coil metal products after rolling and draw angle processing. The 10# production line is used to

produce aluminum coils with high precision. In the whole production line, degasser and filter furnace are the focus in this paper.

2. COMPOSITION AND PROCESS REQUIREMENTS OF LIQUID ALUMINUM REFINING

2.1 Composition and Process Requirements of Degassing Furnace

In continuous aluminum casting, the aluminum liquid will pass through the flow tank after the treatment device, and contact with the atmosphere, so that hydrogen will be fully absorbed. During aluminum solidification, the oversaturated hydrogen will nucleate on the surface of the inclusion, generating tiny hydrogen bubbles and resulting in gas defects. The type of rotating nozzle represented by the SNIF method can obtain fine bubbles and stay for a long time. Because of the excellent contact efficiency between aluminum liquid and bubbles, the highest degassing rate is shown in current degassing devices. The graphite rotor is steplessly regulated by the frequency converter. The structure of the nozzle can disperse the bubbles. The centrifugal force produced by agitating aluminum alloy melt form gas/liquid flow, increasing the contact area and contact time between bubbles and aluminum alloy liquid, and improving the effect of degassing purification.

The box-type on-line deaeration system is adopted, including chute, motor, reducer, graphite rotor, heater, heater thermocouple, aluminum liquid thermocouple, lining, shell, aluminum outlet, etc. The degassing device uses graphite rotor to immersed degas. The graphite rotor can be lifted. A "U" shaped silicon carbon rod with a protective cover is used for heating to stabilize the temperature.

Basic requirements of degassing control process:

- (1) Rotor speed is adjustable from 0 to 500 RPM;
- (2) The working temperature of the aluminum liquid is 760°, and the error is no more than 3°. If the temperature exceeds 800°, the alarm will be given.
- (3) The highest temperature of the heater shall not exceed 1200°, otherwise alarm will be given.
- (4) For the initial installation, the furnace will heat up to 760° within 80 hours according to the heating curve; After normal production, the preheating time can be set arbitrarily within 20 hours.
- (5) Sound and light alarm shall be used at the end of over temperature and preheating, and it can be confirmed.

2.2 Deep-Bed Filtration Furnace and Process Requirements

Aluminium melt filtration should be prior to casting/cast-rolling. The application of filtration technology is to reduce impurities and inclusions in the melt. The filter medium of deep-bed filter is alumina ball and sand gravel sintered by special process. The filter medium is 500mm thick (that is deep filtration bed). The performance of the filter medium is different from the two formers, and the operation procedure of the equipment is also different. This deep filtration technology has been recognized in the foundry industry to meet the needs of high-end products with high quality requirements.

The deep bed filter furnace is composed of radiation heater, radiation heater thermocouple, aluminum liquid thermocouple, mini heater, mini heater thermocouple, etc.

Filtration control process requirements:

- (1) The working temperature of the liquid aluminum is 760°, and the error is no more than 3°. If the temperature of the liquid aluminum exceeds 800°, the alarm will be given.
- (2) The highest temperature of the heater shall not exceed 1200°, otherwise alarm will be given;
- (3) For the initial installation, the furnace will heat up to 760° within 80 hours according to the heating curve; After normal production, the preheating time can be set arbitrarily within 20 hours;
- (4) Sound and light alarm shall be used at the end of over temperature and preheating, and it can be confirmed.

3. THE DESIGN OF CONTROL SYSTEM

3.1 The Design of Hardware

According to the control requirements, the system has three working modes: manual, automatic and heat preservation. The controlled object includes a frequency converter, three power modulators and three valves. The touch screen is used as the control interface.

The silicon carbon rod has the electric characteristic of negative value from room temperature to 800 °C and positive value above 800 °C, showing the nonlinear rule. At a certain temperature, the longer the heating time is, the greater the resistance is. In the case of the same heating time, the higher the temperature is, the faster SiO₂ is generated, resulting in greater increase in resistance. The larger the surface load is, the faster the reaction will be. When the resistance value increases to 3~4 times of the original resistance value, the electric heating efficiency is already very low, and the failure of the silicon carbide rod can be considered.

SCR power regulators using zero-position control mode may be called power modulators, also known as cycle controllers. It controls the cycle of AC voltage and the power of load by the cycle breakdown ratio of load voltage. With this kind of control, the

temperature control is realized and the high-order harmonic pollution caused by phase control is also eliminated. But the control precision is reduced.

Within the set cycle T_c , T_c is usually for one second. The trigger signal renders the primary loop go on several frequencies (a few complete sine wave), and then disconnect from several frequencies. On-off time ratios of the thyristor in its period are set to adjust the average power of AC load, and then achieve the purpose of adjusting the load power [1].

Including switching input, output, and power circuit which is the control core of the system.

Including rotor speed controlled by analog, temperature of degassed heater, temperature of aluminum liquid in degasser, temperature of aluminum liquid on ceramic plate, speed of frequency converter controlled by analog, power regulator of degassed heater, power regulator of ceramic plate heater.

Includes digital output driven power devices.

Includes thermometer, tachometer, voltmeter, ammeter. A Type K single-core stainless steel thermocouple with silicon carbide sleeve for measuring the temperature of liquid aluminum and transmitting to an ordinary thermometer.

Including frequency converter circuit, silicon controlled circuit, silicon carbide heater, resistance wire heater, etc.

In addition, the control circuit also adopts the following measures and anti-interference measures: correctly grounding, good grounding of control cabinet and furnace body, shielding cables a used for the control lines, and grounding of both ends of the shielding layer.

3.2 Design of System Software

There are four modes of operation. The main program is responsible for initialization. The touch screen could be set to be manual, automatic and thermal insulation parameters. The acquisition and conversion of each analog quantity (temperature of heater, temperature of aluminum liquid, speed) is displayed by the touch screen. The motor animation is controlled by the main program and displayed on the touch screen. Unconditional PID operation, PID parameters come from the corresponding subroutine. And the operation results are fetched by the corresponding subroutine for further processing.

Take the automatic mode as an example to illustrate the control flow. Switch to auto mode, touch screen to auto screen, click auto degassing, then enter auto degassing state. First, input the set parameters into the corresponding memory and start the frequency converter, heater, cooling fan, nitrogen valve and cooling air valve in turn. The temperature corresponding to the calculation parameters is sent to the main program for PID operation, and then the PID operation results are protected and finally sent to the corresponding export [2].

Because PLC and frequency converter are in the same control cabinet, the distance is short, and the analog quantity control is more appropriate.

Siemens Micromaster440/420 (h referred to as MM440/420) converter is a series of products used for speed regulation of three-phase AC motors, controlled by microprocessor, using insulated gate bipolar transistor (IGBT) as the power output component, with high reliability and strong function. It adopts modular structure, flexible configuration. A variety of complete convertor and motor protect its functions. The built-in RS-485/232C interface and simple process control PI closed-loop controller, can be customized I/O terminal function according to the special needs of users. Fast current limitation (FCL) improves dynamic response characteristics and can also output high torques at low frequencies.

When setting converter parameters, users can choose the cheap basic operation panel (BOP) or advanced Operation Panel (AOP) with multiple text display functions. AOP can store up to 10 sets of parameter setting values.

MM420 has an output power of 0.12~11kW and is suitable for various variable speed transmission, especially for driving control of water pump, fan and conveyor system [3].

Program is composed of main program and subroutine. The main program realize the initialization, stop, status selection, and determine the system work in which state, thus invoking the corresponding subroutine (manual, automatic, or heat preservation). And it is also responsible for the PID calculation, animation program, advertising, animation, start-stop of cooling fan motor, alarm, and analog acquisition, conversion, etc.

3.3 Interface Design of the Touch Screen

When a touch screen works, a finger or other object is used to touch the touch screen installed in the front of the display, and then the system locates and selects

information input according to the icon or menu position touched by the finger. The touch screen is composed of touch detection parts and touch screen controller. The touch detection component is installed in front of the display screen to detect the user's touch position and accept the touch screen controller. The main role of the touch screen controller is to receive touch information from the touch point detection device, convert it into contact coordinates, and then send it to the CPU. It can also receive commands from the CPU and execute them.

The man-machine interface of the system include manual, automatic, heat preservation, alarm, parameter setting and help. The main screen is mainly used for switching among automatic, manual, heat preservation, alarm, parameter setting and help. Automatic screen is employed for production, including automatic degassing and automatic ceramic plate. When a button is pressed on the manual screen, the corresponding action will take place and the system will be released, which is mainly used by equipment maintenance personnel.

The thermal insulation screen is used for production suspension, including degassing thermal insulation and ceramic plate thermal insulation. Parameter setting is used to set manual and automatic parameters, including rotor speed, heater temperature, maximum, etc. Alarm screen can display alarm information.

REFERENCES

- [1]L. Hou, Design and temperature control of tunnel kiln control system, Phil. Trans. Roy Shenyang, Northeastern University, 2008.
- [2]S. S. Zhang, PLC applied technology, Xidian University Press Xi'an, 2018, P252-260.
- [3]H. F. Wang, M. Chen, and W. Fan, PLC-based industrial powder micro-metering system, Industrial Metrology, 2019, 03.

Quantum Watermarking Scheme Based on Selective Qubit Embedding

Gao-Feng Luo¹, Yudan Ning^{2,*}, Liang Zong¹

¹ Key Laboratory of Information Service in Rural Area of Southwestern Hunan, Shaoyang 422000, Hunan, China

² Department of Information Technology and Creativity, Shaoyang Polytechnic, Shaoyang 422000, China

Abstract: We investigate the watermarking algorithm using quantum the novel enhanced quantum image representation and propose a novel quantum image watermarking method based on edge pixels embedding using least significant qubit approach. The edge pixels of the cover image are selected for embedding. To this end, the original watermark needs to be scrambled and expanded. Supported by theoretical analysis, quantum image watermarking by this method has less distortion. Also, it is an efficient method due to the parallel processing of quantum computing.

Keywords: Image watermarking; Qubit embedding; Least significant qubit

1. INTRODUCTION

During the past two decades, many extensive studies have been conducted on quantum theory. Since the 1990s, many researchers have reported that there exists a close relationship between quantum systems and computational systems. Quantum systems have many important properties such as quantum entanglement and superposition. A quantum computer has been demonstrated to have bright prospects over the classical computer, particularly with respect to Feynman's computation model [1], Shor's integer factoring algorithm [2], and Grover's database searching algorithm [3].

In recent years, quantum image processing has attracted more and more attentions from researchers because of its special advantage. First, various quantum image representation methods have been proposed, such as a flexible representation of quantum images (FRQI) [4] and a novel enhanced quantum representation of digital images (NEQR) [5]. NEQR uses the basis state of a qubit sequence to store the grayscale value of every pixel instead of the angle encoding of a qubit in FRQI. Second, to illustrate the feasibility and capability of the QIP algorithm and application, researchers prefer to simulate the image processing tasks on the basis of FRQI and NEQR. Thus far, researchers have contributed to quantum image feature extraction [6,7], quantum image scaling [8-10], quantum image translation [11,12], quantum image segmentation [13,14], quantum image encryption [15-19], and so on.

In this paper, we propose a novel quantum watermarking scheme using selective qubit embedding. The rest of the paper is organized as follows. Section 2 discusses previous works on quantum image

watermarking. Section 3 introduces the proposed scheme. Section 4 is devoted to the theoretical analysis. Finally, the conclusions are presented in Section 5.

2. REVIEW WORKS

Quantum image security technologies have attracted considerable research interest in the last three years, such as quantum image encryption, quantum image steganography, and quantum image watermarking [20]. Quantum image watermarking aims to protect the copyright of a quantum image by embedding a watermark into the cover image. There have been many research achievements in this field.

First, to enhance the confidentiality, watermark image is often scrambled before embedding into the cover image. Some methods, such as Arnold and Hilbert transformations, were proposed to perturb the coordinates distribution of quantum image [21,22]. In Ref. [23], quantum image Gray-code and bit-plane scrambling scheme was presented.

Second, some of the frequency domain quantum watermarking algorithm were proposed. The quantum watermark strategy based on a quantum Fourier transform [24] is aimed to embed the watermark image into the Fourier coefficients of the quantum carrier image without affecting the visual effect of the carrier images. The dynamic watermarking scheme for quantum images using a quantum wavelet transform [25] is aimed to embed the watermark image into the wavelet coefficients of the quantum carrier image. The dynamic watermarking scheme based on a Hadamard transform was also proposed [26].

Third, because classical LSB method provides an easy way to hide secret data in a cover image, the study of the quantum watermarking LSB steganography has been acquired richest results in general. In 2015, Jiang et al. proposed a novel strategy for quantum image steganography and moire patterns [27] and an LSB-based quantum image steganography algorithm [28]. Two LSB steganography algorithms were proposed: one is plain LSB, which uses the message bits to substitute for the pixels' LSB directly; and the other is block LSB, which embeds a message bit into a number of pixels that belong to one image block. In 2016, Sang et al. [29] proposed a least significant qubit information hiding algorithm for quantum images using a novel quantum representation for color digital images. Miyake et al. [30] proposed a new quantum grayscale image watermarking scheme by using simple and small-scale quantum circuits. Heidari et al.

proposed a new quantum watermarking protocol including quantum image scrambling based on LSB [31]. In 2017, Naseri et al. [32] proposed a new watermark strategy that uses LSB and the most significant bit. Zhou et al. [33] proposed a quantum watermarking scheme through Arnold scrambling and LSB steganography. Li et al. [34] proposed an improve quantum watermarking scheme using small-scale quantum circuits and color scrambling, which embeds the expanded watermark image into the carrier image by the controlled-NOT gates. In 2018, Zhou et al. [35] proposed a quantum watermarking scheme based on the improved NEQR and a quantum color image watermarking based on Arnold transformation and LSB steganography [36].

It seems that the previous works aimed to enhance the visual effect and increase the robustness of a watermarked image. However, existing results and numerical simulation studies on quantum watermarking were mostly aimed at the processing of all pixels in the cover image. This paper mainly concerns quantum watermarking method using selective boundary pixels embedding, which is based on the characteristics of human visions insensitivity to image boundary areas.

3. PROPOSED SCHEME

In this section, our method for quantum watermarking based on selective pixel embedding is presented. The scheme aims to hide a secret watermark into a cover image, where only parts of pixels are processed. The proposed scheme consists of three parts: preparation, embedding and extraction, respectively. The proposed embedding procedure is as follows and the details will be discussed subsequently.

Step 1 Transform a classical cover image into a quantum image using NEQR representation $|C\rangle$.

Step 2 Transform a classical watermark image with a $2^m \times 2^m$ size and 8-bit grayscale into a quantum image $|W\rangle$.

Step 3 Scramble the watermark $|W\rangle$ into a meaningless watermark $|W'\rangle$.

Step 4 Expand the scrambled watermark $|W'\rangle$ to $|EW'\rangle$ with an appropriate size.

Step 5 Embed the expanded and scrambled watermark into $|C\rangle$.

Step 6 Obtain the digital watermarked image through quantum measurement.

3.1. Preparation

Assume there are three quantum images: a $2^n \times 2^n$ quantum grayscale image $|C\rangle$ (cover image), a $2^m \times 2^m$ quantum grayscale image $|W\rangle$ (watermark image, where $m = n - 2$) and an empty quantum binary image $|K\rangle$, which are represented respectively as formula(1):

$$\begin{aligned} |C\rangle &= \frac{1}{2^n} \sum_{Y=0}^{2^n-1} \sum_{X=0}^{2^n-1} |C_{YX}^i\rangle |YX\rangle \\ |W\rangle &= \frac{1}{2^m} \sum_{Y=0}^{2^m-1} \sum_{X=0}^{2^m-1} |W_{YX}^i\rangle |YX\rangle \\ |K\rangle &= \frac{1}{2^{\frac{m+n}{2}}} \sum_{Y=0}^{2^m-1} \sum_{X=0}^{2^n-1} |k_{YX}\rangle |YX\rangle \end{aligned} \quad (1)$$

3.2. Image Expanding

First, to embed the watermark into the boundary pixels of a cover image, the embedded image must satisfy certain requirements of the size. That is, if the size of the watermark in X-direction (horizontal) is the same as that of a cover image, it will be embedded into the horizontal direction boundary of the cover image. Similarly, the same conclusion could be obtained when considering Y-direction (vertical). Without loss of generality, considering that both horizontal and vertical directions expanding are the same in essence, the upper and lower boundary of the horizontal direction is discussed in our proposed scheme. Figure. 1 gives a visual representation of this method. Then we will demonstrate how to select the region of an image for embedding into the cover image.

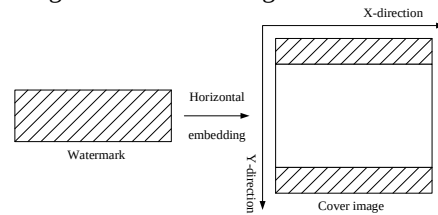


Figure 1 Horizontal direction embedding

3.3. Embedding Process

Considering the watermark will be embedded into the selective pixels of horizontal direction, it will be evenly divided into two partitions. Therefore, quantum equation circuit is used to compare the coordinates of the boundary pixels of cover image $|C\rangle$ and the resulting quantum image $|S\rangle$. The output qubits act as the control qubits of the embedding circuit. Here, the classical quantum least significant bit method is used. Using a part of selective pixel embedding, the watermark is only embedded into the region of cover image.

3.4. Extraction Procedure

In general, the watermark extraction is the inverse procedure of the watermark embedding. This procedure does not need the assistant of the original cover image. At first, the least significant qubit of the watermarked image is utilized to retrieve it. By using the same method, the second least significant qubit can be obtained. Then, through the inverse expanding and scrambling method, the quantum watermark image can be obtained.

4. ANALYSIS AND DISCUSS

From the description of the proposed scheme above, we embed the watermark into the quantum cover image only using some of the pixels embedding. To this end,

we select the region pixels of the cover image. Since only a few of the pixels in the edge are modified in the proposed scheme, which has good image quality. Hence, the theoretical analysis indicate that the algorithm can effectively improve image quality. However, the proposed scheme has poor embedding capacity, which is limited by the edge pixels of a quantum cover image. Therefore, the proposed scheme is suitable to the small capacity watermarking method. In addition, the proposed scheme, which only uses least significant qubit approach, is simple and efficient.

5. CONCLUSIONS

We have proposed a quantum image watermarking method based on selective pixels embedding. The watermark embedding process can be realized by modifying the edge region pixels of the quantum cover image. The proposed watermarking algorithm only uses simple least significant qubit approach, it is simple and efficient, superior to its classical counterpart.

ACKNOWLEDGMENTS

This work was supported by the Scientific Research Fund of Hunan Provincial Education Department (Grant No. 19B512).

REFERENCES

- [1]R. P. Feynman, Simulating physics with computers, *Int. J. Theor. Phys.*, 1982, 21(6): 467–488.
- [2]P. W. Shor, Algorithms for quantum computation: discrete logarithms and factoring, in *Proceedings of 35th Annual Symposium on Foundations of Computer Science*, 1994, 124–134.
- [3]L. K. Grover, A fast quantum mechanical algorithm for database search, in *Proceedings of the 28th Annual ACM symposium on the Theory of Computing*, 1996, 212–219.
- [4]P. Q. Le, F. Dong, and K. Hirota, A flexible representation of quantum images for polynomial preparation, image compression, and processing operations, *Quantum Inf. Process.*, 2011, 10(1): 63–84.
- [5]Y. Zhang, K. Lu, Y. Gao, and M. Wang, NEQR: a novel enhanced quantum representation of digital images, *Quantum Inf. Process.*, 2013, 12(8): 2833–2860.
- [6]Y. Zhang, K. Lu, K. Xu, Y. Gao, and R. Wilson, Local feature point extraction for quantum images, *Quantum Inf. Process.*, 2015, 14(5): 1573–1588.
- [7]Y. Zhang, K. Lu, and Y. H. Gao, QSobel: a novel quantum image edge extraction algorithm, *Sci. China Inf. Sci.*, 2014, 58(1): 012106.
- [8]N. Jiang and L. Wang, Quantum image scaling using nearest neighbor interpolation, *Quantum Inf. Process.*, 2015, 14(5): 1559–1571.
- [9]J. Sang, S. Wang, and X. Niu, Quantum realization of the nearest-neighbor interpolation method for FRQI and NEQR, *Quantum Inf. Process.*, 2016, 15(1): 37–64.
- [10]R.-G. Zhou, W. Hu, P. Fan, and H. Ian, Quantum realization of the bilinear interpolation method for NEQR, *Sci. Rep.*, 2017, 7: 2511.
- [11]J. Wang, N. Jiang, and L. Wang, Quantum image translation, *Quantum Inf. Process.*, 2015, 14(5): 1589–1604.
- [12]R.-G. Zhou, C. Tan, and H. Ian, Global and local translation designs of quantum image based on FRQI, *Int. J. Theor. Phys.*, 2017, 56(4): 1382–1398.
- [13]H.-S. Li, Q. Zhu, L. Song, C. Y. Shen, R.-G. Zhou, and J. Mo, Image storage, retrieval, compression and segmentation in a quantum system, *Quantum Inf. Process.*, 2013, 12(6): 2269–2290.
- [14]S. Caraiman and V. I. Manta, Image segmentation on a quantum computer, *Quantum Inf. Process.*, 2015, 14(5): 1693–1715.
- [15]H. R. Liang, X. Y. Tao, and N. R. Zhou, Quantum image encryption based on generalized affine transform and logistic map, *Quantum Inf. Process.*, 2016, 15(7): 2701–2724.
- [16]N. Zhou, Y. Hu, L. Gong, and G. Li, Quantum image encryption scheme with iterative generalized Arnold transforms and quantum image cycle shift operations, *Quantum Inf. Process.*, 2017, 16(6): 164–186.
- [17]X. H. Song, S. Wang, A. A. Abd El-Latif, and X. M. Niu, Quantum image encryption based on restricted geometric and color transformations, *Quantum Inf. Process.*, 2014, 13(8): 1765–1787.
- [18]L. H. Gong, X. T. He, S. Cheng, T. X. Hua, and N. R. Zhou, Quantum image encryption algorithm based on quantum image XOR operations, *Int. J. Theor. Phys.*, 2016, 55(7): 3234–3250.
- [19]P. Li and Y. Zhao, A simple encryption algorithm for quantum color image, *Int. J. Theor. Phys.*, 2017, 56(6): 1961–1982.
- [20]F. Yan, A. M. Iliyasu, and P. Q. Le, Quantum image processing: a review of advances in its security technologies, *Int. J. Quantum Inf.*, 2017, 15(03): 1730001.
- [21]N. Jiang, Luo, Wang, and W. Wu, Quantum hilbert image scrambling, *Int. J. Theor. Phys.*, 2014, 53(7): 2463–2484.
- [22]N. Jiang, W. Y. Wu, and L. Wang, The quantum realization of Arnold and Fibonacci image scrambling, *Quantum Inf. Process.*, 2014, 13(5): 1223–1236.
- [23]R.-G. Zhou, Y. Sun, and P. Fan, Quantum image Gray-code and bit-plane scrambling, *Quantum Inf. Process.*, 2015, 14(5): 1717–1734.
- [24]Zhang, Wei-Wei, F. Gao, B. Liu, Q.-Y. Wen, and H. Chen, A watermark strategy for quantum images based on quantum fourier transform, *Quantum Inf. Process.*, 2013, 12(2): 793–803.
- [25]X.-H. Song, S. Wang, S. Liu, and A. A. A. El-latif, A dynamic watermarking scheme for quantum images using quantum wavelet transform, *Quantum Inf. Process.*, 2013, 12(12): 3689–3706.
- [26]X. Song, S. Wang, A. A. Abd El-Latif, and X. Niu, Dynamic watermarking scheme for quantum images based on Hadamard transform, *Multimed. Syst.*, 2014, 20(4): 379–388.
- [27]N. Jiang and W. Luo, A novel strategy for quantum

- image steganography based on Moire pattern, *Int. J. Theor. Phys.*, 2015, 54(3): 1021–1032.
- [28]N. Jiang, N. Zhao, and L. Wang, LSB based quantum image steganography algorithm, *Int. J. Theor. Phys.*, 2015, 55(1): 107–123.
- [29]J. Sang, S. Wang, and Q. Li, Least significant qubit algorithm for quantum images, *Quantum Inf. Process.*, 2016, 15(11): 4441–4460.
- [30]S. Miyake and K. Nakamae, A quantum watermarking scheme using simple and small-scale quantum circuits, *Quantum Inf. Process.*, 2016, 15(5): 1849–1864.
- [31]S. Heidari, M. R. Pourarian, R. Gheibi, M. Naseri, and M. Houshmand, Quantum red-green-blue image steganography, *Int. J. Quantum Inf.*, 2017, 15(5): 1750039.
- [32]M. Naseri et al., A new secure quantum watermarking scheme, *Optik.*, 2017, 139: 77–86.
- [33]R. G. Zhou, W. Hu, and P. Fan, Quantum watermarking scheme through Arnold scrambling and LSB steganography, *Quantum Inf. Process.*, 2017, 16(9): 212–232.
- [34]P. Li, Y. Zhao, H. Xiao, and M. Cao, An improved quantum watermarking scheme using small-scale quantum circuits and color scrambling, *Quantum Inf. Process.*, 2017, 16(5): 127–160.
- [35]R.-G. Zhou, Y. Zhou, C. Zhu, L. Wei, X. Zhang, and H. Ian, Quantum watermarking scheme based on INEQR, *Int. J. Theor. Phys.*, 2018, 57(4): 1120–1131.
- [36]R.-G. Zhou, W. Hu, P. Fan, and G. Luo, Quantum color image watermarking based on Arnold transformation and LSB steganography, *Int. J. Quantum Inf.*, 2018, 16(3): 1850021.

Research on Energy Saving in the Operation of Central Air Conditioning System

Yuye Hu

Zibo Vocational Institute, Department of Electronic and Electrical Engineering, Zibo 255000, Shandong, China

Abstract: In view of the operation and management status of the central air-conditioning system, the current energy-saving technologies are analyzed to tap the energy-saving potential of the current central air-conditioning. To summarize the problems existing in the energy saving of the central air conditioning system, the purpose is to build a targeted solution through the analysis of various influencing factors, in order to comprehensively improve the efficiency of the central air conditioning system's energy-saving use, and provide power for the sustainable development of the central air conditioning system.

Keywords: Central air conditioning; System operation; Energy saving

1. INTRODUCTION

In the context of the current development of social urbanization, construction projects are showing a vigorous development. The central air-conditioning system is composed of more important equipment. Although it can meet people's daily life needs, there is a problem of serious resource loss. According to statistics at home and abroad, the energy consumption of the central air-conditioning system accounts for 40%-60% of the energy consumption of the entire building. It is imperative to improve the efficiency of the central air-conditioning and reduce the energy consumption of the central air-conditioning. When it comes to energy saving, the first thing people think of is to use energy-saving technology to achieve energy-saving in buildings, but they often ignore the energy-saving potential in management. This article discusses the problems in the operation and management of the central air-conditioning system of the new library of Shantou University, and proposes energy-saving methods and strategies for reducing energy consumption in the operation and management of the central air-conditioning system.

2. CENTRAL AIR-CONDITIONING SYSTEM PROBLEMS AND THE NECESSITY OF ENERGY-SAVING MANAGEMENT

The central air conditioning system is generally composed of refrigerant, chilled water circulation system, cooling water circulation system, fan and other equipment. The cooling water circulation system in the central air conditioner is mainly composed of cooling pumps and cooling water pipes and other equipment. During the heat exchange process of the central air conditioning system's freezing host, it will release heat while reducing the

water temperature, and then increase the temperature of the central air conditioning system. Thereby, the heat exchange between the cooling tower and the outside atmosphere is realized, and the heat absorbed by the freezing host is reduced in the process of continuous circulation. In the operation of the central air-conditioning system, the refrigerant will compress the refrigerant to form a liquid substance, and send the refrigerant to the evaporator and the chilled water heat exchange system, so as to achieve the cooling of chilled water [1]. In this case, the chilled water pump machine in the central system will send the cold water to the cooling plate, and the fan will blow the cold air to achieve the purpose of cooling the room. In the actual operation of the central air-conditioning system, mainly through heat exchange and absorption, etc., to achieve the operation purpose of the central air-conditioning, in order to fully meet people's demand for the use of the central air-conditioning.

2.1 The Necessity of Central Air-Conditioning System to Save Energy

Combined with the operation status of the central air-conditioning system of the construction project, as a complex and bulky engineering project, relevant personnel will carefully consider the load characteristics of the central air-conditioning and the use requirements of the construction project in order to fully guarantee the air-conditioning system. Consistent with people's use status, improve resource utilization efficiency. That is to say, the current central air-conditioning has a certain energy-saving space. However, due to the lack of rationality in some engineering projects, it will increase the energy consumption of the central air-conditioning and fail to achieve the purpose of energy conservation and environmental protection. Through the energy-saving management of the central air-conditioning system, the efficiency of energy use can be effectively improved, the energy problems encountered in the use of the air-conditioning system can be fully solved, and the phenomenon of waste of resources can be avoided to fully meet the sustainable operation needs of the central air-conditioning system. Provide support for the energy-saving development of the industry.

2.2 The Loss Problem in the Operation of the Central Air Conditioning System

According to the analysis of the operation and management of the central air conditioning system, there are many energy loss problems in use. The specific contents are as follows: First, in the operation

of the central air conditioning system, the refrigeration system accounts for more than 60% of the total air conditioning loss. Set a fixed temperature, the refrigeration system will always be in working condition, increasing energy consumption, resulting in unnecessary power system expenditure. Second, the water pumps, fans and other equipment in the central air conditioner will not be adjusted according to the actual load status, resulting in the problem of excessive resource loss. Third, under the environment where the central air-conditioning system has been operating for a long time, some equipment managers have not cleaned and treated it, resulting in dirt and other impurities in the air-conditioning system, seriously reducing the service life of the equipment and increasing the central air-conditioning system. Of loss. Fourth, there is a lack of professional energy-saving and environmental protection knowledge for central air-conditioning system management personnel. In the use of air-conditioning, the temperature is not adjusted according to outdoor parameters, which increases the energy consumption of the central air-conditioning and also limits the energy-saving management of the central air-conditioning [2].

3. OPTIMIZATION MEASURES FOR ENERGY-SAVING MANAGEMENT OF CENTRAL AIR-CONDITIONING SYSTEM

3.1 Design of Central Air-Conditioning Energy-Saving System

In the context of the current development of social urbanization, in order to achieve energy-saving operation of the central air-conditioning system, the design of the energy-saving system should be taken as the core. There is a controllable terminal device in the room, the room temperature should be set above 26 °C, the terminal device should be closed after work or temporarily away for more than 1 hour, the outdoor window should not be opened in the room, in the season of using air conditioning, when there is direct sunlight. The curtains should be lowered to reduce air conditioning energy consumption. In addition, operational training for air-conditioning operators should be strengthened so that they can skillfully control the central air-conditioning system.

3.2 Improve the Operation and Adjustment Strategy of the Central Air-Conditioning System

In the operation of the central air conditioning system, through the improvement of the system operation adjustment strategy, the refrigeration system in the unit can be operated in accordance with the standard process. Through system energy-saving adjustment and operation parameter monitoring, different system adjustment schemes are formulated. It should be noted that in the improvement of the central air-conditioning system's operation adjustment strategy, it should do: first, reasonably formulate the time for turning on the host and shutting down; second, in the design of the central air-conditioning

adjustment system, the operating parameters of the system should be manually or automatically adjusted according to the actual load situation To ensure that the water volume and air volume of the air conditioning system match. For example, in the transformation of the cooling water circulation system, the temperature difference between the cooling water needs to be adjusted reasonably. It should be noted that the greater the temperature difference between the inlet water and the outlet water between the cooling water circulation system, it means that the space needs the more heat exchanged. Therefore, in the upgrading of the cooling water circulation system, sensors can be used to adjust the temperature of the cooling water. The system can reduce the temperature difference between the cooling water sequential systems and reduce the operating speed of the motor through data simulation and frequency conversion of the inverter. In order to achieve the purpose of energy saving management of central air conditioning; third, in the case of air conditioning system cooling, it is necessary to set the temperature difference between the supply and return of the water system to <3 °C in order to achieve the purpose of energy saving and consumption reduction. Fourth, in the regulation operation of energy saving and consumption reduction of the central air conditioning system, it is necessary to emphasize the implicit energy saving of the water system and improve the use value of the operation and mediation system [3].

3.3 Make Sure the End Energy-Saving Management Plan

In the design of the central air-conditioning system, the implementation of the terminal energy-saving management plan is very important. First, in the design of the central air-conditioning system, the terminal system should be automatically controlled to automatically adjust the temperature and the running time according to the characteristics of the indoor environment of the construction project in order to achieve the operation purpose of energy saving and consumption reduction of air conditioning system. Secondly, in the end energy-saving management, it is necessary to increase the return air temperature difference of the wind system and reduce the energy consumption. Finally, in the operation and management of the central air conditioning system, relevant equipment maintenance personnel should strengthen indoor inspection and maintenance work in order to effectively avoid the problem of waste of energy resources, and provide a reference for the safe use of the central air conditioning system and energy saving.

3.4 Implementation of Energy-Saving Management System for Central Air-Conditioning Operation

With the sustainable development of the network environment, in the operation and management of the central air-conditioning system, in order to reduce energy consumption and achieve the purpose of

saving control, an energy-saving management system should be established. First, the central air-conditioning management personnel should determine the key monitoring content for the central air-conditioning system. Main engine, water pump and cooling tower heat dissipation, etc., implement specific energy-saving management plan, in order to achieve the purpose of energy-saving management of central air-conditioning system operation. Second, establish a complete inspection system, and carefully record the inspection time and content of the central air conditioning system. Third, in the operation and management of the central air conditioning system, it is also necessary to establish a maintenance system [4]. By regularly replacing the freezing oil, the water quality in the central air conditioning system is cleaned up in time to avoid pipeline clogging caused by scale, increase the energy loss of the system, and reduce the system. Operating efficiency. Fourth, in the energy-saving management of the central air-conditioning system, it is necessary to use environmental factors reasonably, and to avoid the loss of indoor air-conditioning cooling capacity through the use of natural energy.

3.5 Enhancement of the Comprehensive Literacy of Maintenance Personnel for the Central Air-Conditioning System

Combined with the characteristics of the operation and management of the central air conditioning system, in the implementation of energy saving and environmental protection programs, the management of personnel should be strengthened. Due to the particularity of the operation of the central air-conditioning system, relevant management personnel are required not only to have professional technical capabilities, but also to advance with the times in their daily work. Through the learning of professional knowledge and the integration of energy-saving concepts, the operation and management of the central air-conditioning system is enhanced. Energy-saving value, improve the utilization efficiency of central air conditioning resources, and meet the sustainable development of

China's environmental resources.

4. CONCLUSIONS

All in all, in the implementation of energy-saving measures in the management of the central air-conditioning system, the design concept of the central air-conditioning energy-saving system should be clarified, and the energy-saving awareness of the air-conditioning managers should be strengthened through the design of the adjustment system and the implementation of the terminal energy-saving management plan. Adopting reasonable operation management and necessary automatic control means are the key elements of energy saving in the central air conditioning system. Only by mastering these technologies can each owner ensure energy-saving operation and reduce the energy efficiency of the central air conditioning system under the condition of satisfying the use effect of the central air conditioning. Consume. Only in this way can the operation and management requirements of the central air-conditioning system be fully satisfied, and support can be provided for the sustainable development of the environment and energy conservation and consumption reduction in my country.

REFERENCES

- [1]S. B. Zhai, Energy saving analysis of central air conditioning system, *Energy and Environment*, 2008, (2): 51–53.
- [2]J. Li, J. R. Wang, K. L. Feng, et al., Reform measures of low-carbon energy-saving technology for central air-conditioning in hospitals, *China Medical and Pharmaceutical Guide*, 2016, 13(3): 172–176.
- [3]H. Q. Huang, Analysis of energy-saving measures of central air-conditioning supply system in high-rise buildings, *Science and Technology Outlook*, 2016, 26(20): 143–144.
- [4]J. H. Shen, Energy saving analysis and improvement measures of central air conditioning system, *Engineering Construction Standardization*, 2015, (4): 239–240.

Virtual Simulation Design of Robot Palletizing Workstation Based on Robot Studio

Jing Zhao

Department of Electrical and Electronic Engineering, Zibo Vocational Institute, Zibo, Shandong Province, China

Abstract: RobotStudio is widely used in robot simulation. This article uses RobotStudio to analyze the virtual simulation design method of the robot palletizing workstation. The layout of the workstation is completed, and the design of the conveyor chain components and the method of signal connection are discussed. And completed the working logic design of the signal board and workstation, and finally realized the control simulation of the robot. From the simulation results, the designed workstation can successfully complete the palletizing operation, and the operation efficiency is higher.

Keywords: RobotStudio; Robot palletizing workstation; Virtual simulation design

1. INTRODUCTION

Industrial robots, as an important part of intelligent chemical factories, play a decisive role in the construction of intelligent chemical factories. At present, the application in palletizing, welding, die casting, spraying and other industries is very common, and the economic benefits achieved are also very obvious. In the preliminary design of robot production lines, planning implementation plans, etc., robotic software is often developed with the help of robotic technology and computer technology to simulate the various equipment on the production line in a computer environment to evaluate the feasibility and potential of intelligent production lines. The problem has a very good effect on reducing development costs and shortening the research and development cycle of the entire intelligent production line. At present, RobotStudio of Sweden ABB, Sim-Pro of Germany KUKA, and RoboGuide of Japan FAUNC are relatively mature in the field of industrial robot simulation. Among them, ABB robots have excellent performance in the fields of handling, 3C, food, medicine, chemical industry, metal processing, solar energy, etc., involving logistics transportation, turnover, warehousing, etc. In terms of handling, the use of robotic handling can greatly improve handling efficiency, save labor costs, improve positioning accuracy, and reduce product damage rates during handling. This research will be based on the application of robots in the field of palletizing, from the spatial layout of the entire production line to the actual operation of the simulation.

2. ROBOTSTUDIO VIRTUAL SIMULATION SOFTWARE

RobotStudio virtual simulation software is developed

by ABB and belongs to PC software. It can be applied to various ABB industrial robots, and realizes robot cell modeling, offline creation and virtual simulation analysis. When actually designing the robot system, the software is used for offline simulation, which can test the designed system. Using software, it can realize the import of CAD files, and realize the automatic generation of paths and automatic analysis and extension, complete collision detection and simulation, and thus provide support for the secondary design of the system [1]. In addition, the simulation teach pendant, controller, and robot body are the same as the actual robot, and the simulation signals, programs, etc. are consistent with the signals and programs during the operation of the actual robot production line, and can also perform interference checks and alarms on the operation status. However, the modeling function of the software is limited. In most cases, it needs other 3D CAD software for modeling and other operations before importing from the interface. The industrial robot environment provided by the software can correspond to the real environment, so the use of software to establish workstations and perform robot debugging can complete the actual application verification.

3. SIMULATION SYSTEM CREATION STEPS

Use SolidWorks software to design a three-dimensional simulation model of robot end effector, conveyor belt, pallet and other workstations, and convert it to STL format, import the file to complete the modeling layout work; open the software model library, import ABB-IRB2600 robot; adjust the RobotStudio visualization system, Adjust the workstation in the working space of the robot.

3.1. Workstation Layout Analysis

In the actual intelligent production line, PLC is often used as the control core. This control mode is very common in the application of multi-robot production lines. The palletizing robot selected for this simulation is ABB-IRB2600, which has an effective working range of 1.65 m and a load capacity of 12 kg. This robot meets the working characteristics of palletizing robots. A vacuum suction cup is installed at the end actuator of the robot to suck the turnover box. Turnover boxes are transported by roller conveyor chain. The product reaches the end through the conveyor chain and is checked by the surface sensor. The signal is sent back to the robot, and at the same time, the vacuum suction cup is set in vacuum to suck the product [2]. After the product reaches the

specified quantity, the robot sends a stop motion signal, and the AGV cart transports the pallet away to load the next pallet.

3.2. Design of Conveyor Chain Components

In the virtual simulation design of the conveyor chain, Smart components are needed to realize the dynamic simulation of the goods in the transmission chain. Using RobotStudio to add this component can complete the copy of the goods. Then according to the queue Queue, the execution of the cargo copy command is performed to ensure that all cargoes have the same dynamic attributes. Using the linear motion component Linear-Mover, sensor contact control can be achieved. When the cargo reaches the end of the transmission chain, it will contact the sensor and send the corresponding signal. Using plane sensor Plane Sensor can realize this part of function simulation. Logic Gate [NOT] logic inversion component can be added to perform signal inversion operation. In fact, the ABB model robot will not produce movement when the signal realizes high frequency and low frequency switching, so it will cause the palletizing operation to be affected. Performing the inverse operation can ensure the normal movement of the robot, so it can complete the palletizing movement simulation.

3.3. Conveyor Chain Signal Connection

In the signal connection of the conveyor chain, Smart components can be used for signal connection. In actual operation, the signal setting must be completed before the signal connection. First of all, the I/O signal needs to be regarded as the basis, and the signal is placed at the position of the tote and the cargo pallet. At this time, the initial value of the signal is 0, and the acting end is located on the car and the robot. According to the signal and logic value of the transmission chain, the signal connection can be made, that is, the workstation signal creation is completed, and the component signal interaction is realized. Specifically, it is necessary to complete the creation of the Simulation Event component, and then send the pulse signal to set Logic SR Latch to 1. After the sensor completes the signal status detection, the system will generate a duplicate product and perform the enqueue operation. After the sensor touches, it will receive the cargo signal and send a stop signal to realize the dequeue operation and signal transmission. After InPos obtains the detection signal, the robot will automatically pick up the parts.

3.4. Robot Signal Board Design

In terms of signal board-card design, the DSQC652 communication board should also be used to achieve signal communication connection by installing in the robot. The digital quantity of the board is 16 into 16 and the bus address is 10. In the process of connecting the robot and peripheral I/O signals, it is necessary to complete the setting of the I/O board and complete the control signal of the robot suction cup action. The replacement of the tray triggers the data recovery

signal. The 4 inputs of the end of the conveyor chain and the station tray detection signal Output digital signal settings.

3.5. Workstation Working Logic

In terms of robot work, you should also complete the tool coordinate system and load settings, and then realize the signal connection between the robot and the conveyor chain, and click the workstation logic button under the simulation option. In actual design, you need to use the default coordinate system tool, and then offset 100mm along the positive direction of the Z axis to get the origin of the trans [0, 0, 100] coordinate system, the center of gravity cog is [0, 0, 90], and the load weight is 10kg [3]. With LoadIdentify, tool load and work center of gravity can be measured automatically. After the robot completes the corpse extraction, the center of gravity is shifted by about 50 mm along the positive direction of the Z axis relative to tGrip. Using LoadIdentify, the payload can be calculated and the empty load data can be obtained. Through the reasonable setting of load data, the robot can be kept running smoothly and its service life can be extended. To simplify programming, pHome should also be set to the robot's safe waiting position, the default wobj0 workpiece coordinate system should be selected, the product position at the end of the conveyor chain should be set to pPick, the teaching tool coordinate system should be tGrip, and the pallet position should be pBase. For the unexpected path of the teaching point, it is necessary to use the program to perform enhanced control and configure a reasonable posture. The offset algorithm can be used to confirm the position change of the pallet. If the position is at the reference position, the position of the odd and even layers of the pallet can be determined. After completing the signal connection between the robot and the conveyor chain, make sure that the product is in place. The conveyor chain can transfer the signal to the input signal diBoxInPos/diPalletInPos, and then execute the running procedure until the suction position is reached. The vacuum needs to be set 0.2s before the suction to achieve the set vacuum, the signal is established, and then the product is completely sucked after a delay of 0.5s, and finally the product is placed. There is a corresponding logical relationship between the logical source signal and the target signal of the workstation. For example, the source signal is doGrip and the corresponding target signal is diVacuum, which can reflect the logical relationship between the source pair PalletizeSys and the target object SCI. Input the edited program into the PC and then transfer it to the controller, which can realize the robot motion control.

3.6. Workstation Virtual Simulation Analysis

After completing the virtual simulation design of the robot palletizing workstation according to the above method, perform virtual simulation analysis on the work of the workstation, you can first complete the

settings of I/O communication, the coordinate system of the transport tool, and the use of components. Then click on the Simulation Run button of RobotStudio. In the simulation process, the robot can be required to complete a pallet production shipment, perform 5x4 palletizing, and perform collision detection. From the simulation results, the robot needs 90s to fill the pallet, plus the time to replace the pallet with the AGV trolley. It takes a total of 100s. In the whole process, the execution objects will not collide. In a working cycle, it takes 190s. If the 8h/d working system is used, 150 pallet loads will be completed, so the production efficiency can be significant Promote.

4. CONCLUSIONS

In summary, Robot Studio is used for virtual simulation design in the design of the robot palletizing workstation, which can complete the layout and simulation of the workstation by calling the corresponding components, and realize the accurate organization of the workstation. Direct

search of the programming results can find the problems in the robot's movements, and then manually correct the robot debugging, which provides a scientific basis for the design of the workstation.

REFERENCES

- [1]M. X. Huang and W. D. Hui, Simulation research of robot palletizing workstation based on RobotStudio, *Southern Agricultural Machinery*, 2018, 49(23): 43–44.
- [2]Y. Li, Li Yong's exploration of the intelligent workstation simulation of palletizing robot based on RobotStudio, *Science and Technology Information*, 2018, 16(28): 31–32.
- [3]C. X. Hao and H. Ye, Industrial robot palletizing simulation design based on smart components, *Automation Technology and Application*, 2018, 37(8): 63–66.

Application of Neural Network Based on Pyramid Module in Image Semantic Segmentation

Jing Zhou*, Yuhang Wang, Tianran Xue

School of Control and Computer Engineering, North China Electric Power University, Beijing, 102206, China

Abstract: In recent years, convolutional neural networks have been used in the field of computer vision. When they are used in the field of semantic segmentation, they will have the problems of incomplete feature extraction and too single feature scale. Due to the importance of feature extraction to image semantic segmentation, this paper proposes a neural network based on pyramid modules. First, the modified deep residual network is used as a reference network to initially extract features. Then, using the pyramid module to process the feature image to obtain the enhanced feature image. Finally completing the task of semantic segmentation. Through experiments on the mainstream data set PASCAL VOC2012, the network obtained 59.8% of mIoU, and achieved a good segmentation effect compared with other models.

Keywords: Deep learning; Semantic segmentation; Neural network

1. INTRODUCTION

With the continuous development of computer vision algorithms, computer vision is widely used in scene analysis, unmanned driving and image modeling. Semantic image segmentation makes full use of the semantic information of the image, so it can play a huge role in scene analysis. The semantic information of the image includes not only the pixel value of the image, but also the changing trend of pixels in each area of the image. These semantic information can help the completion of the image segmentation task. The traditional image feature extraction method is aimed at a specific task. If the task changes, the effect get worse, and the convolutional neural network performs feature learning and feature extraction according to multiple layers of abstract processing. Convolutional neural networks uses hierarchical iterative processing that simulates human visual processing, and analyzes images from multiple angles to obtain results. Compared with the traditional neural network, the parameter sharing of the convolutional neural network makes the network lightweight to a certain extent, which reduces the training time and improves the utilization rate of the parameters. Modern society has higher requirements for image segmentation. The convolutional neural networks have excellent performance in the field of image segmentation, because they have more efficient image

feature learning than traditional algorithms.

Semantic segmentation can be divided into two parts: image feature extraction and image segmentation, where image feature extraction is the key part that determines the effect of image segmentation. The convolutional neural network built by Krizhevsky [1] achieved good results in the competition, demonstrating the perfect combination of convolution and neural network. Then, VGGNet [2] adds more network layers to the network, and reduces the error rate of image processing without reducing the image recognition effect. Excessively increasing the depth and width of the network has enhanced the performance of the network, but it has also brought down accuracy and optimization problems. In order to solve these problems, he [3] proposed ResNet with interval connection. Through the new connection method, the optimization difficulty caused by the increase of the network depth is reduced, and the network performance is improved. Long applied the convolutional neural network to the feature extraction task in semantic segmentation, thus proposing a brand new network FCN [4]. FCN removes the fully connected layer in the convolutional neural network, so that the task of image semantic segmentation can be completed. In this paper, a neural network based on the pyramid module is proposed, and the optimized residual neural network is used as the basic network. After that, a pyramid module is added to further extract the feature image, and finally the image is segmented.

2. THE NEURAL NETWORK BASED ON PYRAMID MODULE

In this section, the description and design of the neural network based on the pyramid module will be introduced. The entire network processing flow is shown in Fig. 1, assuming that i is the image number, and $0 \leq i \leq 4$, H_i is the image height, and W_i is the image width, C_i is the number of image channels, and the whole process is divided into 3 steps:

- (1) Input the image img ($H_0 \times W_0 \times C_0$) to the residual neural network to obtain multiple preliminary feature images F_1 ($H_1 \times W_1 \times C_1$)
- (2) Input the feature image F_1 ($H_1 \times W_1 \times C_1$) to the pyramid module, continue the feature extraction and feature fusion, and obtain the enhanced feature map F_2 ($H_2 \times W_2 \times C_2$)
- (3) Input the feature map F_2 ($H_2 \times W_2 \times C_2$) to the

comprehensive segmentation prediction module, perform image semantic segmentation, and obtain the prediction segmentation map P_map ($H_0 \times W_0 \times C_0$)

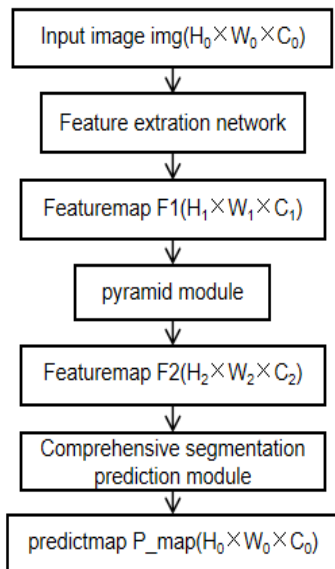


Figure 1 Semantic segmentation process of neural network based on pyramid module

2.1 Feature Extraction Network

In traditional image feature extraction, the area segmentation method [5,6] and the threshold segmentation method [7] segment the image's pixel change characteristics, the method is simple and easy to understand, and the effect is good. The traditional image segmentation method is only suitable for images with a single feature. Once it encounters a complex and changeable image, it will be affected by similar edges, resulting in a wrong segmentation effect. Therefore, how to use image information correctly is very important for image segmentation. The residual neural network uses its deep network layer to map and use the information contained in the image in multiple layers to prepare for the next image segmentation.

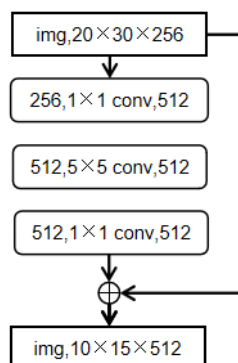


Figure 2 F_conv layer partial structure

The residual neural network has a very deep network layer, so it will produce a lot of small-size feature images in the end. Feature maps that are too small in size will result in loss of information connection between images and are not conducive to subsequent

image segmentation. Therefore, the last convolutional layer F_conv of the residual neural network is modified, so that the F_conv layer does not perform dimensionality reduction operations on the picture. Part of the structure of the F_conv layer is shown in Fig. 2, which mainly uses a 5×5 window to extract features. Before extracting features, first transform the feature map dimensions through a 1×1 convolutional layer, and then use 5×5 convolutional layers for feature extraction. The superposition of the small convolution module is equivalent to replacing the role of the large convolution module, so this paper uses the superposition of the small convolution module to replace the original convolution module of the F_conv layer, and set the number of steps to 1, so that the size of the image before and after entering the F_conv layer remains unchanged, Not only save the original feature extraction performance, but also reduce the amount of network parameters. The method of stacking blocks [5] is added to the feature extraction to further enhance the feature extraction of the network

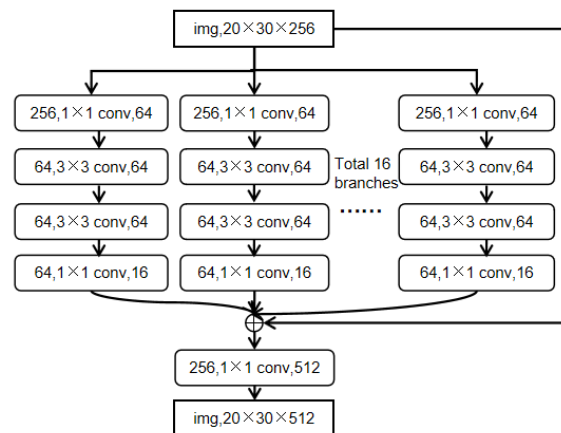


Figure 3 Partial structure of optimized F_conv layer

The method of stacking blocks does not increase the amount of parameters, but also improves the difference of feature maps. As shown in Fig. 3, the dimension of the input feature image is $20 \times 30 \times 256$, which is converted into 64 feature maps after small convolution. The 3×3 convolutional layer is used to replace the original 5×5 convolutional layer, and the reduction of the convolution window of the original convolutional block is replaced by the accumulation of small convolutional blocks, and the network performance is not reduced. Although the number of convolutional layers in each branch is reduced to 64, the overall width of the convolutional layer is increased. The advantage is that it improves the extraction effect and reduces the number of network parameters. The optimized F_conv layer has a total of 16 branches for feature extraction at the same time, and finally the results of each branch are combined and passed to the lower layer. The optimized feature extraction network can provide data for subsequent semantic segmentation tasks and improve the overall

recognition accuracy of the network.

2.2 New Pyramid Module

The feature map extracted by the feature extraction network is still somewhat rough when semantic segmentation. The pyramid module not only extracts the rough feature map again, but also performs feature fusion. The traditional image pyramid method [8] performs well in the extraction of image information,

but usually ignores the role of low-level feature maps, and only treats it as one-time data, and the traditional image pyramid method feature fusion effect is not ideal. In order to improve feature detail extraction and feature fusion, this paper proposes a new pyramid module to provide better feature images for semantic segmentation tasks.

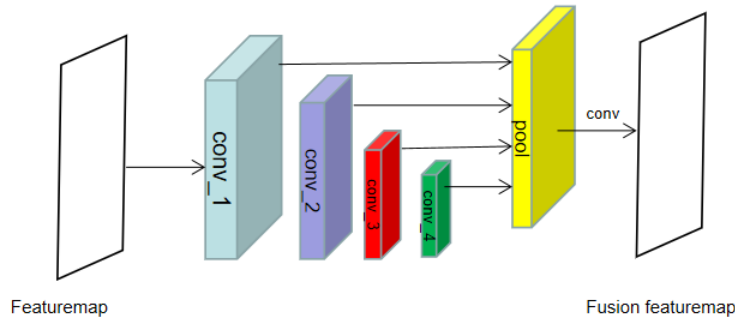


Figure 4 New pyramid module structure

The new pyramid module has multiple convolutional layers with different scales, which can generate multiple feature maps containing different semantic information, and the feature maps are fused. Unlike the traditional pyramid module, the new pyramid uses a unified pooling layer to perform feature filtering of feature maps, which improves the utilization rate of features. The new pyramid module has 4 convolutional layers, which are 11×11 conv_1, 7×7 conv_2, 5×5 conv_3, and 3×3 conv_4 respectively. The four convolutional layers generate feature images F1, F2, F3 and F4, and input four parts of feature maps of different sizes into the pooling layer for processing to obtain new multiple feature atlases A. As shown in formula (1), the new feature atlas A is generated by multi-scale extraction, which contains multiple feature maps. They store the information of different regions of the image, and learn the semantic information of the image better.

$$A = f_{\text{pool}}(f_{11 \times 11 \text{ conv}}(F_1; \theta_1) + f_{7 \times 7 \text{ conv}}(F_2; \theta_2) + f_{5 \times 5 \text{ conv}}(F_3; \theta_3) + f_{3 \times 3 \text{ conv}}(F_4; \theta_4); \theta_k) \quad (1)$$

Among formula (1), f_{conv} is the convolution layer function, f_{pool} is the pooling layer function, θ is the parameter in the function. i, j, k, m and n are the parameter number of each function.

The new pyramid module extracts the features of each area of the image multiple times through multiple convolution layers with different scales to generate a new fusion feature map. From Equation 1, the new Golden Tower processes images from multiple angles, which allows for more detailed and extensive feature extraction. The various feature maps after extraction are input to the feature atlas A generated in the pooling layer and cannot be used directly. The feature maps in the feature atlas A are fused after the convolution layer to generate the final features Figure. The final feature map integrates the aggregated image

features and contains the related information of each area of the image, which provides good data for the semantic segmentation of the image.

2.3 Semantic Segmentation Module

The semantic segmentation module performs semantic segmentation on the feature map fused by the new pyramid module, and restores the image to the original size to generate a predicted segmentation map. The structure of the semantic segmentation module is shown in Fig. 5. The fused feature map first undergoes a 1×1 convolutional layer to unify the dimensions, and then performs the convolution operation. After the convolution operation, the deconv layer deconv restores the feature image to the same size as the original image, and finally enters the predicted segmentation image through the image segmentation layer.

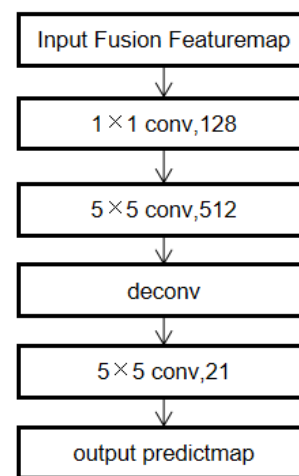


Figure 5 Structure diagram of semantic segmentation module

3. EXPERIMENT AND ANALYSIS

3.1 Experimental Environment

The experimental environment of this article is shown in Table 1:

Table 1 Experimental environment settings

Category	Configuration
Processor	Inter(R) Xeon(R) Gold 5120T
GPU	NVIDIA GTX 2080Ti
RAM	8G
Development Framework	Pytorch

3.2 Data Set

The data set used in this paper is PASCAL VOC2012, and its part of semantic segmentation data is selected for the image semantic segmentation experiment in this paper. The data set is divided into a training set and a test set. The pictures contained in the two data sets are not repeated, so as not to affect the experimental judgment. The data set contains 21 categories, namely people, plants, sheep, motorcycles, horses, dogs, tables, cows, chairs, cats, cars, buses, bottles, boats, birds, bicycles, airplanes, sofas, trains, TVs and background. The data set has close to 1500 pictures, samples are various and sufficient, and there are multiple semantic segmentation scenarios, which can accurately test the network performance.

The evaluation standard of the performance of the semantic segmentation network is intersection over union (iou), which is the ratio of the intersection and union of the two types of pixel distribution of the segmentation object in the segmentation graph and the segmentation object in the label graph. The evaluation standard used for network performance in this paper is mean intersection over union (miou), which is to calculate the average value of each segmented object category iou after calculation.

3.3 Experimental Analysis

In the experiment of this paper, two representative semantic segmentation networks are selected and compared with the network in this paper. The first is a semantic segmentation neural network with only feature extraction network and semantic segmentation module, referred to as FECNN; the second is a fully convolutional neural network (FCN), which is a typical algorithm in the field of semantic segmentation; the third algorithm is this paper proposes a network based on pyramid modules. This section mainly compares and analyzes the performance of the three algorithms on the data set.

In addition to the modified part of the feature extraction network in this paper, the remaining part uses the pre-trained residual neural network parameters to initialize the training parameters. Before training, the data set needs to be simply preprocessed for data enhancement. For training convenience, the data set is generally cropped to a uniform size by ordinary cropping, but due to the limitation of the cropping method, some features of the image will be missed. So this article uses random cropping to do the same operation on the images of the training set and the test set. Random detection of the same picture multiple times can generate multiple pictures with different orientations to ensure that the

image information is not lost after cropping. In the experimental training of this paper, the parameter optimization method is Adam (adaptive moment) algorithm. The learning rate selection method is an adaptive method. During the training process, if the network performance declines, the learning rate is reduced and training continues. Under the same environment, compare the network performance of FECNN, FCN32s and the model in the same data set, as shown in Table 2.

Table 2 Comparison of iou (%) of each model under PASCAL VOC2012

	FECNN	FCN32s	The network we proposed
background	87.8	90.2	91.3
plane	55.1	65.6	66.2
bike	15.2	23.2	30.5
bird	47.5	57.8	61.5
boat	35.6	42.4	55.6
bottle	42.6	50.3	57.5
bus	57.0	62.6	67.0
car	55.1	65.5	71.0
cat	58.4	66.7	70.4
chair	14.9	15.3	30.1
cow	46.8	57.5	71.5
table	27.6	35.6	50.8
dog	48.8	59.8	61.6
horse	47.3	52.0	70.1
motorbike	37.3	45.3	55.7
person	61.6	69.8	70.5
plant	33.7	36.6	47.3
sheep	59.0	61.4	65.4
sofa	25.0	29.2	45.6
train	61.4	65.8	66.5
tv	37.2	41.5	51.0
miou	45.4	52.1	59.8

It can be seen from Table. 1 that the new pyramid module has greatly improved the performance of the network after optimizing the feature extraction network. Compared with FCN32s, the network performance of this article is also improved overall. Especially in sofa, TV, bike and boat, iou has significantly improved, indicating that the network of this article has significantly improved the feature recognition of small objects. In the experiment, the relevant data may have a slight gap with the original comparison network. The main reason is that the training environment and training process are different, which resulting in a gap between the experimental data and the original paper.

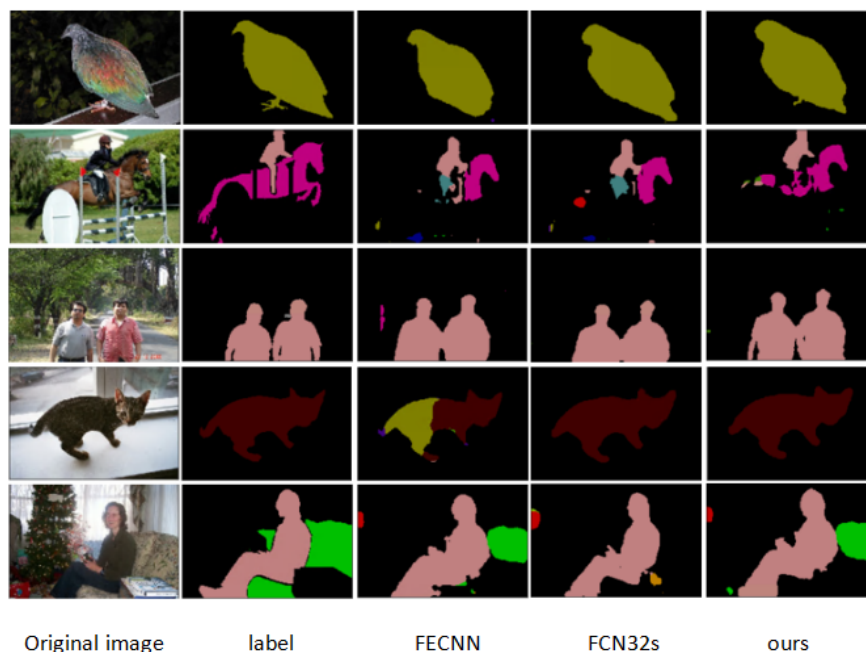


Figure 6 Comparison of experimental results of semantic segmentation

The comparison results of the experiment are shown in Fig. 6. The network in this paper shows a good segmentation effect. The first group and the third group of objects are single animals. FECNN's feature extraction is too simple, which leads to poor results. The network in this paper accurately segmented the detailed features of animals, such as bird claws etc. The third group of objects are similar objects. In this paper, the network divides the gap between similar objects well. The second group and the fifth group of objects are multiple segmented objects. Compared with other networks, the network in this paper can segment the objects correctly and completely. The model in this paper is excellent in extracting the detailed features of the image. It can segment the target object more accurately under the interference of other objects, and has significantly improved the segmentation of similar targets.

4. CONCLUSION

This paper proposes a semantic segmentation neural network based on the pyramid module. First, the feature extraction network based on the deep residual network is structurally optimized, then the optimized pyramid module is added, and finally a new semantic segmentation network is formed. The new pyramid module of the network in this paper can significantly enhance the image recognition performance of the network and improve the extraction of detailed features of the image. Through experiments, on the PASCAL VOC2012 data set, it is superior to other networks, and has obtained 59.8% of miou. In the follow-up work, we will continue to optimize and improve the network's feature extraction capabilities and the network's image recognition performance.

ACKNOWLEDGMENT

This paper is supported by the Fundamental Research Funds for the Central Universities (Grant No. 2018 MS169).

REFERENCES

- [1] A. Krizhevsky, et al., ImageNet classification with deep convolutional neural networks, Communications of The ACM, 2017, 60(6): 84–90.
- [2] K. Simonyan and Z. Andrew, Very deep convolutional networks for large-scale image recognition, ICLR 2015: International Conference on Learning Representations, 2015.
- [3] K. He, X. Zhang, S. Ren, et al., Deep residual learning for image recognition, 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), IEEE Computer Society, 2016.
- [4] J. Long, E. Shelhamer, and T. Darrell, Fully convolutional networks for semantic segmentation, IEEE Transactions on Pattern Analysis and Machine Intelligence, 2017, 39(4): 640–651.
- [5] S. Xie, R. Girshick, P. Dollár, et al., Aggregated residual transformations for deep neural networks, In CVPR, 2017, 634.
- [6] S. T. Li and B. Yang, Multifocus image fusion using region segmentation and spatial frequency, Image and Vision Computing, 2008, 971–979.
- [7] W. U. Yi-Quan, et al., Image thresholding based on 2-D Histogram θ -Division and minimum error, Journal of Shanghai Jiaotong University, 2012, 892–899.
- [8] T. Y. Lin, P. Dollár, R. Girshick, K. M. He, B. Hariharan, and S. Belongie, Feature pyramid networks for object detection, In CVPR, 2017.

Fabrication of WO₃ Nanofilms by W-ion Implantation and Subsequent Thermal Annealing

Xiaodong Zhou^{1,*}, Yongmei Wang², Qiang Wang¹, Songfeng Zhang¹, Xiaodong Lao¹

¹ School of Mechanical and Electrical Engineering, Zhoukou Normal University, Zhoukou, 466001, China

² School of Physics and Telecommunication Engineering, Zhoukou Normal University, Zhoukou, 466001, China

Abstract: WO₃ nanofilms on the surface of fused silica have been fabricated by W-ion implantation and subsequent thermal annealing in oxygen ambience. The silica glasses were implanted by W ions at an accelerating voltage of 30 kV with fluence 2×10^{17} ions/cm² using a metal vapor vacuum arc (MEVVA) ion source implanter. The influence of annealing parameters on the formation and growth of the WO₃ nanofilms was detailed studied. The optical absorption spectroscopy and scanning electron microscopy (SEM) measurements were done to figure out the formation mechanism of the WO₃ nanofilms. **Keywords:** Ion implantation; Thermal annealing; WO₃ nanofilms

1. INTRODUCTION

Many experimental techniques have been developed for synthesizing various types of nanocomposite materials. Among the different processing techniques [1–4] used in an attempt to synthesize nanoparticles of uniform size, shape, and depth distribution, ion implantation provides an attractive method of fabricating metal nanoparticles in solids due in part to the spatial controllability.

Ion implantation was first used for this purpose in the 1970s to form Ag and Au nanoparticles embedded in silica glass [5]. In the early work, it was noted that an extremely high local concentration of precipitates was obtained in a thin layer near the specimen surface. In this paper, ion implantation technology was applied to fabricate WO₃ nanofilms by a solid phase growth process of W-ion implantation into fused silica substrate and subsequent thermal annealing in oxygen ambience. The influence of implantation and annealing parameters on the formation, phase and growth of the WO₃ nanofilms was detailed studied, in order to figure out the mechanism for the formation of the WO₃ nanofilms. The thickness and phase of the nanofilms can be well tailored by controlling the implantation and annealing parameters.

2. EXPERIMENTAL

2.1 Fabrication of Samples

High purity silica slides (20 mm×20 mm×1 mm in dimensions) were implanted by W ions at an accelerating voltage of 30 kV to fluence of 2×10^{17} ions/cm², respectively, by using a metal vapor vacuum arc (MEVVA) ion source implanter. The

samples were kept rotating in a horizontal plane during ion implantation and kept at the room temperature with the circulation of cooling water. The implanted samples were annealed in a conventional tube furnace for 1, 2 and 3 hours in oxygen atmosphere at 500 °C.

2.2 Characterization of Samples

The optical absorption spectra of the samples were measured using a spectrophotometer with wavelengths varying from 200 to 800 nm. The surface morphologies of the implanted samples before and after thermal annealing were examined by using a scanning electron microscopy (SEM).

3. RESULTS AND DISCUSSION

3.1 Optical Absorption Spectra of W Implanted Sample

Figure 1 shows the optical absorption spectra of the 2×10^{17} W ions/cm² implanted samples annealed for 1, 2 and 3 hours at 500 °C, respectively. In the absorption spectra of the three as-implanted samples, the background absorption drastically increases in the UV and visible regions (not shown here). This is due to absorption of irradiation induced point defects and the W metal nanoparticles formed in silica substrate. After annealing at 500 °C, the background absorption reduces drastically due to the defect annihilation after thermal annealing. At the same time, an abrupt absorption edge appears which results from the phase of WO₃ [6,7]. It suggests that the WO₃ has been formed upon post-implantation annealing at 500 °C. In addition, the spectra present a trend that the absorption edges shift to longer wavelength with the increase of annealing temperature, implying an increase in mean sizes of the WO₃ nanoparticles. The results show that the absorption edges are found to be influenced by the annealing time. The absorption edge undergo a remarkable shift to longer wavelength when the sample annealed for 3 hours.

3.2 SEM Images of W ions Implanted Samples

The surface morphologies of the samples were investigated by SEM. Figure 2 and Figure 3 show the SEM images of the W ions implanted samples annealed for 1 h and 3 h at 500 °C, respectively. On the whole, there is a very obvious difference in the surface morphology change of the samples via thermal treatment. Figure 2 shows some small-sized nanoparticles began to appear, showing the WO₃

nanoparticles began form after annealing at 500 °C for 1 h. When the annealing time was increased for 3 h, a smooth and homogenous film consisted of many near-spherical nanoparticles compactly distributed on the surface of the substrate was produced.

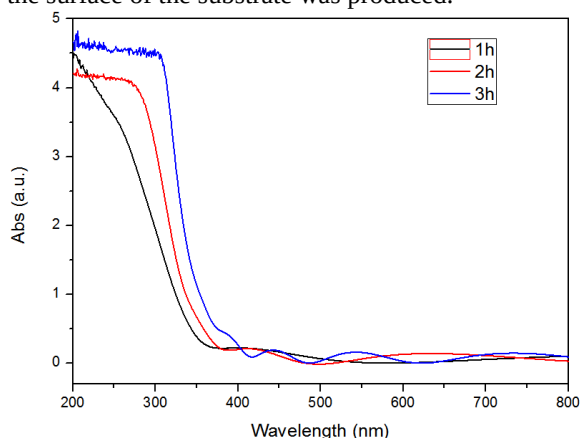


Figure 1 (Color online) Optical absorption spectra of the 2×10^{17} W ions/cm² implanted samples annealed at 500 °C for 1, 2 and 2 hours, respectively

It is important to point out that the evolution of the surface morphologies of all of the samples shown in Figs. 2 and 3 as a function of annealing time is well related with the results given by optical absorption spectra (Fig. 1). The increase in both the size of nanoparticles and crystal quality as a function of annealing time leads to the shift of absorption edge towards to the longer wavelength.

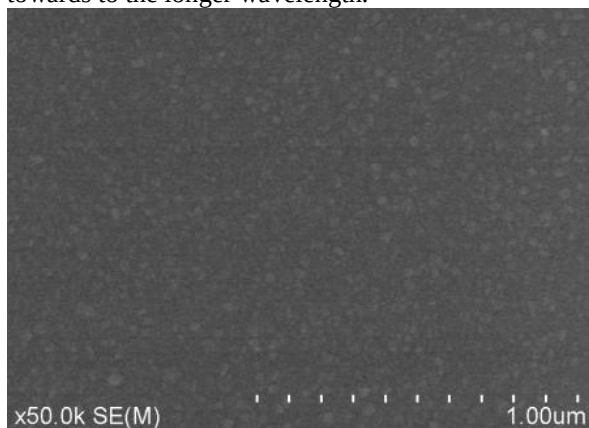


Figure 2 SEM image of the 2×10^{17} Ti ions/cm² implanted sample annealed for 1 h at 500 °C

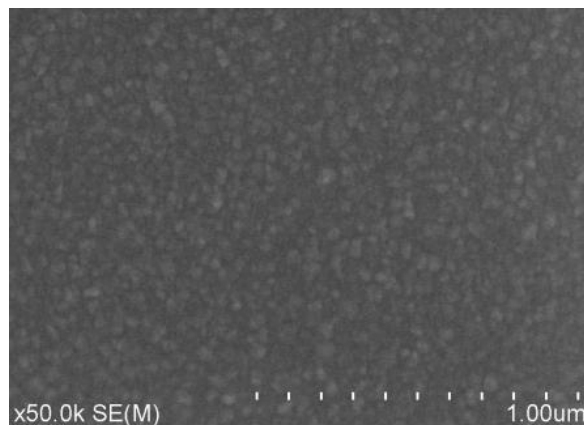


Figure 3 SEM image of the 2×10^{17} Ti ions/cm² implanted sample annealed for 3 h at 500 °C.

3.3 Mechanism for the Formation of TiO₂ Nanofilms

During annealing in the oxygen atmosphere, implanted W atoms diffuse to the surface of silica and are oxidized to form WO₃ when they met oxygen at the surface. Meanwhile, the Ostwald ripening effect takes place in the small W nanocrystals embedded in silica to form larger ones. The solid phase growth process of the WO₃ nanofilms is similar to the previous reported study of implanted Zn atoms in silica and sapphire, which finally formed high-quality ZnO nanofilms on the surface of substrates [8-10].

4. CONCLUSIONS

In summary, WO₃ nanofilms were fabricated on fused silica substrate by a solid phase growth process of W-ion implantation and subsequent thermal annealing in an O₂ atmosphere. The mechanism for the formation, phase and growth of the TiO₂ WO₃ nanofilms were detailed discussed. The size and the phase of the WO₃ nanocrystals can be tailored by controlling the annealing parameters. A longer annealing time produced a larger nanocrystal size. The thickness of the WO₃ nanofilms is annealing time dependent, which is determined by all of the W atoms diffuse out of the substrate to form a thicker WO₃ nanofilms through subsequent thermal annealing under an O₂ atmosphere. Thus, the formation, phase and growth of the WO₃ nanofilms can be well tailored by controlling the annealing parameters (temperature and time). The results indicate that the WO₃ nanofilms fabricated by this approach have great potential for applications.

REFERENCES

- [1] M. Epifani, E. Carlino, C. Blasi, C. Giannini, L. Tapfer, and L. Vasanelli, Sol-Gel Processing of Au Nanoparticles in Bulk 10 B₂O₃-90 SiO₂ Glass. Chem. Mater., 2001, 13: 1533.
- [2] Y. Kojima and T. Kato, Nanoparticle formation in Au thin films by electron-beam-induced dewetting Nanotechnology, 2008, 19: 255604.
- [3] D. Barreca, A. Gasparotto, C. Maccato, and E. Tondello, Silica-sandwiched Au nanoparticle arrays by a soft PE-CVD/RF sputtering approach.

Nanotechnology, 2008, 19: 255602.

[4]R. Toledano and D. Mandler, Electrochemical Codeposition of Thin Gold Nanoparticles/Sol-Gel Nanocomposite Films. *Chem. Mater.*, 2010, 22 (13): 3943.

[5]G. W. Arnold and J. A. Borders, Aggregation and migration of ion-implanted silver in lithia-alumina-silica glass. *J. Appl. Phys.* 1977, 48, 1488.

[6]P. K. Biswas, N. C. Pramanik, M. K. Mahapatra, D. Ganguli, J. Livage, Optical and electrochromic properties of sol - gel WO_3 films on conducting glass, *Materials Letters*, 2003, 57(28): 4429-4432.

[7]S. J. Wang, G. Cheng, X. H. Jiang, Y. C. Li, Y. B. Huang, and Z. L. Du, Direct observation of photoinduced charge redistribution of $\text{WO}_3 - \text{TiO}_2$

double layer nanocomposite films by photoassisted Kelvin force microscopy. *Appl. Phys Lett.*, 2006, 88(21): 212108.

[8]F. Ren, C. Z. Jiang, and X. H. Xiao, Fabrication of single-crystal ZnO film by Zn ion implantation and subsequent annealing. *Nanotechnology*, 2007, 18: 285609.

[9]X. H. Xiao, F. Ren, L. X. Fan, et al., ZnO single-crystal films fabricated by the oxidation of zinc-implanted sapphire. *Nanotechnology*, 2008, 19: 325604.

[10]Y. X. Liu, Y. C. Liu, C. L. Shao, et al., Excitonic properties of ZnO nanocrystalline films prepared by oxidation of zinc-implanted silica. *J. Phys. D: Appl. Phys.*, 2004, 37: 3025-3029.

The Research about Different Varieties of Mushrooms' effects on the Absorption or Enrichment of Three Kinds of Heavy Metals and the Safety Limit Value

Ying Lai, Xingnuo Xu

College of Life Science and Agriculture, Zhoukou Normal University, Zhoukou 466001, Henan, China

Abstract: In order to study different varieties of mushrooms on law about the absorption or enrichment of three kinds of heavy metals and the safety limit value of heavy metals in the cultivational materials. We use two kinds of mushrooms in two mediums to do cultivational experiments through adding different concentrations of lead, cadmium chloride and nitrate arsenic trioxide, and next, gather the sporocarps. Then we respectively detect the contents of mushrooms' sporocarps, and Pb, Cd, As in the cultivational materials before bagging, and use the SPSS software to an analysis in the correlation between the obtained data. Results show that: The two mushrooms on the law about three kinds of heavy metal enrichment or absorption capacity is: $Cd > As > Pb$; totally about ten regression equations are obtained; the values of R^2 are above 0.9. We fingered out eight Pb values by using these two mushrooms which are cultivated in the cotton seed shells or the corn cobs. The critical value of Pb are respectively 63.34, 55.09 $mg\ kg^{-1}$; the critical value of Cd are 0.29, 0.41, 0.16, 0.40 $mg\ kg^{-1}$; the critical value of As are respectively 3.16, 1.51 $mg\ kg^{-1}$. To conclude, different cultivational materials cultivate the same mushroom, or the same kind of cultivational materials culture different varieties of mushrooms. There are different laws between them.

Keywords: Mushroom; Heavy metals; Enrichment; Safety limit value

1. INTRODUCTION

Nowadays industrial and agricultural scraps are always used as medium in edible mushroom industry. And it is identified that heavy metals are much easier to be accumulated in edible mushroom fruit bodies [1,2]. As a result of this, heavy metal pollution has seriously influenced the quality and food safety of edible mushroom [3]. So to keep a proper level of heavy metal content in medium and covering soil can improve the quality of edible mushroom and also make a great sense to the development of edible mushroom industry [4-6].

Edible fungus, which contain a lot of nutritions such as protein, amino acids, vitamins, are a delicious and healthy food [7]. However, as the emission of

industrial waste, the use of pesticides and herbicides containing different heavy metals, the sources diversification of cultivation materials of edible fungus increasingly outstanding [8,9]. Therefore, we need to control the content of heavy metals in edible fungi to enhance the food safety of edible fungi which has far-reaching significance to the edible fungus industry in China.

In this research, the main cultivars such as two different varieties of mushrooms were used as the experimental species, and three methods were taken by selecting different mediums, or adding Pb, Cd, and As of different concentrations in mediums, or adding Pb, Cd, and As of different concentrations in covering soil [10]. Effects of heavy metal content in medium or casing soil on the product security of edible mushroom had been analyzed. The capacity of edible mushroom fruit bodies in accumulating Pb, Cd, and As had been researched.

2. MATERIALS AND METHODS

2.1 Experimental Materials

2.1.1 Test strain

Two different varieties of mushrooms P-5 and P-8, Zhoukou academy of agricultural sciences, providing by Zhoukou Academy of Agricultural Sciences.

2.1.2 Experimental reagents

Concentrated nitric acid, concentrated sulfuric acid, hydrogen peroxide solution, perchloric acid, sodium hydroxide solution, arsenic trioxide, cadmium chloride, lead nitrate, 75% ethanol, deionized water, all above reagents are analytical pure;

Lead standard solution: 0.16 g lead nitrate, 10 mL hydrogen nitrate, 1000 mL water.

Cadmium standard solution: 2.03 g $CdCl_2 \cdot 2H_2O$, 1000 mL water;

Arsenic standard solution: 1.32 g As_2O_3 , 1.20 mL Sodium hydroxide solution ($0.1\ g\ mL^{-1}$), 1000 mL water.

2.1.3 Experimental instrument

JD200-3 electronic balance, Shenyang Longteng Electronics Co., Ltd; SW-CJ-2FD super-clean worktable Suzhou City Gold Purification Equipment Technology Co., Ltd; UV-5100 UV vis Spectrophotometer, Shanghai Metash Instruments Co., Ltd; JJ-2 Kinematica, Jintan Jieruier Instrument

Manufacturing Co., Ltd.

2.1.4 Mediums

Culture Medium Components: Cotton Seed Hull 85%, bran 15%, ratio of material to water 1:1.2, under natural pH;

Corn cob 85%, bran 15%, ratio of material to water 1:1.2, under natural pH;

2.2 Experimental

2.2.1 Experiment process

Using Cottonseed hull and corncob as Major cultivating materials with different concentration of heavy metal solution were stirred until homogenous. The final concentrations of heavy metals Pb, Cd and As were shown in Tables 1, 4 and 6, and every cultivating material repeated 9 times. In this experimental, control group was established. The heavy metals were not added into the samples in the control group. The remaining experimental steps were the same to the experimental groups.

Loading into high density polyethylene bag (33 cm *17 cm *0.04 cm) in each bag of 0.10 kg (wet weight) after cultivating material treatment, and allow it to cool in a sterile environment after disinfection by high temperature, high pressure, then vaccinated two

Table 1 two kinds of mushroom on the enrichment of cottonseed shell cultivation materials Pb

Pb concentration (mg kg ⁻¹)	Lead content in cultivation materials (mg kg ⁻¹)	Lead content in sub entities (mg kg ⁻¹)		Enrichment factor	
		P-5	P-8	P-5	P-8
0	0.22 ±0.030	0.10 ±0.000	0.27 ±0.030	0.432a	1.213b
2	1.72 ±0.040	0.31 ±0.004	0.18 ±0.030	0.178	0.106
7	6.78 ±0.120	0.41 ±0.006	0.19 ±0.005	0.028	0.044
15	13.36 ±0.310	0.17 ±0.013	0.04 ±0.004	0.013	0.003
30	19.37 ±0.480	0.23 ±0.010	0.12 ±0.000	0.012	0.006
60	43.46 ±1.320	0.91 ±0.020	1.08 ±0.010	0.021	0.025

Note: the results of the above table show that the average of the measured 9 times of the data is deviation, and the difference between the different letters of the same line after the enrichment factor is significant, the same as the next table.

P-5 and P-8 mushroom for enrichment pattern in cottonseed hull Cultivation material Shown in Table 1. This result indicated the average of the bioconcentration coefficient of Pd in 2 mushrooms were 0.114 and 0.233, and the bioconcentration coefficient was low. As can be seen from Table 3 (x

Table 2 Two kinds of mushroom on enrichment of corn cob cultivation materials Pb

Pb concentration (mg kg ⁻¹)	Lead content in cultivation materials (mg kg ⁻¹)	Lead content in sub entities (mg kg ⁻¹)		Enrichment factor	
		P-5	P-8	P-5	P-8
0	0.32 ±0.030	0.18 ±0.000	0.23 ±0.000	0.563	0.719
2	3.22 ±0.070	0.25 ±0.001	0.19 ±0.007	0.078	0.059
7	7.68 ±0.100	0.38 ±0.030	0.21 ±0.010	0.050	0.027
15	14.49 ±0.280	0.57 ±0.050	0.22 ±0.010	0.039	0.015
30	46.40 ±4.245	1.11 ±0.010	0.53 ±0.016	0.024	0.013
60	60.97 ±0.050	0.85 ±0.050	1.01 ±0.007	0.014	0.017

P-5 and P-8 mushroom for enrichment pattern in cottonseed hull Cultivation material Shown in Table 2. This result indicated the average of the bioconcentration coefficient of Pd in 2 mushrooms

kinds of mushrooms P-5 and P-8.

After management of mushroom growth, the spectrophotometer method has been applied to the determination content of heavy metal of Pb, Cd, and As in the fruiting body.

2.2.2 Detection method

The content of Pb, Cd, and As were determined by the methods of national standard.

2.2.3 Data-processing

Enrichment coefficient were calculated to analyze the content of Pb, Cd, and As enrichment trend at the fruiting body of two kinds of mushrooms P-5 and P-8. Application of Non-linear Regression Analysis was used for comparing the content of Pb, Cd, and As between cultivating material and the fruiting body. According to the concentration standard of the dried products of mushrooms [the Arsenic content ≤1.00 mg kg⁻¹; the lead content ≤2.00 mg·kg⁻¹; the Cadmium content ≤1.50 mg·kg⁻¹], and Calculated the safety limit value of three heavy metals in cultivating material.

3. RESULT AND ANALYSIS

3.1 The Enrichment of Cottonseed Shell Cultivation Materials Pb in Two Kinds of Mushroom

was the content of Pb in cultivation, y was the content of Pb in the fruiting food), when y = 2.00 mg kg⁻¹, which could be calculated by the safe limit value of Pb was 66.34 mg kg⁻¹, 55.09 mg kg⁻¹ in the cottonseed hull cultivation material and corncob cultivation material through the regression equation.

were 0.128 and 0.142, and the bioconcentration coefficient was low also.

As can be seen from Tables 1 and 2, when the content of Pb of the experiment setup was between 0.00~60

mg kg⁻¹, the highest value of the content of Pb in the fruiting body was only 1.11 mg kg⁻¹. According to food safety standards, it was not exceeding the safety value.

Table 3 Two kinds of mushroom on three kinds of heavy metals absorption and accumulation regression equation and safety limit values

Heavy metal	Cultivation material	Mushroom varieties	Regression equation and correlation		Safety limited (mg kg ⁻¹)
Pb	Cottonseed hull	P-5	$y=0.0008x^2-0.0257x+0.4176$	$R^2=0.932$	63.34
		P-8	$y=0.0011x^2-0.0290x+0.2687$	$R^2=0.990$	55.09
	Corn cob	P-5	$y=-0.0005x^2+0.0425x+0.1148$	$R^2=0.978$	
		P-8	$y=-0.0004x^2-0.0093x+0.2428$	$R^2=0.991$	
Cd	Cottonseed hull	P-5	$y=-0.5343x^2+5.2732x+0.0061$	$R^2=0.995$	0.29
		P-8	$y=-0.4367x^2+3.9306x-0.0431$	$R^2=0.985$	0.41
	Corn cob	P-5	$y=-0.4623x^2+5.0694x+0.6823$	$R^2=0.977$	0.16
		P-8	$y=-0.2652x^2+3.2780x+0.2142$	$R^2=0.977$	0.40
As	Cottonseed hull	P-5	$y=-0.0170x^2+0.3499x+0.1346$	$R^2=0.981$	3.16
		P-8	$y=-0.0244x^2+0.6273x+0.1052$	$R^2=0.988$	1.51

Base on Table 3, when $y=2.00$ mg kg⁻¹, equation had no solution which showed that there was no Correlation between the bioconcentration coefficient of two mushrooms in corncob cultivation material and the Pb concentration in the cultivation material, therefor which could not obtain the safe limit value of Pb. Through significant analysis about the enrichment factor of two mushrooms in corncob cultivation material, the result was not significant for enrichment capacity above every of additive concentration of Pb.

2.2 Enrichment of Cottonseed Shell Cultivation Materials Cd in Two Kinds of Mushroom

Table 4 Two kinds of mushroom on enrichment of cottonseed shell cultivation materials Cd

Cd concentration (mg kg ⁻¹)	Cadmium content in cultivation materials (mg kg ⁻¹)	Cadmium content in fruiting bodies (mg kg ⁻¹)		Enrichment factor	
		P-5	P-8	P-5	P-8
0	0.06±0.007	0.19±0.000	0.17±0.006	3.124	2.822
0.1	0.19±0.001	1.19±0.010	0.73±0.020	6.243a	3.859b
0.5	0.81±0.012	3.66±0.020	2.61±0.025	4.523a	3.226b
1	1.98±0.025	8.92±0.065	6.72±0.050	4.505a	3.394b
2	2.74±0.020	10.05±0.045	6.95±0.090	3.668a	2.536b
5	6.42±0.115	11.86±0.190	7.22±0.006	1.847a	1.124b

P-5 and P-8 mushroom for enrichment pattern in cottonseed hull Cultivation material Shown in Table 4. This result indicated the average of the bioconcentration coefficient of Pd in 2 mushrooms were 3.985 and 2.827, and the bioconcentration coefficient was higher. As can be seen from Table 3 (x was the content of Cd in cultivation, y was the content of Cd in the fruiting food), when $y=1.50$ mg kg⁻¹ and R^2 was greater than 0.98, the safety values of Cd of two mushrooms in cottonseed hull cultivation material were 0.29 mg kg⁻¹ and 0.41 mg kg⁻¹.

Table 5 Two kinds of mushroom on enrichment of corn cob cultivation materials Cd

Cd concentration (mg kg ⁻¹)	Cadmium content in cultivation materials (mg kg ⁻¹)	Cadmium content in fruiting bodies (mg kg ⁻¹)		Enrichment factor	
		P-5	P-8	P-5	P-8
0	0.06±0.011	0.30±0.001	0.29±0.010	4.924	4.820
0.1	0.18±0.011	1.20±0.010	0.86±0.015	6.667a	4.759b
0.5	0.61±0.030	4.65±0.012	1.60±0.020	7.623a	2.626b
1	1.28±0.020	7.15±0.115	5.03±0.030	5.586a	3.927b
2	2.44±0.120	9.52±0.120	6.12±0.010	3.902a	2.508b
5	7.12±0.365	13.40±0.170	10.14±0.050	1.882a	1.424b

P-5 and P-8 mushroom for enrichment pattern in corn cob Cultivation material Shown in Table 5. This result indicated the average of the bioconcentration coefficient of Pd in 2 mushrooms were 5.097 and 3.344, and the bioconcentration coefficient was very high. Base on Table 5, when $y=1.50$ mg kg⁻¹ and R^2 was over than 0.97, the safety value were 0.16 mg kg⁻¹ and 0.40 mg kg⁻¹, and the enrichment factor was highest, being 7.623; when the content of Cd was 0.5 mg kg⁻¹, the content of Cd in cottonseed hull Cultivation material and corn cob cultivation material were all higher than the safety value. This result indicated the enrichment capacity of Cd for P-5 was more than P-8 no matter what it was in corncob

cultivation material or cottonseed hull Cultivation material.

2.3 Enrichment of Cottonseed Shell Cultivation Materials As in Two Kinds of Mushroom

Table 6 Two kinds of mushroom cultivation in cottonseed hull material for the enrichment of As

As concentration (mg kg ⁻¹)	Arsenic content in cultivation materials (mg kg ⁻¹)	Arsenic content in sub entities (mg kg ⁻¹)		Enrichment factor	
		P-5	P-8	P-5	P-8
0.00	0.05±0.003	0.02±0.005	0.02±0.006	0.401	0.425
0.10	0.07±0.005	0.07±0.004	0.08±0.010	1.000a	1.143b
0.50	0.64±0.006	0.46±0.006	0.54±0.004	0.723a	0.838b
1.00	1.03±0.016	0.64±0.018	0.92±0.012	0.620a	0.890b
2.00	1.46±0.035	0.62±0.019	1.12±0.020	0.425a	0.767b
4.00	4.72±0.030	1.31±0.024	2.28±0.065	0.278a	0.483b
6.00	5.42±0.024	1.60±0.024	2.68±0.070	0.295a	0.494b
8.00	7.93±0.068	1.78±0.030	3.80±0.120	0.224a	0.479b
10.00	11.06±0.035	1.96±0.045	3.99±0.125	0.177a	0.361b

P-5 and P-8 mushroom for enrichment pattern in cottonseed hull Cultivation material Shown in Table 6. This result indicated the average of the bioconcentration coefficient of As in 2 mushrooms were 0.460 and 0.653, and the bioconcentration coefficient was between Pb and Cd. the result was not significant for enrichment capacity above every of additive concentration of Pb. This result indicated the enrichment capacity of Cd for P-5 was more than P-8 no matter what it was in corn cob cultivation material or cottonseed hull Cultivation material. When $y=1.00$ mg kg⁻¹, the safety values were 3.16 mg kg⁻¹ and 1.51 mg kg⁻¹, the content of As in cottonseed hull Cultivation material were all higher than the safety value.

3. CONCLUSION

This paper wants study on different varieties of mushrooms on law about the absorption or enrichment of three kinds of heavy metals and the safety limit value of heavy metals in the cultivational materials, We use two kinds of mushrooms in two mediums to do cultivational experiments through adding different concentrations of lead, cadmium chloride and nitrate arsenic trioxide., and next, gather the sporocarps. Then we respectively detect the contents of mushrooms' sporocarps, and Pb, Cd, As in the cultivational materials before bagging, and use the SPSS software to an analysis in the correlation between the obtained data. Results show that: The two mushrooms on the law about three kinds of heavy metal enrichment or absorption capacity is: Cd>As>Pb; Totally about ten regression equations are obtained; The values of R² are above 0.9, We fingered out eight Pb values by using these two mushrooms which are cultivated in the cotton seed shells or the corn cobs. The critical value of Pb are respectively 63.34,55.09 mg kg⁻¹;The critical value of Cd are 0.29, 0.41, 0.16, 0.40 mg kg⁻¹;The critical

value of As are respectively 3.16,1.51 mg kg⁻¹.To conclude, different cultivational materials cultivate the same mushroom, or the same kind of cultivational materials culture different varieties of mushrooms .There are different laws between them.

REFERENCES

- [1]Edible and medicinal mushroom 2013, 21(3): 156-157.
- [2]benazir J F, Sugantlu R, Rajvel ed al. Bioremediation of cluomium in tannery effluent by microbial consortia. African Journal of Biotecluology. 2010, 9(21): 3140-3143.
- [3]YU De-yang, CHENG Xian-hao, LUO Yi, etal. Research progress on accumulation of heavy metal in macro-fungi. Edible Fungi of China, 2011, 30(1): 10-13.
- [4]ZHANG Yu-jie, HU Guo-hai, LI Hong-chao. Analysis and assessment of heavy metal pollution in fresh edible meshroom collected from several aereas in Yunnan Province. Northern Horticulture, 2011(20): 171-174.
- [5]GB/T 5009. 12 2010, The Determination of Pb in Food.
- [6]GB/T 5009. 15 2014, The Determination of Cd in Food.
- [7]GB/T 5009. 11 2003, The Determination of As in Food.
- [8]Ministry of Agriculture of the People's Republic of China. GB 7096-2003 Hygienic standard for edible fungi. Beijing: China Agriculture Press, 2003.
- [9]Ministry of Agriculture of the People's Republic of China. NY 749—2012 Green food: Edible mushroom. Beijing: China Agriculture Press, 2012.
- [10]LIN Yan-kui, WANG Bing-tao, YAN Zhi, et al. Total arsenic and arsenic species analysis in edible fungus. Food Science and Technology, 2012, 37(5): 295-299.

An Empirical Analysis of the Effect of Rural Industrial Structure Transformation on Improving Rural Issues

Jia-Ming Zhu¹, Xiao-Ran Dong¹, Wei Fan², Xiao-Jian Li^{3,*}

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

² School of Business Administration, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

³ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: In order to explore the problems of agriculture, rural areas and farmers, we chose Huoshan county, Lu 'an city, Anhui province as the research object. In the implementation of the rural industrial structure transformation projects, we establish a lot of reliable models to predict the improvement of the three-agriculture problems. And some of the analyses that we use are Time series analysis, Data envelopment analysis, Analytic hierarchy process and so on. Then the established models are as follows: C2R model, Multidimensional evaluation model, Descriptive statistical analysis model. Finally, we conclude the leading factors and influencing ways of the transformation of agricultural industrial structure by using MATLAB software.

Keywords: Three Rural Issues; Transformation of rural industrial structure; Multidimensional evaluation model; Data envelopment analysis; Clustering analysis

1. INTRODUCTION

After the implementation of the reform and opening policy, the development of market economy is extremely rapid and rural land, population and capital are in the form of long-term net outflow because of urbanization and industrialization. Therefore, "Three rural problems" is more and more serious. Moreover, 19 times the National Congress of the Communist Party of China further clear the country revitalization strategy. It puts forward the five key tasks of 'thriving industry, livable ecology, civilized local customs, effective governance, and prosperous life'. So, the rural industrial structure has undergone great changes compared with the original foundation, and it slowly develops from leading agriculture to the integration of primary industry, secondary industry and tertiary industry. The reason why we chose Huoshan county, Lu 'an city, Anhui province as the investigation area is that we want to have a deeper understanding of the implementation of the rural revitalization strategy and the improvement effect of 'three rural problems'. Particularly, we focus on whether the transformation of the structure of the agricultural industry can improve the 'three rural issues' according to data and

mathematical methods based on the survey. And if so, what are the dominant factors and how do these factors of influence.

2. LITERATURE REVIEW

Since the rural revitalization strategy was put forward, many domestic scholars have studied the "three rural issues". Tie-jun Wen [1] proposed that the historical turning point of the rural revitalization strategy is closely related to the reversal of the historical logic of "western modernization" in one hundred years base on the evolution of the 'three rural issues' in 40 years of reform and opening. And Mei-xia Ren [2] pointed out that the modern circulation industry has improved the development of agriculture, the transfer of rural population and the construction of a new countryside by combined the improvement of Shandong province's "three agriculture problems" with the development of its logistics industry in 2018. In addition, Jian Zhou [3] put forward that the biggest factor influencing the transformation of dual economy is the proportion of non-agricultural output under the industrial structure transformation and upgrading index through the establishment of the evaluation index system and analysis of the primary index, secondary index. Moreover, Jiao Fan [4] believes that the upgrading of industrial structure can improve the pure technical efficiency of rural labor transfer based on the data envelopment analysis method.

3. C2R MODEL FOR IMPROVING THE QUALITY OF 'AGRICULTURE, RURAL AREAS AND FARMERS'

3.1 Research Approach

The first, we have the data preprocessing. In order to explore the improvement direction and degree of "three rural problems" more reasonably, this paper divides the survey data into two parts: before and after the implementation of the rural revitalization strategy, and eliminate other irrelevant data. The second, we select fixed asset investment, special poverty alleviation funds and other investment indicators as input variables, and choose the output indexes such as farmers' disposable income and agricultural output value as the output variables. Then we established the data envelopment analysis model

and used LINGO software to solve the efficiency. In the end, we compare the efficiency of the rural revitalization strategy before and after its implementation, and to determine whether the execution of the strategy of rejuvenating rural can effectively improve the 'three rural problems'.

3.2 Research Method

(1) Theoretical preparation

Data envelopment analysis [5] is a quantitative analysis method, it uses the linear programming method and also considers multiple inputs and multiple output indicators to evaluate the relative effectiveness of comparable units of the same type. This method [6] is generally used to measure the productivity of some decision-making departments.

(2) Modeling

Firstly, we determine the input-output index by

Table 1 Input-output comparison

	indicators	Before the implementation	After the implementation
Input	Fixed asset investment	141.4	155.54
	Special fund for poverty alleviation	1.13	1.24
Output	Farmers' disposable income	0.00012164	0.0001332
	Total value of agricultural output	28.61	28.89

Therefore, we can get the C2R model before the implementation of the rural revitalization strategy as follows:

$$\begin{aligned} \min \theta \\ \begin{cases} 141.4\lambda_1 + 155.54\lambda_2 \leq 141.4\theta \\ 1.13\lambda_1 + 1.24\lambda_2 \leq 1.13\theta \\ 0.00012164\lambda_1 + 0.0001332\lambda_2 \geq 0.00012164 \\ 28.61\lambda_1 + 28.89\lambda_2 \geq 28.61 \\ \lambda_i \geq 0 (i=1,2) \end{cases} \end{aligned} \quad (1)$$

Then, we also can get the C2R model after the implementation of the rural revitalization strategy as follows:

$$\begin{aligned} \min \theta \\ \begin{cases} 141.4\lambda_1 + 155.54\lambda_2 \leq 155.54\theta \\ 1.13\lambda_1 + 1.24\lambda_2 \leq 1.24\theta \\ 0.00012164\lambda_1 + 0.0001332\lambda_2 \geq 0.0001332 \\ 28.61\lambda_1 + 28.89\lambda_2 \geq 28.89 \\ \lambda_j \geq 0 (j=1,2) \end{cases} \end{aligned} \quad (2)$$

(2) The result of DEA

We solved the model with LINGO software, and the DEA effectiveness result is shown in table 2.

Table 2 DEA effectiveness results

	θ	λ_1	λ_2
Before the implementation	0.9978	1.095	0
After the implementation	1	0	1

As can be seen from the table, the implementation of rural revitalization strategy is DEA effective. Therefore, the implementation of rural vitalization strategy can improve the problems of agriculture, rural areas and farmers in some extent. And its

consulting relevant information and filter and calculate the corresponding data. Secondly, we established the C2R model of DEA effectiveness [7] before and after the implementation of the rural revitalization strategy. Then, we solved it using LINGO. Finally, we analyze whether the implementation of the rural revitalization strategy has driven the local development to some extent, and whether the problems in agriculture, rural areas and farmers have been effectively improved.

3.3 The Analysis of the Results

(1) The results of index selection

In this paper, input and output data before and after the implementation of the rural revitalization strategy are obtained by consulting relevant literature and processing actual data, and detailed data are shown in table 1.

concrete expression is in high investment and high return. Of course, all input resources have been fully utilized.

4. ANALYSIS OF THE TRANSFORMATION MEASURES OF RURAL INDUSTRIAL STRUCTURE

4.1 Research Approach

The first, we refer to survey data and relevant literature and have established an analytical hierarchy system that the secondary indicators are composed of the performance factors of "three rural issues" and the three-level indicators are composed of corresponding concrete measures under the banner of "agriculture, rural areas and farmers". Then, we construct the comparison discriminant matrix and perform a consistency check and build a multi-dimensional evaluation model. The last, we ranked the importance of the measures based on the results calculated by MATLAB software, and found out the leading factors and potential influencing factors to improve the problems in agriculture, rural areas and farmers.

4.2 Research Method

(1) Theoretical preparation

Analytic hierarchy process [8] is a method of qualitative and quantitative analysis and it breaks down decision factors into goals, criteria, and plans according to different attributes. The method [9] is suitable for the situations with uncertainty and subjective information, and it can directly measure the relative importance of indexes.

(2) Modeling

Firstly, we establish a hierarchy analysis system. Then, we use EXCEL and MATLAB to build the two mathematical models that before and after the implementation of the rural revitalization strategy.

Finally, we use weights to rank different indicators and compare and analyze the same indicators.

4.3 The Analysis of the Results

(1) The results of hierarchical analysis system

The first, we established the hierarchical analysis system that we have broken down the improvement of

the problems concerning agriculture, rural areas and farmers into different constituent factors and grouped them according to the degree of membership between the different factors. And the hierarchical substructure analysis diagram is shown in figure 1.

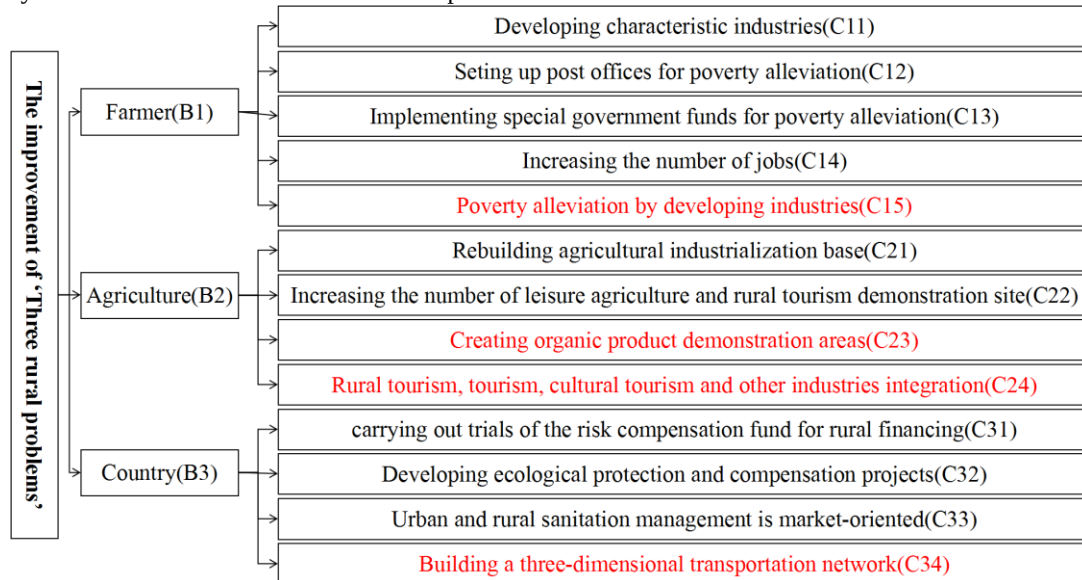


Figure 1 Hierarchical structure

Secondly, we construct the comparative discriminant matrix.

We can obtain the comparative judgment matrix of the scheme layer to the criterion layer before the

$$B_{11} = \begin{pmatrix} 1 & 5 & 1/5 & 3 \\ 1/5 & 1 & 1/7 & 1/3 \\ 5 & 7 & 1 & 5 \\ 1/3 & 3 & 1/5 & 1 \end{pmatrix}; \quad B_{21} = \begin{pmatrix} 1 & 3 \\ 1/3 & 1 \end{pmatrix}; \quad B_{31} = \begin{pmatrix} 1 & 1/3 & 1/5 \\ 3 & 1 & 1/3 \\ 5 & 3 & 1 \end{pmatrix}$$

In the same way, we can obtain the comparative judgment matrix of the scheme layer to the criterion layer after the implementation of the revitalization

$$B_{12} = \begin{pmatrix} 1 & 7 & 1/3 & 5 & 3 \\ 1/7 & 1 & 1/9 & 1/3 & 1/5 \\ 3 & 9 & 1 & 7 & 5 \\ 1/5 & 3 & 1/7 & 1 & 1/3 \\ 1/3 & 5 & 1/5 & 3 & 1 \end{pmatrix}; \quad B_{22} = \begin{pmatrix} 1 & 3 & 5 & 1/3 \\ 1/3 & 1 & 3 & 1/5 \\ 1/5 & 1/3 & 1 & 1/7 \\ 3 & 5 & 7 & 1 \end{pmatrix}; \quad B_{32} = \begin{pmatrix} 1 & 1/3 & 1/5 & 3 \\ 3 & 1 & 1/3 & 5 \\ 5 & 3 & 1 & 7 \\ 1/3 & 1/5 & 1/7 & 1 \end{pmatrix}$$

Finally, we achieve single criteria under the sorting and consistency check.

By using MATLAB, we calculate the eigenvalues and eigenvectors of the comparison discriminant matrix at various levels and obtain the relative importance weight vector and the consistency ratio CR of the

Table 3 Results before the implementation of the rural-revitalization strategy

Discriminant matrix	The weight vector of hierarchical single order ω	$\lambda_{\max}$	CR
B_{11}	$(0.2195, 0.0521, 0.6194, 0.1090)^T$	4.2404	0.08
B_{21}	$(0.75, 0.25)^T$	2	0
B_{31}	$(0.1047, 0.2583, 0.6370)^T$	3.0385	0.03

implementation of the revitalization strategy by using the pant-to-two comparison method. Let's call them B_{11} , B_{21} and B_{31} .

strategy by using the pant-to-two comparison method. Let's call them B_{12} , B_{22} and B_{32} .

corresponding hierarchical ranking. Therefore, the calculation results before the implementation of the rural revitalization strategy are shown in table 3, and the calculation results after the implementation of the rural revitalization strategy are shown in table 4.

Table 4 Results after the implementation of the rural-revitalization strategy

Discriminant matrix	The weight vector of hierarchical single order ω	$\lambda_{\max}$	CR
B_{12}	$(0.2615, 0.0333, 0.5128, 0.0634, 0.1290)^T$	5.2375	0.05
B_{22}	$(0.2622, 0.1175, 0.0553, 0.5650)^T$	4.1170	0.04
B_{32}	$(0.1175, 0.2622, 0.5650, 0.0553)^T$	4.11698	0.04

From these two tables, we can conclude that the value of each hierarchy is less than 0.1. So, the matrix passes the consistency test.

(2) Multidimensional evaluation results

Taking the weight vector of the target layer to the

criterion layer as $(0.6370, 0.2583, 0.1047)^T$, we can get the overall arrangement before and after the implementation of the rural revitalization strategy. And table 5 shows the results of the total hierarchical sorting.

Table 5 The results of the hierarchical total sort calculation

Indicators	Total weight before the rural revitalization strategy	Total weight after the rural revitalization strategy
C11	0.1398215	0.1665755
C12	0.0331877	0.0212121
C13	0.3945578	0.3266536
C14	0.069433	0.0403858
C15	—	0.082173
C21	0.193725	0.06772626
C22	0.064575	0.03035025
C23	—	0.01428399
C24	—	0.1459395
C31	0.01096209	0.01230225
C32	0.02704401	0.02745234
C33	0.0666939	0.0591555
C34	—	0.00578991

We used MATLAB to visualize the data, and get the rural revitalization strategy before and after the

implementation of the index weight order. The sorting results are shown in figure 2.

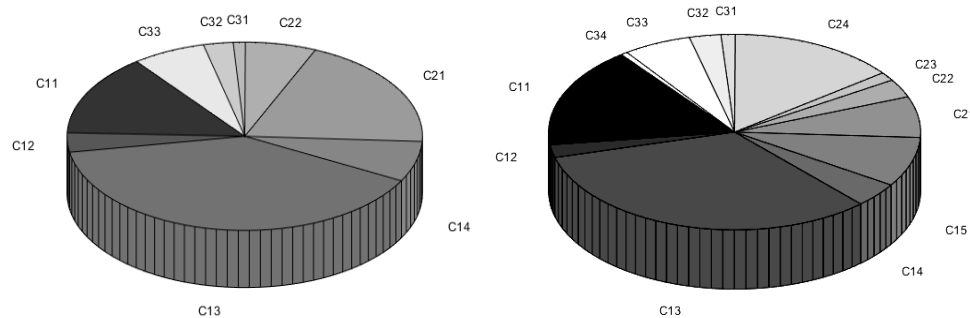


Figure 2 Ranking of index weights

From what has been discussed above, we can conclude that the leading factors to improve the "three rural problems" are the implementation of special financial funds for poverty alleviation, the development of characteristic industries and the reconstruction of agricultural industrialization bases. And in the process of implementing the rural revitalization strategy, industrial poverty alleviation and the integration of agriculture, health, culture and tourism industries are new effective factors. In addition, the development of ecological protection and compensation projects and the marketization of urban and rural sanitation management are potential improvement factors.

5. DESCRIPTIVE STATISTICAL ANALYSIS OF FARMERS' LIVING CONDITIONS AFTER THE TRANSITION

5.1 Research Approach

This article divides the problem into the following three directions: the first, we describe the current trend of urban and rural disposable income in the county. Then, we analyzed the main source of income for farmers in the county. The last, we calculate the increase or decrease of farmers' income and their happiness level.

5.2 Research Method

(1) Theoretical preparation

Descriptive statistics are activities that describe the

characteristics of data using tabulation, categorization, graphics, and computational generalizations. So, descriptive statistical analysis refers to the method of analyzing data related to all variables in the survey population, and it mainly includes data frequency analysis, central trend analysis and some basic statistical figures.

Cluster analysis is the process that group a collection of physical or abstract objects into several classes composed of similar objects. And it classifies data sources into different clusters by measuring the similarity between different data sources. Therefore, the classification methods include hierarchical clustering and iterative clustering.

(2) Modeling

Firstly, this paper uses R software to establish a time series model and analyzes the actual change trend of urban and rural disposable income. Secondly, we use Table 6 Urban and rural income level

year	2013	2014	2015	2016	2017
The per capita disposable income of urban residents	19099	20761	22443	24305	26289
The per capita disposable income of rural residents	8407	9449	10328	11175	12164

From table 6, we draw a broken line diagram with MATLAB, and the result is shown in figure 3.

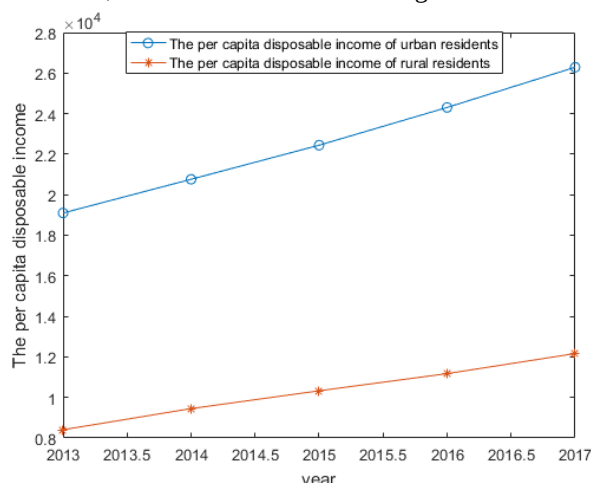


Figure 3 The contrast of disposable income

In recent years, the disposable income of both urban

Table 7 Comparison of major sources of income of non-contractors

Source of income	Breed	Picking	Odd jobs	Retail sale	Agricultural processing	The government subsidies
Before the implementation	5	5	3	3	7	3
After the implementation	1	3	9	7	5	5

As can be seen from table 7, with the implementation of the rural revitalization strategy, the number of small farmers doing odd jobs in small rural households has increased greatly and the number of scattered farmers is also increasing, but like farming, picking such a large range of land use is contracted by large farmers for special planting, and the number of farmers participating in the project shows a decreasing trend. Surely, now the government is recruiting garbage collectors to clean the roads, and

Table 8 The ratio of direct income growth to farmers

EXCEL and MATLAB software to cluster all kinds of income sources and then we use the comparison criterion matrix to judge the change of income source before and after the implementation of the strategy. Finally, we choose statistical graphs to analyze the intuitive income status and happiness level of farmers.

5.3 THE ANALYSIS OF THE RESULTS

(1) Results of time series analysis

The big macro policy directions [10] set by the superior government are implemented only after they are broken down. So it is difficult for us to collect detailed and specific data during the investigation. And hence, in order to eliminate the subjective thinking of the wrong lead, we look for relevant information on the official website. And we obtain the per capita disposable income of rural and urban areas of the county from 2013 to 2017, as shown in table 6.

and rural residents has been increasing and the rate of rise is accelerating. This shows that the county government adopted the means of governance has a positive role in promoting. But as far as the two curves are concerned, the growth rate of urban residents' disposable income is still significantly higher than that of rural residents' per capita disposable income. In particular, there was no significant difference between the two upward trends before 2015. After 2015, the growth rate of per capita disposable income in rural areas lags behind obviously. And after 2016, the per capita disposable income of rural residents increased slightly.

(2) The results of cluster analysis

We filter and calculate the data, and get the six main sources of income and the number of large non-contractors comparison results. The specific results are shown in table 7.

sanitation is getting cleaner. Therefore, on the whole, the county's policy of "thriving industry, livable ecology and civilized countryside" is in line with the policy of improving the beautiful countryside.

(3) Results of descriptive analysis

This paper uses EXCEL software to summarize and calculate the data. The proportion of farmers' intuitive income growth is shown in table 8, and the proportion of happiness index is shown in figure 4.

Income condition	Rising incomes	No change in income	Income decrease
The proportion of farmers' evaluation	86.37%	12.54%	1.09%

As can be seen from table 8, about 86.37% of farmers believe that their income has increased significantly in this year. Even though all the land used to be farmed by big farmers, at present, the implementation of the rural revitalization strategy policy has provided a large number of job opportunities. Farmers who used to be engaged in farming now have the time and energy to invest in low-cost and high-wage jobs, such as Courier delivery, industrial material collection, and higher-paying labor in related secondary industries. Therefore, it is generally seen that the income of most farmers has shown a significant trend of increase.

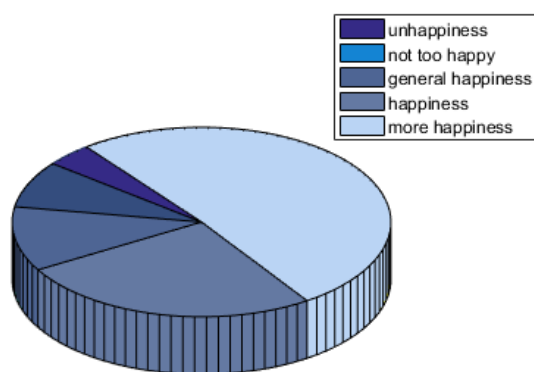


Figure 4 Statistics on farmers' happiness

As can be seen from figure 4, the change trend of the overall happiness statistical population is: more happiness, happiness, general happiness, not too happy, unhappiness. But on the whole, more than two-thirds of the peasants are in a relatively happy state or above, that is, the happiness effect under the well-off level. Based on the actual survey in various places, we speculate that the reason for this phenomenon is largely due to the effective implementation of targeted poverty alleviation policies. In addition, under the rural revitalization strategy, the driving effect of tourism on the sales of agricultural products, the establishment of local farmers' confidence and the promotion of foreign exchanges with the entry of e-commerce have all played a positive role in the improvement of happiness to a certain extent.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006). Anhui university of finance and economics 2018

undergraduate research and innovation fund project: "An Empirical Analysis of the Effect of Rural Industrial Structure Transformation on Improving Rural Issues" (XSKY1834ZD).

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCE

- [1]M. X. Ren, D. L. Chen, and P. P. Chang, The development of logistics in modern circulation industry and the problems of "agriculture, rural areas and farmers"--a case study of Shandong province, *Agricultural Economy*, 2018, 11: 129-132.
- [2]T. J. Wen, J. S. Qiu, and H. S. Che, The evolution of "three rural issues" in the past 40 years of reform and opening-up and the proposal of rural revitalization strategy, *Theoretical discussion*, 2018, 05: 5-10.
- [3]J. Zhou and G. W. Zhang, The particularity of the transition of dual economic structure in China and the construction of its Evaluation Index System J, *Exploration of economic issues*, 2018, 04: 1-8+53.
- [4]J. Fan, An empirical study on the effect of industrial restructuring on the absorption efficiency of rural labor migration in China, *Xinjiang University*, 2017.
- [5]F. Gao, L. Jiang, and Y. J. Hou, The influence of the change of input and output index on the effectiveness of DEA, *Journal of Shenyang Ligong University*, 2018, 37(02): 88-90+94.
- [6]Y. Q. Wang, B. Y. Jiang, T. M. Zhao, et al., Relative eco-efficiency evaluation of petrochemical enterprises based on C²R and BC² models, *Journal of the Shenyang University of Technology*, 2018, 11(06): 538-543.
- [7]D. Q. Zhang, An empirical analysis of the impact of education on regional differences in economic growth contribution, *Statistics and decision-making*, 2019, 35(02): 149-152.
- [8]Y. P. Li, C. Zhu, L. X. Zhang, et al., Evaluation and countermeasures of water environment ecological security based on improved analytic hierarchy process: a case study of Xingtai, *Journal of Peking University*, 2019, 02: 1-6.
- [9]G. Y. Zhang, Sustainable livelihood evaluation method for farmers with land transfer based on fuzzy matter-element model, *Statistics and decision-making*, 2019, 05: 121-125.
- [10]G. Y. Yang and J. M. Zhu, Evaluation and analysis of excellent papers in mathematical modeling contest, *China University of Science and Technology Press* Hefei, 2013.

An Empirical Analysis of the Effectiveness of China's Monetary Policy Transmission Mechanism Based on VAR Model

Jia-Ming Zhu¹, Na Sun², Meng Zhu³, Chun-Li Wang^{4,*}

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

² School of Finance, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

³ Bengbu Zhongguang Technology Co., Ltd., Bengbu, Anhui, 233000, China

⁴ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: This article uses a series of measurement methods to conduct an empirical analysis of the effectiveness of China's 2012 currency exchange rate adjustment mechanism after a large exchange rate adjustment, and finds that the transmission from monetary policy to exchange rate is relatively ineffective. It can be seen that although there is a certain quantitative relationship between changes in the money supply and interest rates to changes in exchange rates, there is no causality; the transmission from the exchange rate to the ultimate goal of monetary policy is effective. Although there is a certain time lag, but with the increase of time, the effect of exchange rate changes on the price level and GDP gradually appeared. Finally, the article makes suggestions on how to improve the effectiveness of the exchange rate transmission mechanism.

Keywords: monetary policy; exchange rate; transmission mechanism; Cointegration test; Granger causality test; VAR

1. INTRODUCTION

Whether the monetary policy transmission mechanism is effective plays an important role in economic development [1-3]. After July 2005, China reformed the exchange rate system into a managed floating exchange rate system, and the effects of the monetary policy exchange rate transmission mechanism have appeared in China since then. In April 2012, the exchange rate of the RMB exchange rate against the US dollar expanded again, the RMB exchange rate reached a relatively stable stage, and the role of the monetary policy exchange rate transmission mechanism was increasingly strengthened. An empirical analysis of the currency policy exchange rate transmission mechanism after the exchange reform in April 2012 found that its advantages and obstacles in the transmission process have important reference significance for the future effective implementation of China's monetary policy through this transmission path.

2. LITERATURE REVIEW

Before the exchange rate reform in China in July 2005, some scholars explored the relationship

between exchange rate and China's monetary policy from different aspects: Guo et al. [4] and Zhang [5] analyzed the possibility of the exchange rate transmission mechanism in China and how to adjust the RMB exchange rate to improve the effectiveness of monetary policy; Guo [6] systematically analyzed the relationship between "the dispute between the floating exchange rate system and the fixed exchange rate system under the" The Impossible Trinity "" and "the dispute over the floating fixed exchange rate when the exchange rate is only used as a sub-channel for monetary policy transmission" and provided suggestions on how to form and establish a scientific exchange rate mechanism in China. Sun et al [7] used monthly bank total data from 1996 to 2006 and classified data on bank and loan types, and found that China's monetary policy transmission mechanism has bank lending channels, interest rate channels, and asset price channels. However, it does not emphasize the role of the exchange rate transmission mechanism. It can be seen that this channel has not yet existed before the exchange rate reform in China. After the exchange rate reform, many scholars began to discuss the issue of China's monetary policy exchange rate transmission mechanism: Hui [8] and Feng [9] analyzed the exchange rate transmission mechanism of China's monetary policy based on the perspective of financial innovation using the exchange rate transmission model.

From the above literature, we can see that many scholars' research based on different positions not only laid the theoretical foundation for the future research of China's exchange rate transmission mechanism, but also pointed out the direction for how to implement it concretely and effectively. However, there are still few theoretical studies on the exchange rate transmission mechanism in China, and there are fewer analyses on the effects of the exchange rate transmission mechanism after another major adjustment of China's exchange rate in April 2012. Based on the above research, this article selects quarterly data from April 2012 to September 2019, and analyzes the specific transmission effects from the two transmission links of "Monetary

Policy→Exchange Rate” and “Exchange Rate→The ultimate goal of monetary policy”.

3. INTRODUCTION OF ANALYSIS INDICATORS

The selection of indicators follows the principles of systemicity, typicality, quantification, etc., combined with the characteristics of China's monetary policy

Table 1 Corresponding variable selection and symbol definition (Unit: 100 million yuan)

Monetary policy transmission	Indicator	Corresponding variable selection (After taking natural logarithm and seasonal adjustment)	symbol
Monetary Policy	Money Supply	M2	LNLM2_SA
	Interest Rate	7-day weighted average interest rate for interbank lending	LNR
Exchange Rate	Exchange Rate	USD to RMB exchange rate	LNE
The ultimate goal of monetary policy	Price Level	CPI	LNCPI_SA
	Economic Growth	GDP	LNGDP_SA

("M2, 7-day weighted average interest rate and exchange rate for interbank lending" data source: Official website of the People's Bank of China; "CPI, GDP" data source: website of the National Bureau of Statistics.)

4. ANALYSIS OF THE TRANSMISSION EFFECT OF MONETARY POLICY TO EXCHANGE RATE

4.1 ADF stationarity test and unity judgment

At the 0.05 level of significance, Eviews software was used to perform ADF test on LNM2_SA, LNE, LNR and its first-order difference DLNM2_SA, DLNE, Table 2 ADF inspection

goals. Monetary policy is represented by "Money Supply, Interest Rate", and the ultimate goal of currency growth is represented by "Price Level, Economic Growth", corresponding Variables and symbols are shown in Table 1.

DLNR. The results are shown in Table 2. Among them, c in the test type (c, t, k) is the intercept term, c = 0 means no intercept term, c = 1 means there is no other intercept term; t is the trend term, t = 0 means no trend term, t = 1 means there is a trend item; k is the number of lag periods.

variable	type	ADF value	P value	conclusion	variable	type	ADF value	P value	conclusion
LNM2_SA	(1,1,2)	-0.796339	0.9536	unstable	DLNM2_SA	(1,1,0)	-4.489925	0.0068	stable
	(1,0,2)	-3.558136	0.0139	stable		(1,0,0)	-2.953159	0.0520	unstable
	(0,0,2)	2.177200	0.9910	unstable		(0,0,4)	-1.956681	0.0499	stable
LNE	(1,1,4)	-2.516765	0.3179	unstable	DLNE	(1,1,1)	-4.306301	0.0108	stable
	(1,0,4)	-0.479827	0.8815	unstable		(1,0,1)	-4.225358	0.0028	stable
	(0,0,4)	1.051382	0.9183	unstable		(0,0,1)	-4.104928	0.0002	stable
LNR	(1,1,1)	-2.215130	0.4635	unstable	DLNR	(1,1,0)	-5.878328	0.0002	stable
	(1,0,1)	-1.918763	0.3195	unstable		(1,0,0)	-5.964317	0.0000	stable
	(0,0,1)	-0.345467	0.5514	unstable		(0,0,0)	-6.077245	0.0000	stable

The specific values of c, t, and k in the table are determined according to the SC and AIC criteria. From Table 2, we can see that the sequences LNM2_SA, LNE, and LNR all have first-order monointegrity and can be tested for cointegration.

4.2 Cointegration Test

In order to explore the impact of exchange rate on price level and total output value, we use the EG test method to carry out bivariate cointegration tests on "LNM2_SA and LNE" and "LNR and LNE" to determine the long-term relationship between them. First, we establish a long-term equilibrium equation between LNM2_SA and LNE with a lag period of 0, and then conduct a stationarity test on the residual terms of the equation. From the test, we get the P value of ADF statistics corresponding to 0.0005 < 0.05. To test the cointegration between LNR and LNE, the lag period is still selected as 0, and the P value corresponding to its statistics is 0.0012 < 0.05, so we know that between LNM2_SA and LNE, between LNR and LNE 1,1) Co-integration relationship. Further examination of LNE, LNM2_SA, LNR, we

get the value of ADF is -4.836370, the corresponding P value is 0.0006, there is a cointegration relationship between the three, that is, in the long run, changes in the money supply and interest rate on the exchange rate Floating has a certain effect.

Due to the co-integration relationship between LNE, LNM2_SA, and LNR, we establish the error correction model with LNE as the explained variable as follows:

$$\Delta LNE_t = 0.1256 * \Delta LNM2\_SA_t - 0.0446 * \Delta LNR_t + 0.1056 * ECM_{t-1}$$

$$R^2 = 0.8021, \quad \bar{R}^2 = 0.7869$$

The model passes the significance test, but the sign of LNR is inconsistent with the long-term relationship of the above test cointegration, indicating that the interest rate increase in the short term is conducive to RMB appreciation, but in the long run, the increase in interest rate will eventually depreciate the local currency, which is equivalent to "Interest-Rate-Parity Theory". The above formula shows that in the short term, when the money supply increases by 1% and the interest rate decreases by 1%, the exchange rate of the US dollar against the RMB will increase by 12.56%

and 4.46%, respectively.

4.3 Granger Causality Test

In order to further explore the causal relationship between monetary policy and exchange rate, Granger

causality test was conducted on the three variables LNE, LNR and LNM2_SA. The results are shown in Table 3.

Table 3 Granger causality test

Lag period	Null hypothesis	F statistic	P value	result
2	LNM2_SA is not a Granger cause for LNE	4.27618	0.0264	False
	LNE is not a Granger cause for LNM2_SA	0.02394	0.9764	True
	LNR is not a Granger cause for LNE	2.29112	0.1238	True
	LNE is not a Granger cause for LNR	0.09332	0.9112	True
3	LNM2_SA is not a Granger cause for LNE	2.01405	0.1444	True
	LNE is not a Granger cause for LNM2_SA	0.26676	0.8485	True
	LNR is not a Granger cause for LNE	2.03651	0.1411	True
	LNE is not a Granger cause for LNR	0.05486	0.9809	True
4	LNM2_SA is not a Granger cause for LNE	2.33076	0.0975	True
	LNE is not a Granger cause for LNM2_SA	0.45395	0.7683	True
	LNR is not a Granger cause for LNE	1.49306	0.2484	True
	LNE is not a Granger cause for LNR	0.03876	0.9968	True
5	LNM2_SA is not a Granger cause for LNE	1.3056	0.3168	True
	LNE is not a Granger cause for LNM2_SA	0.44207	0.8119	True
	LNR is not a Granger cause for LNE	1.49462	0.2535	True
	LNE is not a Granger cause for LNR	0.02748	0.9996	True

Choose a lag period of 5, as can be seen from Table 3, there is no causal relationship between LNM2_SA and LNE, LNR and LNE, that is, the money supply and interest rate have no direct causal relationship with exchange rate changes, which means that monetary policy. The conduction effect is not good.

5. ANALYSIS OF THE EFFECT OF EXCHANGE

Table 4 ADF inspection

variable	type	ADF value	P value	conclusion	variable	type	ADF value	P value	conclusion
LNCPI_SA	(c,t,0)	-1.84333	0.657	unstable	DLNCPI_SA	(c,t,0)	-5.24233	0.001	stable
	(c,0,0)	-0.60695	0.854	unstable		(c,0,0)	-5.23934	0.000	stable
	(0,0,0)	1.366109	0.953	unstable		(0,0,0)	-5.07512	0	stable
LNGDP_SA	(c,t,0)	-1.38761	0.843	unstable	DLNGDP_SA	(c,t,0)	-4.21361	0.012	stable
	(c,0,0)	-0.08013	0.942	unstable		(c,0,0)	-4.32885	0.002	stable
	(0,0,0)	19.85464	1	unstable		(0,0,1)	-0.69882	0.404	unstable

It can be seen from Table 4 that LNCPI_SA, LNGDP_SA and the above-mentioned LNE sequences have first-order singleness.

5.2 Cointegration Test

Based on the first-order unity of LNE, LNCPI_SA, LNGDP_SA, in order to explore the impact of exchange rate on price level and gross output value, we still use the method described above to carry out bivariate analysis on "LNCPI_SA and LNE" and "LNGDP_SA and LNE" Co-integration test. The results show that the relationships between LNCPI_SA and LNE, LNGDP_SA and LNE are (1,1) cointegration. In the long run, fluctuations in exchange rates have an impact on price levels and

RATE ON THE ULTIMATE GOAL OF MONETARY POLICY

5.1 ADF stationarity test and unity judgment

At a significance level of 0.05, we use Eviews software to test LNCPI_SA, LNGDP_SA and their first-order difference sequences. The results are shown in Table 4.

changes in GDP.

5.3 Granger Causality Test

To further explore the causal relationship between the exchange rate and the ultimate goal of monetary policy, we conducted Granger causality tests on LNCPI_SA, LNGDP_SA, and LNE.

According to the above table 5, we can get that after different lag periods, LNCPI_SA and LNE, LNGDP_SA and LNE are Granger reasons for each other, that is, there is a corresponding relationship between exchange rate and price level, GDP Causality, the transmission of exchange rates to the ultimate goal of monetary policy is relatively effective.

Table 5 Granger causality test

Lag period	Null hypothesis	F statistic	P value	result
2	LNCPI_SA is not a Granger cause for LNE	0.22326	0.8016	True
	LNE is not a Granger cause for LNCPI_SA	3.52809	0.0461	False
	LNGDP_SA is not a Granger cause LNE	3.75329	0.0388	False
	LNE is not a Granger cause for LNGDP_SA	4.50825	0.0223	False
3	LNCPI_SA is not a Granger cause for LNE	2.99111	0.0553	True
	LNE is not a Granger cause for LNCPI_SA	2.86465	0.0624	True
	LNGDP_SA is not a Granger cause LNE	1.45368	0.2572	True
	LNE is not a Granger cause for LNGDP_SA	4.57303	0.0135	False
4	LNCPI_SA is not a Granger cause for LNE	1.78647	0.1781	True
	LNE is not a Granger cause for LNCPI_SA	3.13745	0.042	False
	LNGDP_SA is not a Granger cause LNE	2.04517	0.1334	True
	LNE is not a Granger cause for LNGDP_SA	2.54237	0.0777	True
5	LNCPI_SA is not a Granger cause for LNE	5.05286	0.0237	False
	LNE is not a Granger cause for LNCPI_SA	3.71991	0.0237	False
	LNGDP_SA is not a Granger cause LNE	2.3078	0.0999	True
	LNE is not a Granger cause for LNGDP_SA	4.32173	0.0138	False
6	LNCPI_SA is not a Granger cause for LNE	4.23995	0.0187	False
	LNE is not a Granger cause for LNCPI_SA	3.31563	0.0408	False
	LNGDP_SA is not a Granger cause LNE	2.63013	0.0783	True
	LNE is not a Granger cause for LNGDP_SA	2.7711	0.0681	False

5.4 Building a VAR Model

Because of the mutual influence between the exchange rate and the ultimate goal of monetary policy, in order to further explore the relationship, we established two VAR models: the VAR model $LNCPI\_SA = 0.7061 * LNCPI\_SA(-1) + 0.0431 * LNCPI\_SA(-2) + 0.0281 * LNE(-1) + 0.0756 * LNE(-2) + 0.9676$

$LNE = -0.2534 * LNCPI\_SA(-1) + 0.4120 * LNCPI\_SA(-2) + 1.3220 * LNE(-1) - 0.4367 * LNE(-2) - 0.5166$

$R^2 = 0.8861$, $\bar{R}^2 = 0.8862$

The stationarity test is shown in Figure 1.

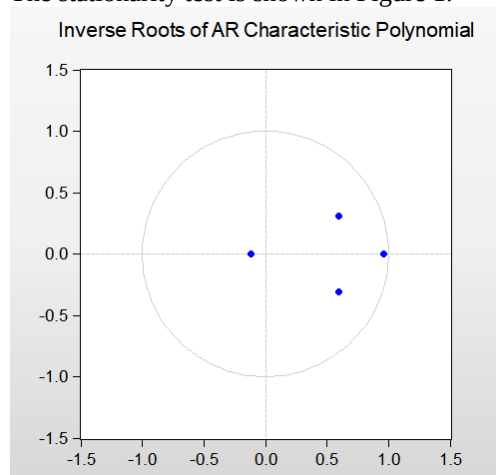


Figure 1 stationarity test

From the stationarity test in Figure 1, we can see that the VAR model between LNCPI_SA and LNE is stable, so we can do impulse response function analysis and analysis of variance.

1) Impulse response function analysis

between the exchange rate and the price level, and the VAR model between the exchange rate and the GDP.

(1) VAR model of LNCPI_SA and LNE

Using Eviews, the second-order lag VAR models of LNCPI_SA and LNE are established as follows [10]:

$LNCPI\_SA = 0.7061 * LNCPI\_SA(-1) + 0.0431 * LNCPI\_SA(-2) + 0.0281 * LNE(-1) + 0.0756 * LNE(-2) + 0.9676$

$LNE = -0.2534 * LNCPI\_SA(-1) + 0.4120 * LNCPI\_SA(-2) + 1.3220 * LNE(-1) - 0.4367 * LNE(-2) - 0.5166$

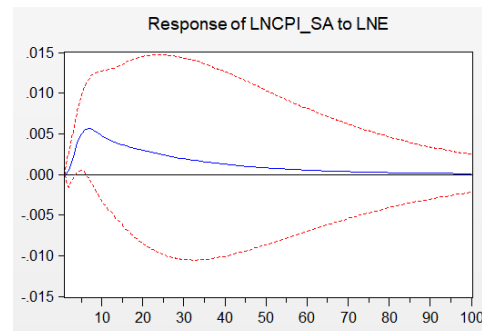
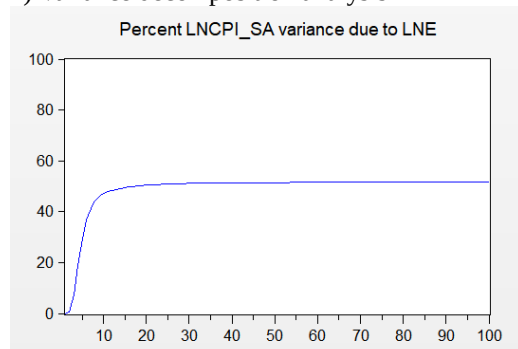


Figure 2 Impulse response

From the figure 2, we know that for the price level, the impact from the exchange rate in the first three periods is relatively weak, almost 0. As the number of periods increases, the impact of the exchange rate on the price level gradually becomes a positive effect, and it reached its maximum at the seventh period, and then the positive influence continued to weaken, and in the eightieth period the influence tended to zero. It can be seen that there is a certain time lag in the response of the price level to changes in the exchange rate, and its maximum positive impact is around 0.05, indicating that the overall impact of the exchange rate on the price level does not fluctuate as a whole [11]. In the short term, the increase in the

exchange rate means that the depreciation of the local currency has no obvious effect on the price level. There is a certain time lag. With the extension of time, the depreciation of the local currency on the price level will promote the price rise. Function, but the promotion effect gradually weakens.

2) Variance decomposition analysis



$$\text{LNGDP\_SA} = 0.9004 * \text{LNGDP\_SA}(-1) + 0.0756 * \text{LNGDP\_SA}(-2) + 0.0679 * \text{LNE}(-1) + 0.0518 * \text{LNE}(-2) + 0.0905$$

$$\text{LNE} = -0.2052 * \text{LNGDP\_SA}(-1) + 0.2823 * \text{LNCPI\_SA}(-2) + 1.1107 * \text{LNE}(-1) - 0.4290 * \text{LNE}(-2) - 0.3327$$

$$R^2 = 0.9992, \quad \bar{R}^2 = 0.9992$$

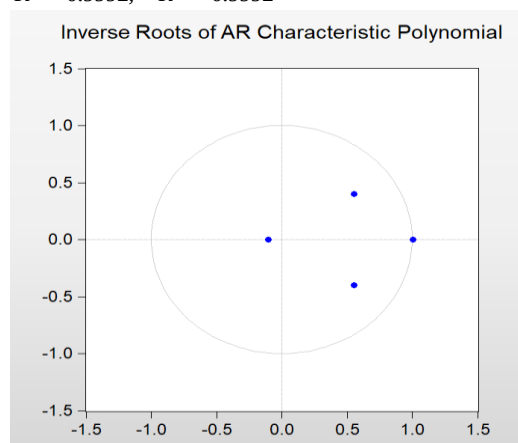


Figure 4 Stationary test

It can be seen from Figure 4 that the above VAR models of LNGDP_SA and LNE are stable.

1) Impulse response function analysis

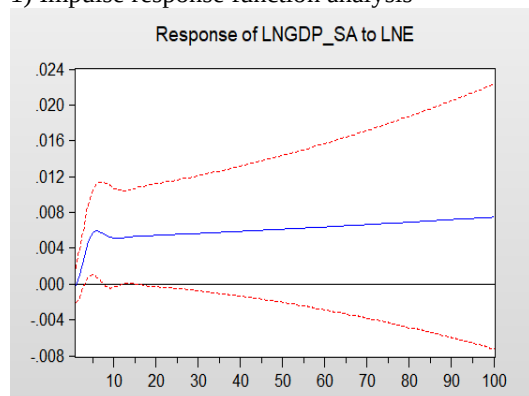


Figure 5 Impulse response

From the figure 5, we know that for GDP, the impact from the exchange rate was zero in the previous first period. As the number of periods increased, the impact of the exchange rate on GDP gradually became positive, and reached its maximum in the

Figure 3 Variance decomposition

It can be seen from Figure 3 that in the short term, the exchange rate gradually increases the price level over time, that is, the depreciation of the local currency promotes the price increase; in the long run, the impact of exchange rate changes on the price level is relatively large And it tends to be stable, indicating that the transmission of monetary policy from the exchange rate to the price level is effective.

(2) VAR model of LNGDP_SA and LNE

Using Eviews, the second-order lag VAR models of LNGDP_SA and LNE are established as follows:

sixth period, and the number of periods continued Increase, the impact began to weaken, and continued to rise steadily after reaching the wavelet valley in the tenth period. It can be seen that there is a certain time lag in the response of the GDP level to the exchange rate. The maximum positive impact in the early period is around 0.05. Although the positive impact in the later period has increased, the amplitude has not exceeded 0.008 in the first 100 periods, indicating changes in exchange rate The impact on GDP is small. In the short term, the depreciation of the local currency has little effect on GDP, and there is a certain time lag. With the extension of time, the depreciation of the local currency on the price level will promote the increase in GDP; The increase in total value still has a promoting effect, and the promoting effect is steadily enhanced.

2) Variance decomposition analysis

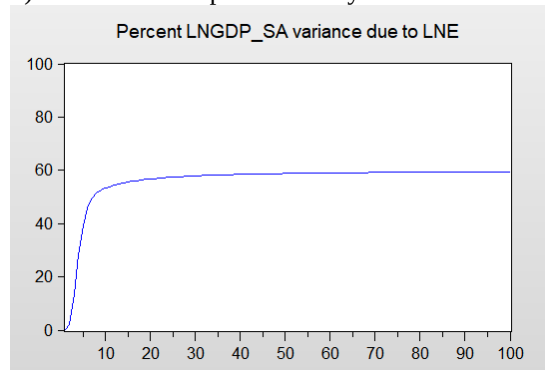


Figure 6 Variance decomposition

From Figure 6, we know that in the short term, with the extension of time, the degree of exchange rate's impact on GDP will gradually increase, and the depreciation of the local currency will promote GDP growth; The transmission mechanism between the exchange rate and GDP is also effective.

6. CONCLUSIONS AND RECOMMENDATIONS

The analysis found that in the monetary policy exchange rate transmission mechanism of the period studied in this article, the transmission from monetary policy to exchange rate is relatively ineffective, specifically in the short-term or long-term perspective, although the money supply and interest rate. There is a certain quantitative relationship between changes and exchange rate changes, but there is no causal relationship; the transmission from the exchange rate to the ultimate goal of monetary policy is effective. Although there is a certain time lag, with the increase of time, the exchange rate changes have affected the price level and the role of GDP gradually emerged.

In order to further improve the effectiveness of the monetary policy exchange rate transmission mechanism, on the one hand, the flexibility of the RMB exchange rate relative to interest rates and money supply should be appropriately increased, the opening of the financial market should be appropriately increased, and the marketization of the exchange rate formation mechanism should be promoted in a timely manner to ensure the amount of money. The linkage between the interest rate and the exchange rate, in order to ease the contradiction between monetary policy and exchange rate, thereby ensuring the effectiveness of monetary policy transmission to the exchange rate. On the other hand, the depreciation of the renminbi will greatly promote the price increase or inflation in the long run, but the depreciation of the renminbi is conducive to GDP growth. Therefore, it is very important to find the equilibrium level of China's exchange rate between the contradictions between the above two. In addition, the blind exchange rate policy will not be conducive to China's price stability and sustained economic growth, thus damaging the effectiveness of the transmission of the monetary policy exchange rate transmission mechanism from the exchange rate to the ultimate goal of monetary policy.

Annotate

① All comparisons of the article are at the 0.05 significance level, and the selection of lag period is based on AIC and SC criteria

② When the reciprocal values of all the characteristic roots of VAR are within the unit circle, the model is stable

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese

Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

REFERENCES

- [1] C. Zhang and W. Fan, Empirical research on time-varying characteristics and efficiency of the Chinese economy and monetary policy: evidence from the MI-TVP-VAR model, Routledge, 2018, 50(33).
- [2] H. Zhang, An empirical study of the asset price channel of monetary policy transmission in China, Routledge, 2017, 53(6).
- [3] J. G. Fernald and M. Mark, Spiegel, Eric T. Swanson. Monetary policy effectiveness in China: Evidence from a FAVAR model, Elsevier Ltd, 2014, 49.
- [4] M. J. Guo and Y. Z. Cai, Whether the exchange rate should become the main goal of monetary policy-analysis based on exchange rate transmission mechanism and central bank response function, Finance and Economics, 2004, 05: 88–92.
- [5] Q. Y. Zhang, Exchange rate in monetary policy transmission mechanism, Nankai Economic Research, 2004, 05: 91–94.
- [6] X. M. Guo, The Research Group of Xi'an Branch of the People's Bank of China, Research on the relationship between monetary policy transmission mechanism and exchange rate formation mechanism, Xi'an Finance, 2007, 05: 3–6.
- [7] L. X. Sun, J. L. Ford, and G. David, Dickinson. Bank loans and the effects of monetary policy in China: VAR/VECM approach, Elsevier Inc., 2009, 21(1).
- [8] H. Zhang and Z. H. Huang, A study on the exchange rate transmission mechanism of China's monetary policy, Economic Trends, 2011, (08): 53–57.
- [9] F. Kang, Research on the impact of China's financial innovation on the transmission mechanism of monetary policy, Central University of Finance and Economics Beijing, 2016.
- [10] J. M. Zhu, L. Wang, J. B. Liu, et al., Eradication of ebola based on dynamic programming, Computational and Mathematical Methods in Medicine, 2016, (31): 1–9.
- [11] J. M. Zhu, W. Y. Xia, J. J. Sun, et al., The spread pattern on Ebola and the control schemes, Int. J. of Innovative Computing and Applications, 2018, 9(2): 77–89.

Analysis of Chinese Retail Price Characteristics and Short-term Forecast Based on ARMA Model

Hang Zhang¹, Jia-Ming Zhu^{1,*}, Bao-sheng Yu¹, Chun-Li Wang²

¹School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

²Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: The commodity retail price index can reflect the fluctuation of price and the range of fluctuation, which has a certain influence on the economic growth of Chinese people. So studying the future trend of commodity retail price index can provide the basis and reference for the Chinese government in fiscal policy and monetary policy. It is also possible to determine whether the economy is in a state of inflation or contraction by observing its index characteristics and its extent. This paper uses the data of China's retail price index in 1951~2018, with the help of EVIEWS software to model and analyze it by ARMA time series model, and analyzes its characteristics in the process of analysis. Finally, the retail price index of Chinese goods in the next few years is predicted with different confidence intervals, and policy suggestions are given to the problems reflected.

Keywords: Commodity retail price index; ARMA; Short-term forecast; National economy; Inflation

1. INTRODUCTION

The retail price index, compiled by the National Bureau of Statistics, is an economic index reflecting the trend of retail price changes in urban and rural commodities. The adjustment and change of retail price directly affects the living expenditure of urban and rural residents and the national financial income, affects the purchasing power of residents and the balance of market supply and demand, and affects the proportion of consumption and accumulation. Therefore, the calculation of retail price index can observe and analyze the above economic activities from one side. If the economy of the society develops rapidly, the consumption of the individual will increase, and the supply exceeds supply, which leads to the rise of prices, and the index will rise, otherwise it will fall. It can be seen that with the development of social economy, the income level and consumption level of residents in China are constantly improving, so the purchasing power is constantly increasing, and the retail price index of commodities can reflect the social and economic state and the overall change degree of prices. Therefore, it is of great significance to study this. General analysis idea of this study is: the observation value sequence X through the

pre-processing of stationarity test and pure random test, it is judged as stationary non-white noise sequence, so it can be modeled. Calculate the sample autocorrelation coefficient and sample partial autocorrelation value, propose an appropriate ARMA (iPAQ) model to fit according to the nature of sample autocorrelation coefficient and partial autocorrelation relation, then estimate the unknown parameter value in the model, then test the validity of the model. Use the fitting model to predict future trends of the sequence.

2. LITERATURE REVIEW

Luo Bing-xin [1] Five indexes related to retail commodity price index and five indexes related to national economy were selected in 2017 to establish and solve the time series prediction model, to analyze the fluctuation characteristics of the index, and to analyze the specific relationship of commodity retail index to the GDP of our country by artificial neural network time series model. Liu Tong [2] We studied the analysis and prediction of retail price index of social goods in 1950~2002 by time series model in 2005, and obtained the fitting equation by using AR (2) model. Tian Cheng-shi [3] Based on the descriptive analysis of the fluctuation characteristics of China's commodity retail price index in 2011, the ARCH model is used to make an empirical analysis of the fluctuation characteristics, and then put forward policy suggestions.

Although some researchers have studied the trend and forecast analysis of retail commodity price index in China, because the research data are no longer applicable to predict the trend of index development after 2020. Therefore, this study uses the latest data to carry out the research to provide policy reliance [4-7].

3. SOURCES OF DATA

The article data comes from EPS global database, the EPS (Easy Professional Superior) data platform, is the data information service platform which integrates abundant numerical data resources and powerful econometric system. The article mainly extracts the commodity retail price index from the annual data (national) in China's macroeconomic database, and selects the 1951-2018 data for analysis. As shown in the Table 1.

Table 1 Retail price index (CRPI: Commodity Retail Price Index)

Year	CRPI	Year	CRPI	Year	CRPI	Year	CRPI	Year	CRPI	Year	CRPI	Year	CRPI
1951	112.2	1961	116.2	1971	99.3	1981	102.4	1991	102.9	2001	99.2	2011	104.9
1952	99.6	1962	103.8	1972	99.8	1982	101.9	1992	105.4	2002	98.7	2012	102.0
1953	103.4	1963	94.1	1973	100.6	1983	101.5	1993	113.2	2003	99.9	2013	101.4
1954	102.3	1964	96.3	1974	100.5	1984	102.8	1994	121.7	2004	102.8	2014	101.0
1955	101.0	1965	97.3	1975	100.2	1985	108.8	1995	114.8	2005	100.8	2015	100.1
1956	100.0	1966	99.7	1976	100.3	1986	106.0	1996	106.1	2006	101.0	2016	100.7
1957	101.5	1967	99.3	1977	102.0	1987	107.3	1997	100.8	2007	103.8	2017	101.1
1958	100.2	1968	100.1	1978	100.7	1988	118.5	1998	97.4	2008	105.9	2018	101.9
1959	100.9	1969	98.9	1979	102.0	1989	117.8	1999	97.0	2009	98.8	—	—
1960	103.1	1970	99.8	1980	106.0	1990	102.1	2000	98.5	2010	103.1	—	—

(Data source: Chinese National Bureau of Statistics, organized by EPS DATA)

4. TIME SERIES PRE-PROCESSING [8-17]

4.1 Stability Test

I. Timing diagram: Based on the property that the mean and variance of a stationary time series are both constant, it can be seen that the sequence diagram should fluctuate randomly near a constant, and the range of fluctuations is bounded, and there is no obvious trend and periodic characteristics. As shown in the Figure 1.

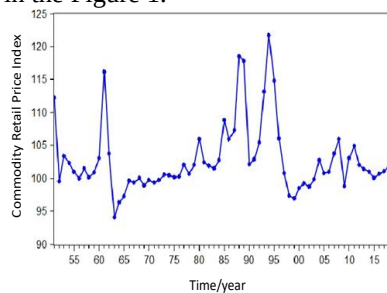


Figure 1 Commodity retail price index timing chart, 1951-2018

It can be seen from the time series diagram that the retail price index of our country presents certain volatility, and the sequence value basically fluctuates around a constant value, without periodicity and monotonic trend. Therefore, the visual measurement simply determines that it is a stationary sequence, and continues to use autocorrelation graph for verification.

II. Autocorrelation diagram: Take the autocorrelation coefficient as the horizontal axis, the number of delay period is the inverted longitudinal axis, and the vertical line in the horizontal direction represents the size of the autocorrelation coefficient. According to the characteristics of the stationary sequence with short-term correlation, the autocorrelation coefficient of the stationary sequence will decay quickly to 0 with the increase of the number of delay periods while the autocorrelation coefficient of the non-stationary sequence will decay slowly to 0.

As shown in Figure 2, the autocorrelation function histogram decreases rapidly to 0 with the increase of the lag order, and the autocorrelation coefficient after the second order is within the double standard deviation, which further indicates that the sequence is stationary.

Date: 12/27/19 Time: 22:49
Sample: 1951 2018
Included observations: 68

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.588	0.588	24.527	0.000
		2	0.230	-0.177	28.328	0.000
		3	0.116	0.096	29.306	0.000
		4	0.095	0.020	29.973	0.000
		5	0.144	0.118	31.531	0.000
		6	0.199	0.088	34.584	0.000
		7	0.146	-0.043	36.255	0.000
		8	0.082	0.016	36.787	0.000
		9	-0.007	-0.095	36.791	0.000
		10	-0.041	0.005	36.927	0.000
		11	-0.120	-0.175	38.123	0.000
		12	-0.159	-0.043	40.265	0.000
		13	-0.133	-0.026	41.785	0.000
		14	-0.112	-0.039	42.894	0.000
		15	-0.103	-0.003	43.843	0.000
		16	-0.115	-0.051	45.044	0.000
		17	-0.146	-0.014	47.021	0.000
		18	-0.143	-0.011	48.974	0.000
		19	-0.099	0.039	49.933	0.000
		20	-0.192	-0.230	53.578	0.000
		21	-0.237	-0.017	59.273	0.000
		22	-0.211	-0.068	63.868	0.000
		23	-0.182	-0.059	67.373	0.000
		24	-0.181	-0.095	70.903	0.000
		25	-0.194	-0.104	75.062	0.000
		26	-0.112	0.140	78.485	0.000
		27	0.020	0.091	78.531	0.000
		28	-0.006	-0.079	78.535	0.000

Figure 2 Auto-correlation chart of commodity retail price index series, 1951-2018

4.2 Pure Randomness Test

The white noise test is the statistical test of pure random sequence. The original hypothesis and alternative hypothesis of this test are:

$$H_0: \rho_1 = \rho_2 = \rho_3 = \dots = \rho_m = 0, \forall m \geq 1 \quad (1)$$

$$H_1: \text{there are at least } \rho_k \neq 0, \forall m \geq 1, k \leq m \quad (2)$$

The adjoint probability of each Q statistic in the previous autocorrelation graph shows that the original hypothesis is rejected, indicating that there is at least some such that the autocorrelation coefficient of the lag k period is significantly non-zero, that is, the rejection sequence is the original hypothesis of white noise, and the sequence is non-white noise.

Therefore, the original sequence is stationary non-white noise sequence. It can be seen that there is a close correlation between the serial values, and the historical commodity retail price index data have a certain impact on the future development. Given the validity of historical information, it can be used to predict the development trend of the commodity retail price index in the short term in the future.

5. MODEL BUILDING AND PARAMETER ESTIMATION

With the help of sequence autocorrelation to reveal the development law of time series. The basic idea: the development of events usually has a certain

inertia, and this inertia is described in statistical language is that there is a certain correlation between sequence values, and this correlation usually has a certain statistical law. Analysis objective: to find out the statistical law of this correlation and to fit out the appropriate mathematical model to describe this law, so as to use this fitting model to predict the future trend of the sequence.

Table 2 Model identification of ACF and PACF methods

Autocorrelation coefficient	Partial correlation	Model Scale			
Tailor	P cut	A R (p) Model			
q cut	Tailor	MA (q) model			
Tailor	Tailor	ARMA (iPAQ) model			
	AR (1)	0.3620	5.8219	5.9198	1.7445
	MA (1)	0.3845	5.7884	5.8863	1.7648
	ARMA (1,1)	0.4158	5.7669	5.8975	2.0865

From Figure 2 autocorrelation diagram and partial autocorrelation diagram, it can be seen that the autocorrelation coefficient has the trend of trailing, and the partial autocorrelation coefficient has the phenomenon of first order truncation. Therefore, we can try to use autoregressive model, moving average model, autoregressive moving average model to fit continuously.

The model type and order are determined according to the properties of autocorrelation graph and partial autocorrelation graph: the autocorrelation coefficient has trailing property, while the other partial autocorrelation coefficients fluctuate randomly in the range of 2 times standard deviation, and the process of attenuation from non-zero correlation coefficient to small value fluctuation is very sudden, so the partial autocorrelation sequence can be regarded as the first order truncation. So AR (1) or MA (1) or ARMA (1,1) models can be considered first.

5.2 Parameter Estimates

First, the model estimation parameters are established according to the AR (1) model. The parameter estimation method is selected x c ar (1) the sequential input LS the Estimate Equation, where the value is the sequence expected value. View the output and observe the significance of the parameters. Then we estimate the LS parameters of the MA (1) model and the LS parameters of the model.

AR (1), MA (1), ARMA (1,1) results of the above model are:

$$\text{AR Model: } X_t = 0.606716X_{t-1}, \varepsilon_t \sim \text{WN}(0, \sigma^2) \quad (3)$$

$$\text{MA Model: } X_t = \varepsilon_t + 0.684506\varepsilon_{t-1}, \varepsilon_t \sim \text{WN}(0, \sigma^2) \quad (4)$$

$$\text{ARMA Model: } X_t = 0.323851X_{t-1} + \varepsilon_t + 0.507957\varepsilon_{t-1}, \varepsilon_t \sim \text{WN}(0, \sigma^2) \quad (5)$$

So we need to compare the advantages and disadvantages of the possible model and get the better model. Generally, it is necessary to compare some important indicators, summarize the current model established by X sequence to compare, as shown in Table 3.

Table 3 Comparison of the advantages and disadvantages of the model

Model	Adjustment R_2	AIC	SC	DW values

5.1 Model Recognition

The most important thing in stationary time series analysis is to use data to identify and model, here we can have a preliminary identification of the fitting model by observing the characteristics of ACF and PACF in a more intuitive way. The specific discrimination methods are shown in the Table 2.

For the comparison and selection of the model, we should not only look at one index, but also synthesize various indicators, make a comprehensive judgment, and choose the optimal model. Among them, the discriminant criteria of several indexes considered: the adjusted representation of the overall goodness of fit of the model, which is between 0~1, the larger represents the better fitting effect. R_2 both AIC and SC represent the information criterion, the smaller the value for the model, the better. DW value should see if it is close to 2, when the DW value is close to 2, it represents that there is no autocorrelation relationship in the residual sequence, the model fits well, and there is a strong positive autocorrelation relationship when it is close to 0, and close to 4 represents a strong negative autocorrelation relationship in the residual sequence.

The R -squares value of the ARMA (1,1) model 0.4158 is relatively large according to the above criteria, and its AIC value is relatively small, and the DW value is the closest to 2. Hence, it can be considered that the overall fitting effect of the ARMA (1, 1) model is the most ideal. $\{X_t\}$, it can be used to fit the stationary sequence and describe it. The relevant forms of the model are as follows:

$$X_t = 0.323851X_{t-1} + \varepsilon_t + 0.507957\varepsilon_{t-1}, \varepsilon_t \sim \text{WN}(0, \sigma^2) \quad (6)$$

6. TESTING OF MODELS

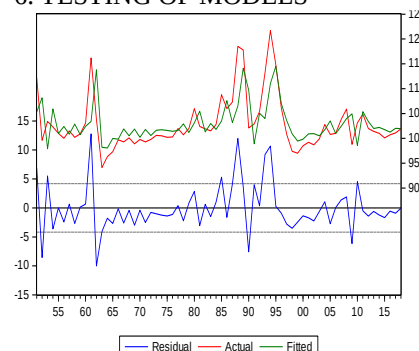


Figure 3 X Residual correlation test diagram of the sequence

Date: 12/28/19 Time: 21:38
Sample: 1951 2018
Included observations: 68
Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 -0.066	-0.066	0.3055	
		2 0.058	0.054	0.5484	
		3 -0.002	0.005	0.5486	0.459
		4 0.025	0.022	0.5953	0.743
		5 0.013	0.015	0.6072	0.895
		6 0.168	0.169	2.7775	0.596
		7 -0.005	0.016	2.7792	0.734
		8 0.090	0.075	3.4243	0.754
		9 -0.067	-0.060	3.7829	0.804
		10 0.031	0.009	3.8626	0.869
		11 -0.079	-0.083	4.3904	0.884
		12 -0.069	-0.118	4.7997	0.904
		13 -0.034	-0.049	4.9019	0.936
		14 -0.034	-0.061	5.0058	0.958
		15 -0.027	-0.010	5.0730	0.974
		16 -0.033	-0.038	5.1712	0.983
		17 -0.037	0.004	5.2990	0.989
		18 -0.133	-0.108	6.9929	0.973
		19 0.113	0.145	8.2421	0.961
		20 -0.147	-0.107	10.374	0.919
		21 -0.087	-0.106	11.132	0.919
		22 -0.073	-0.070	11.680	0.927
		23 -0.054	-0.070	11.993	0.940
		24 -0.037	-0.016	12.144	0.954
		25 -0.113	-0.184	13.548	0.939
		26 -0.085	-0.059	14.362	0.938
		27 0.087	0.083	15.248	0.935
		28 0.077	0.184	15.957	0.937

Figure 4 Pure randomness test of residual sequences
As shown in Figure 3, Figure 4. From Figure 3, it can be seen that the curve of the actual value of red and the curve error of the green fitting value is very small, which indicates that the fitting degree of the model is relatively high, and the residual sequence diagram also shows very stable. As can be seen from figure 4, del

Table 4 Forecast value and confidence interval of retail price index

t of time	Commodity Retail Price Index Forecast	Lower level of confidence	Confidence ceiling
2019	102.7	94.1	111.2
2020	102.9	91.7	114.2
2021	103.0	91.4	114.6
2022	103.0	91.4	114.7
2023	103.1	91.4	114.7

As shown in Table 4, Figure 5. It can be seen from the prediction of the model that the confidence interval increases with the increase of the backward prediction period, which indicates that the lower the prediction accuracy is. Since AR and MA terms in the dynamic model depend on the information and eventually lead to new random error generation. Among them, the forecast value of commodity retail price index in 2019~2023 is 102.7, 102.9, 103.0, 103.0, 103.1, respectively.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusion

I. Commodity retail price index three major characteristics: agglomeration, information asymmetry, long-term memory. Chinese commodity retail price index time series shows obvious sharp fluctuation characteristics; the information asymmetry of the index may be due to the rise of commodity retail index, inflation, and then lead to consumers blindly rush to buy, resulting in anomalies; long-term memory refers to China's commodity index

neither ACF nor PACF are significantly different from 0, and the P values of the Q statistics are far greater than 0.05. Therefore, it can be considered that the residual sequence is a white noise sequence, that is, the original sequence information extraction is relatively sufficient. Among them, the P values of the first order parameters of constant and lag are very small, and the parameters are significant; therefore, the model is better.

7. SEQUENCE PREDICTION ANALYSIS

Changing F orecast Sample to 2019 at 2023, the prediction method is directly based on the system's default D ynamic dynamic prediction method, which can obtain the prediction results.

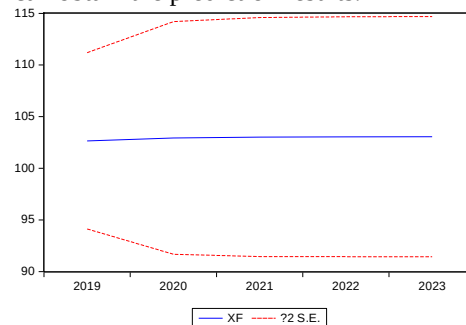


Figure 5 ARMA (1,1) Prediction results of the mo

rising or falling trend will maintain for a period of time, will not immediately change the trend of development [18-22].

II. Results of model prediction: The forecast value of commodity retail price index in 2019~2023 is 102.7, 102.9, 103.0, 103.0, 103.1, respectively. Confidence intervals for the next three years are [94.1, 111.2], [91.7, 114.2], [91.4, 114.6]. And the results in 2022~2023 have a relatively large error.

8.2 Recommendation

First, improve fiscal and monetary policies and accelerate institutional and structural innovation. Because the impact of policy system on the economy has a certain lag, so the formulation of policy also needs to be changed according to the economic trend. How to solve the contradiction of economic fluctuation caused by the trend of price to a great extent, the key to the development of index and the growth of economic quality in China is determined by structural adjustment and institutional innovation. Second, establish relevant coordination mechanisms

to mitigate the impact of index fluctuations. Because the retail price of goods can affect the psychology of consumers to a certain extent, when the frequency of fluctuation is high, we should take effective measures to control the social instability caused by the fluctuation of commodity retail price index, grasp the timing of price regulation and control, and ensure scientific and reasonable.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

- [1]B. X. Luo, On the influence of commodity retail price index volatility on China's economic growth, *Business Economics Research*, 2017, 11: 29-31.
- [2]T. Liu and L. N. Zhang, Analysis and short-term forecast of China's retail price index since the founding of the People's Republic of China, *Heilongjiang Foreign Trade*, 2005, 5: 15-17.
- [3]C. S. Tian, Analysis of the fluctuation characteristics of retail price index and its countermeasures—An empirical study based on ARCH model, *Price Theory and Practice*, 2011, 04: 49-50.
- [4]J. Azizi, M. Kavooosi-Kalashami, and M. S. Allahyari, Behaviour analysis of basic inputs prices in iran's livestock subsector, *Journal of Animal and Plant Sciences*, 2015, 25(3): 860-8.
- [5]J. Bai and S. Ng, Forecasting economic time series using targeted predictors, *Journal of Econometrics*, 2008, 146(2): 304-17.
- [6]P. Berck, E. Leibtag, A. Solis, and S. Villas-Boas, Patterns of pass-through of commodity price shocks to retail prices, *American Journal of Agricultural Economics*, 2009, 91(5): 1456-61.
- [7]E. Bolandifar and Z. Chen, Hedging through index-based price contracts in commodity-based supply chains, *Omega-International Journal of Management Science*, 2020, 90.
- [8]E. P. Carden and J. M. W. Brownjohn, ARMA modelled time-series classification for structural health monitoring of civil infrastructure, *Mechanical Systems and Signal Processing*, 2008, 22(2): 295-314.
- [9]Y. C. Chen, K. S. Rogoff, and B. Rossi, Can exchange rates forecast commodity prices? *Quarterly Journal of Economics*, 2010, 125(3): 1145-94.
- [10]F. L. Chu, Forecasting tourism demand with ARMA-based methods, *Tourism Management*, 2009, 30(5): 740-51.
- [11]J. Davidson, A. Halunga, T. Lloyd, S. McCorriston, and W. Morgan, World commodity prices and domestic retail food price inflation: some insights from the UK, *Journal of Agricultural Economics*, 2016, 67(3): 566-83.
- [12]F. Ding, F. Wang, L. Xu, and M. Wu, Decomposition based least squares iterative identification algorithm for multivariate pseudo-linear ARMA systems using the data filtering, *Journal of the Franklin Institute-Engineering and Applied Mathematics*, 2017, 354(3): 1321-39.
- [13]E. Erdem and J. Shi, ARMA based approaches for forecasting the tuple of wind speed and direction, *Applied Energy*, 2011, 88(4): 1405-14.
- [14]V. Fasen-Hartmann and S. Kimmig, Robust estimation of stationary continuous-time arma models via indirect inference, *Journal of Time Series Analysis*, 2020.
- [15]O. Filip, K. Janda, L. Kristoufek, and D. Zilberman, Dynamics and evolution of the role of biofuels in global commodity and financial markets, *Nature Energy*, 2016, 1: 1-9.
- [16]A. Inoue, Closed-form expression for finite predictor coefficients of multivariate ARMA processes, *Journal of Multivariate Analysis*, 2020, 176.
- [17]A. R. Ives, K. C. Abbott, and N. L. Ziebarth, Analysis of ecological time series with ARMA(p,q) models, *Ecology*, 2010, 91(3): 858-71.
- [18]E. Leibtag, How much and how quick? Pass through of commodity and input cost changes to retail food prices, *American Journal of Agricultural Economics*, 2009, 91(5): 1462-7.
- [19]T. J. Richards, W. J. Allender, and S. F. Hamilton, Commodity price inflation, retail pass-through and market power, *International Journal of Industrial Organization*, 2012, 30(1): 50-7.
- [20]H. Smith, and J. Thanassoulis, Prices, profits, and pass-through of costs along a supermarket supply chain: bargaining and competition, *Oxford Review of Economic Policy*, 2015, 31(1): 64-89.
- [21]J. Song, J. Kang, Sequential change point detection in ARMA-GARCH models, *Journal of Statistical Computation and Simulation*, 2020, 90(8): 1520-38.
- [22]X. Zheng, Z. Pan, and L. Zhuang, Price volatility and price transmission in perishable commodity markets: evidence from Chinese lychee markets, *Applied Economics Letters*, 2020, 27(9): 748-52.

Analysis of the Relationship between Sports and Academic Performance Based on Decision Tree Classification

Yan Hu¹, Jia-Ming Zhu^{1,*}, Xiao-Mei Yin², Li-Zhi Li¹, Chun-Li Wang³

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

² School of Management and Engineering, Anhui University of Finance and Economics, Bengbu, 233030, China

³ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: Under the call of the country, the physical exercise of the school is paid more and more attention, but under the current education system, the school pays attention to the students' achievements, and the students don't have enough time for physical exercise, which makes the students' physical quality worse. Aiming at the relationship between sports condition and college students' performance, based on decision tree classification, K-means clustering and other methods, this paper constructs a model of correlation analysis between sports and performance based on decision tree theory and a model of classification of students' types based on K-means theory, and finally obtains the relationship between physical quality, sports skills, sports frequency, sports intensity and academic performance. Combined with the actual situation, this paper gives some reasonable suggestions on how to combine the physical fitness with the study of college students.

Keywords: Sports characteristics; Decision tree classification; K-means clustering; Relevance analysis; Python

1. INTRODUCTION

Adolescents are the future and hope of the motherland, and the health problems of adolescents are crucial. Various laws and regulations have been promulgated by the state to promote sports, which has improved the physical condition of young people to a certain extent^[1,2]. However, in reality, physical education in the implementation of various schools, due to the traditional examination-oriented education, etc. The influence of various factors will always encounter certain obstacles, resulting in students still not paying attention to sports after entering the university. In order to gain a closer understanding of the relationship between academic performance and physical exercise, a research team surveyed some college students, conducted surveys on physical education, learning, and learning and physical performance, and analyzed the data obtained.

2. DATA SOURCES AND RELATED ASSUMPTIONS

The data in this article mainly comes from the supplementary data obtained from the mathematical

modeling competition questions and the questionnaire survey. In order to facilitate the solution of the problem, this article also proposes the following assumptions: 1) Assume that the results of all questionnaires provided by the investigator are true and reliable. 2) Assume that the respondent filled in the questionnaire completely and objectively according to his true situation. 3) Assume that the respondent is in the same state when filling in each question, and the filling status of each question is independent of each other.

3. CORRELATION ANALYSIS OF SPORTS AND PERFORMANCE BASED ON DECISION TREE THEORY

3.1 Research Ideas

When analyzing sports and learning performance, first of all, the subjective analysis of the sports and sports performance is based on the questionnaire; secondly, by applying the decision tree classification algorithm to the student's sports feature data and learning performance data, the corresponding decision tree classification model is constructed to analyze sports. The correlation between sports and academic performance; finally, the classification criteria are set according to the decision tree model^[3-5].

3.2 Research Methods

(1) Decision tree generation

The generation of the decision tree is a process of recursively selecting the most graduated features, and relying on the training set given by this feature to divide the process, so that each subset has the best classification. The main process is as follows:

(i) Prepare the training set and treat all sample data as a node.

(ii) Traverse all the characteristic attributes that are not used as the dividing conditions, and select a best dividing characteristic attribute.

(iii) Use the selected attribute as the data division node to divide the data.

(iv) Determine whether all data in the divided data sample subset have been fully classified. If it is determined that all data in the data sample subset has been completely correctly classified, establish a leaf node.

- (v) If you are not sure that all the data in the data sample subset has been correctly classified, you need to traverse all the feature attributes that are not used as the dividing conditions, select the best dividing feature attribute, and continue to divide the data sample subset. And establish the corresponding node.
- (vi) Repeat the above operation until all the sample data in the training set are correctly divided. Repeat the above operation until all the sample data in the training set are correctly divided.
- (vii) Generate a decision tree.

(2) Information entropy

In information theory, entropy is a measure of the uncertainty of random variables. The greater the value of entropy, the greater the uncertainty of random variables.

Let X be a discrete random variable with a finite number of values, and its probability distribution is:

$$P(X = x_i) = p_i \quad i = 1, 2, 3, \dots, n \quad (1)$$

Then the entropy of the random variable X is defined as

$$H(X) = -\sum_{i=1}^n p_i \log_2 p_i \quad (2)$$

The information gain formula is as follows:

$$\Delta = I(\text{parent}) - \sum_{j=1}^k \frac{N(v_j)}{N} * I(v_j) \quad (3)$$

(3) GINI coefficient

The GINI coefficient is the same as the information entropy, and it is also an indicator to measure the impurity of information. The calculation formula is as follows:

$$\text{Gini}(D) = \sum_{k=1}^n p_k (1 - p_k) = 1 - \sum_{k=1}^n p_k^2 \quad (4)$$

Where k represents the number of categories included in the sample, p_k is the probability that the sample belongs to the category of k . GINI coefficient and information entropy are almost used to measure the uncertainty of information. In the CART algorithm, the GINI coefficient is used as the selection criterion for dividing features.

3.3 Problem Solving

We analyze the questions in the questionnaire about sports and academic performance, mainly focusing on whether sports bring benefits to our own learning, and the degree of improvement of class efficiency by inter-class sports. The analysis is shown in Figures 1 and 2 below.

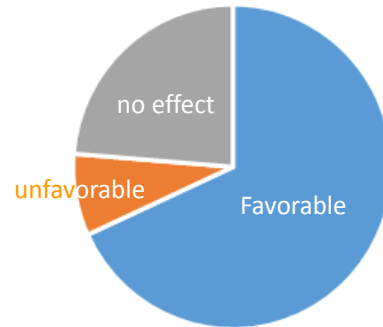


Figure 1 The effect of exercise on learning

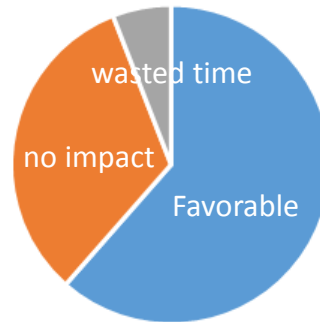


Figure 2 The effect of exercise on learning efficiency
It can be seen from the above figure that 68% of students believe that exercise is beneficial to learning, 24% of students believe that exercise has no effect on learning, and only 8% of students believe that exercise is harmful to learning. It can be seen that for the vast majority of college students, sports are beneficial to learning; learning efficiency has a greater impact on academic performance, and the higher the learning efficiency, the more effective it will be. In the survey, 61% of students believe that sports will improve learning efficiency, and 33% of students think that there is no effect, which means that sports will improve learning efficiency for most of the students, and then improve academic performance. Seeing that sports will promote the improvement of academic performance, students should pay attention to physical exercise.

The above analysis is based on the direct analysis of the results of the student questionnaire data. Below we will use a decision tree to analyze the association between student performance and sports. Choosing appropriate indicators is very important for analyzing the problem. For sports indicators, this paper mainly selects five indicators, namely sports skills, exercise frequency, exercise intensity, physical fitness, and sports development.

Using the method of decision tree, the above five indicators reflecting sports and the ranking of student performance are correlated. The final output of the decision tree model is shown in Figure 3.

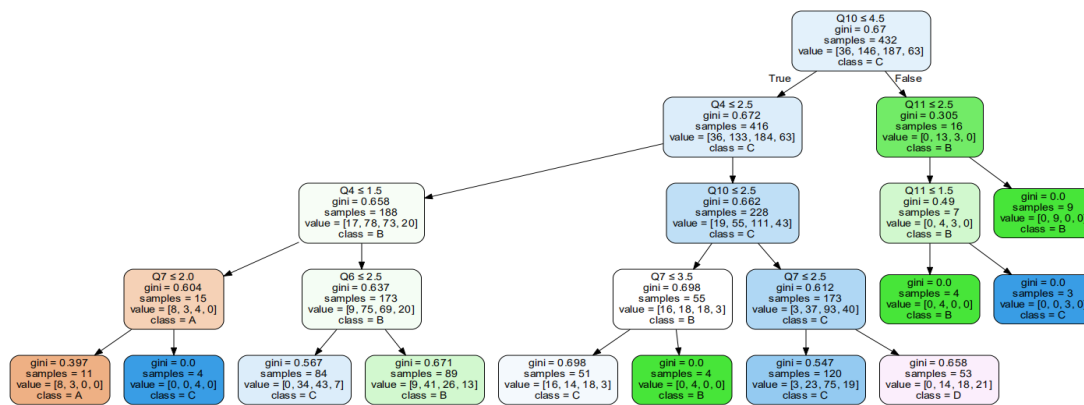


Figure 3 Decision tree model

The characteristics of sports in this article are mainly divided into 5 categories, namely sports skills, exercise frequency, exercise intensity, physical fitness, and sports development. The five types of sports are

Table 1 Correlation coefficient table of each feature and academic performance

Feature name	Sports skills	Movement frequency	Exercise intensity	physical fitness	Sports development
coefficient	0.24	0.13	0.25	0.3	0.09

According to the analysis of the above table, the correlation between sports development and academic performance is very small and can be ignored. The correlations between physical fitness, exercise intensity, sports skills, exercise frequency and academic performance were 0.30, 0.25, 0.24 and 0.13, respectively. It can be seen from the correlation coefficients between various sports characteristics and academic performance that physical fitness and exercise intensity have the greatest influence on academic performance. Students should improve their physical fitness and appropriately increase exercise intensity.

The classification rules can be extracted through the decision tree model diagram in Figure 4 above. According to the classification results, they are "Grade A", "Grade B", "Grade C", and "Grade D". Q13: ranking of results, Q4: sports skills, Q6: exercise frequency, Q7: exercise intensity, Q10: physical fitness, and Q11: sports development. The numbers 1~5 represent the data levels from strong to weak, and the levels are represented by letters A, B, C, D, E. Select a sample with a sample number greater than 10 to determine the grade of grade, and the following results can be obtained from the decision tree diagram:

(1) There are two classification rules for the classification result of "Grade A". The rules are as follows:

Physical fitness level belong to [A,D], Sports skill level = A → Grade A;

Physical fitness level belong to [A,D], Sports skill level=A, Exercise intensity level belong to [A,B] → Grade A.

(2) There are two classification rules for the classification result "Grade B", and the rules are as follows:

included in the decision tree for analysis, you can see the correlation between each feature and academic performance Degree, see Table 1.

Physical fitness level = E → Grade B;

Physical fitness level belong to [A,B], Sports skill level belong to [C,D] obtain result Grade B;

Physical fitness level belong to [A,D], Sports skill level belong to [A,B] obtain result Grade B;

Physical fitness level belong to [A,D], Sports skill level = B obtain result Grade B;

Physical fitness level belong to [A,D], Sports skill level = B, Exercise frequency level belong to [C,D] obtain result Grade B.

(3) There are two classification rules for the classification result "Grade C", the rules are as follows:

Physical fitness level belong to [A,D] obtain result Grade C;

Physical fitness level belong to [A,D], Sports skill level belong to [C,D] obtain result Grade C;

Physical fitness level belong to [A,D], Sports skill level = A, Exercise intensity belong to [C,D] obtain result Grade C;

Physical fitness level belong to [C,D], Sports skill level belong to [C,D] obtain result Grade C;

Physical fitness level belong to [C,D], Sports skill level belong to [C,D], Exercise intensity belong to [A,B] obtain result Grade C;

Physical fitness level belong to [A,B], Sports skill level belong to [A,B], and Exercise intensity belong to [A, C] obtain result Grade C;

(4) There is one classification rule with the classification result "Grade D", in which the rules are as follows:

Physical fitness level belong to [C,D], Sports skill level belong to [C,D], Exercise intensity grade belong to [C,D] obtain result Grade D;

Through the construction and verification of the decision tree model, extraction of classification rules, and analysis of the correlation coefficients of each

feature, it is found that the application of the decision tree model can study the relationship between student sports and academic performance. The following is an analysis of the reasons for the classification rules generated by the decision tree model:

(1) Classification rule “Physical fitness level belong to [A,D], Sports skill level=A obtain result Grade A.” and “physical fitness belong to [A,D], Sports skill level= B obtain result Grade B”, “Physical fitness level belong to [A,D], Sports skill level= C obtain result Grade C. It shows that the physical quality of the students with grade A is between strong and weak, and the sports skills should be accurate and professional and fully mastered. This shows that the limitation of personal physical fitness on performance is broad. A person's physical fitness may not be good, but if he masters a certain sports skill, he can improve his physical fitness, further improve his performance, and then slowly reach the level A degree. However, if the sports skills fall to the B level, it means the importance of a student's sports skills.

(2) Classification rule “Physical fitness level belong to [A,D], Sports skill level=A, Exercise intensity grade belong to [A,B] obtain result Grade A” and “Physical fitness level belong to [A,D], Sports skill level=A, Exercise intensity grade belong to [C,D] obtain result Grade C”. It shows that if the student's Exercise intensity drops almost without sweating or tiredness, the exercise effect will not be achieved, then there will be no benefit to learning, and the grade impact on the academic performance is greater, directly down to grade C.

(3) Classification rule “Physical fitness level belong to [C,D], Sports skill level belong to [C,D], Exercise intensity belong to [A,B] obtain result Grade C” and “Physical fitness level belong to [C,D], Sports skill level belong to [C,D], Exercise intensity grade belong to [C,D] obtain result Grade D” It shows that when the physical fitness and sports skills are at a lower grade, if you can increase Exercise intensity, that is, increase the amount of exercise or try to increase the exercise time, you can promote the improvement of performance.

(4) Classification rule “Physical fitness level belong to [A,D], Sports skill level belong to [A,B] obtain result Grade B” and “Physical fitness level belong to [A,D], Sports skill level belong to [C,D] obtain result Grade C” It shows that students with weaker physical qualities or above, if the sports skills are not high, then learning Grade will directly slide from B to C. Students should pay attention to improving or mastering some basic sports skills, not know nothing.

4. CLASSIFICATION OF STUDENT TYPES BASED ON K-MEANS THEORY

4.1 Research Ideas

First of all, according to the Classification rule derived from the correlation analysis of sports and performance, determine the corresponding learning grade for each student; secondly, remove the data that does not meet the Classification rule, and cluster the remaining data to obtain the classification results^[6] Finally, according to the classification results, a plan to promote college students' academic performance through sports is proposed.

4.2 Research Methods

K-means algorithm is a clustering method based on partition. The algorithm divides data objects into multiple classes or clusters, so that objects in the same cluster have a high degree of similarity, and objects in different clusters have large differences, making clusters dense and inter-cluster. The K-Means algorithm uses the object distance as an indicator. If it determines that the closer the distance between two objects, the higher the similarity. Therefore, each cluster is composed of the closest object.

4.3 Algorithm Work Flow

If the input data sample is, the algorithm work flow is as follow: 1) Start clustering and determine K initial centroid. 2) Measure the distance from each sample i to each centroid and classify it as the nearest centroid. 3) In the classified class, recalculate and select a new centroid. 4) Iterate several times until the distance between the new centroid and the original centroid is equal to or less than the specified threshold.

The specific algorithm flow chart is shown in Figure 4.

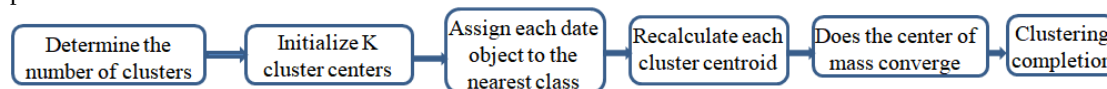


Figure 4 Algorithm flowcharts

4.4 Problem Solving

Using K-means clustering, the obtained clustering under different K values is shown in Table 2 below.

By describing and analyzing each category when K takes different values, when $K = 4$ and 5 , the K-means clustering model can only get the cases where Grade is B and C, and cannot reflect the case where Grade is A. When $K = 7$, students are divided into too many grades, and the school is not easy to manage, so the situation of $K = 7$ is discarded. Therefore, analyzing the situation of $K = 6$, you can get the following information: 1) There is a kind of cluster with Grade

A, and most of the students in it have good characteristics in all aspects of sports; 2) There is a cluster with Grade B. The students' sports skills and Exercise intensity characteristics are better, and the exercise frequency and physical quality are relatively poor; 3) There are three clusters with Grade C. The physical quality of the students is basically poor, and the exercise frequency is not too high; 4) There is a kind of cluster with Grade D, and the characteristics of the students in all aspects of sports are relatively poor.

Table 2 Clustering status of each feature under different K values

k	Cluster	Grade	Sports skills	Movement frequency	Exercise intensity	Movement frequency
4	Cluster1	B	B	C	B	C
	Cluster2	C	C	D	B	C
	Cluster3	C	C	B	C	C
	Cluster4	C	B	A	A	B
5	Cluster1	C	C	D	B	C
	Cluster2	C	C	B	B	C
	Cluster3	B	B	C	B	C
	Cluster4	C	B	A	A	B
	Cluster5	D	C	C	C	C
6	Cluster1	C	C	B	B	C
	Cluster2	D	C	C	C	C
	Cluster3	C	B	A	B	B
	Cluster4	A	A	B	A	B
	Cluster5	B	B	C	B	C
	Cluster6	C	C	D	B	C
7	Cluster1	C	B	C	B	B
	Cluster2	A	A	B	A	B
	Cluster3	B	B	C	B	C
	Cluster4	C	B	A	B	C
	Cluster5	D	C	C	D	C
	Cluster6	D	C	A	C	C
	Cluster7	C	C	D	B	C

5. SCHEME DESIGN

Through the analysis of the correlation between sports and performance, the degree of correlation between students' sports and academic performance is obtained. K-Means is used to group the students ^[7-10]. Exercise improves student performance; the specific plan is as follows.

5.1 Student Perspective

(1) Increase Exercise intensity appropriately

Student Exercise intensity has the greatest correlation with academic performance. Students with larger exercise intensity tend to have better academic performance, which requires students to appropriately increase Exercise intensity. Increasing Exercise intensity is not a sudden increase, it should be done step by step. In accordance with each student's own physical fitness status, exercise intensity is appropriately increased every period of time, not to exceed the physical load. Without violating health, appropriately increase Exercise intensity.

(2) Experience different motor skills

Students' motor skills also have a greater impact on academic performance. There are many kinds of sports, and everyone has their favorite sports. In the survey, more students love running and badminton, but they should not only stick to this. Students should develop more sports hobbies and find their favorite sports. Students take the initiative to exercise and develop good habits of learning sports, learning and life.

(3) Properly enhance exercise efficiency

Sports efficiency also has a greater impact on academic performance. Doing everything must pay attention to methods, and taking the right exercise will make exercise more effective. Warm-up before exercise is indispensable, but during the warm-up process, it is necessary to walk naturally in the clouds, so as to avoid injuries; it is also important to grasp the amount of exercise that suits you when exercising. When you are exercising, you feel unwell or have difficulty breathing. Then, it means that the amount of exercise is too large, reduce or rest properly; the biggest taboo of exercise is to exercise too quickly, and it should be done gradually.^[11-12]

5.2 School Perspective

(1) Change sports concept, pay attention to physical education

Under the influence of the college entrance examination system, many schools only care about students' cultural achievements, and ignore the call of the country to attach importance to students' sports. They often cancel students' physical education classes and supplement cultural classes. Physical education in schools is not only the work of individual teachers, it should be the result of the cooperation of all teachers. Teachers in various subjects should strengthen management and coordination, not only attach importance to the construction of students' spiritual civilization, but also strengthen their physique. Carry out educational activities to change students' sports concepts, so that students take the initiative to get out of the classroom, stay away from electronic equipment, exercise, and enhance physical fitness.

(2) Strengthen the construction of stadium facilities and use them effectively^[13]

The sports venues of some schools are relatively small and cannot meet the sports needs of a large number of students. The dilapidated sports venues and potential safety hazards have become obstacles for students to perform sports; while for some schools with better sports conditions, the sports venues are locked to restrict the use of sports equipment by students not only causes a waste of resources, but also leads to a decline in the enthusiasm of students for sports. Therefore, schools should improve sports facilities, improve the sports environment, open sports venues, and provide sports equipment to students for free. Enrich sports facilities to meet the diverse sports needs of students.

(3) According to student grouping, targeted intervention to students

K-means clustering can be used to classify different students. Teachers can intervene in their sports in a targeted and differentiated manner according to the different characteristics of the students in these six clusters. For students with poor academic performance, they can first intervene in areas that are more relevant to learning and encourage these students to increase exercise intensity appropriately, but they can be allowed to start with more basic exercise methods, such as running, badminton skipping And so on, and then start with the characteristics of relatively small degree of relevance, such as allowing students to enrich their exercise methods. And for students with better grades, you can carry out excellent education, so that these students can do better on the existing basis. Teachers need to teach students according to their aptitude according to the characteristics of different students, in order to improve students' achievements more effectively.

6. CONCLUSION

1. For the vast majority of college students, sports are beneficial to learning and will increase learning efficiency;

2. Through the correlation analysis, we can see that physical fitness and Exercise intensity have the greatest impact on academic performance. Students should improve their physical fitness and appropriately enhance Exercise intensity;

3. The application of decision tree model can study the relationship between student sports and academic performance, and gives the corresponding explanation of the classification rule.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department

Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

REFERENCES

- [1]Y. Q. Chao, Physical exercise can improve academic performance, People's Education, 2016, (17): 10.
- [2]L. S. Li, Research on the influence of physical activity on the academic performance of primary and middle school students in China and its intermediary variables, East China Normal University, 2018.
- [3]X. Wang, Research on the correlation between student behavior habits and academic performance based on data mining, Shanghai Normal University, 2019.
- [4]J. Shi, Research on the influence of student behavior on academic performance based on data mining, Central China Normal University, 2017.
- [5]H. He, D. B. Liu, and B. Zhang, Correlation analysis of online learning behavior of SPOC platform based on learning style classification and student performance, Science and Technology Information, 2019, 17(8): 207-209+211.
- [6]J. Y. Xie, Y. Zhang, and E. H. Chen, Key factors of students' achievement mining and achievement prediction, Journal of Nanjing University of Information Science & Technology (Natural Science Edition), 2019, 11(3): 316-325.
- [7]C. Yao, The relationship between physical exercise behavior and academic performance of senior high school students in Nanjing, Chinese Journal of School Health, 2018, 39(6): 851-853.
- [8]X. Zhang, Research on the relationship among college students' sense of self-support for fitness, physical exercise behavior and learning input, Qufu Normal University, 2019.
- [9]Z. N. Zhang, Research on the impact of the sports entrance examination system on school sports, Lanzhou University of Technology, 2019.
- [10]Y. W. Lu and J. H. Zhu, Research on the relationship between physical exercise and academic achievement of college students, Bulletin of Sports Science and Technology, 2017, 25(2): 63-64.
- [11]Q. Q. Wen, J. M. Zhu, Y. Han, et al., Comprehensive evaluation of physical fitness of college students, Journal of Wenshan University, 2014, 27(3): 115-120.
- [12]J. M. Zhu, S. M. Su, T. M. Zhao, et al., Evaluation of college students' physical health based on cluster analysis method, Journal of Tonghua Teachers College, 2014, 35(6): 20-23.
- [13]J. M. Zhu, Q. Wang, H. S. Hu, et al., Analysis of students' physical health based on fuzzy comprehensive evaluation method, Journal of Jiamusi University (Natural Science Edition), 2014, 32(2): 285-290.

Coal Price Prediction Model Based on Principal Component Analysis and Neural Network

Meng Qi Zheng¹, Jia Ming Zhu^{1,*}, Deng Sheng Liu², Chun Li Wang²

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

² Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: In order to give the order of the main factors affecting the thermal coal price of Qinhuangdao port. First, the theory of data collection, deletion of outliers and dimensionality reduction was used to construct the principal component analysis model, and the software MATLAB was used to solve the problem, and the seven main factors affecting the thermal coal price of Qinhuangdao port were obtained. For the prediction of the next 31 days, a linear regression model was established for the data of 4 weeks from April 3, 2020 to April 31, 2020, and the data of each day was calculated. Then a neural network prediction model was established and the coal price in the next 31 days was predicted by using MATLAB software.

Keywords: Coal price; Forecast; PCA; Neural network; MATLAB

1. INTRODUCTION

1.1 Background Introduction

With the coal industry development and expansion, the competition is intense, between the national coal enterprise, and thus the relevant personage to analyze the factors affecting the price of coal enterprise, and forecast the price of coal research - find out the main factors of coal prices, considering the future situations (such as emergency) caused by the factors affecting the price of coal in importance and structural changes in the coal price comprehensive prediction model is set up, to more accurately predict the price of coal, guarantee the smooth development of China's coal market in the future.

1.2 Research Significance

Study the main factors affecting the price of coal, to predict the price of coal for coal enterprises to improve competitiveness and achieve steady development and to the related departments to take corresponding measures to encourage the production, the protection of coal enterprises in our country has a positive effect, the coal market price changes is closely related to industry, especially the impact on the cost structure of enterprises, management of capital allocation to be reckoned with, therefore, by establishing the model, the method of quantitative analysis to study and analysis to this kind of problem, is advantageous to the relevant government

departments management coal market, also is helpful for enterprises to formulate rational and effective production plan, so as to realize cost savings and revenue maximization,

Increase the competitiveness of enterprises to adapt to the increasingly fierce competition in the coal market and strive to stand out.

2. LITERATURE REVIEW

Dong and Zhang [1] established a grey dynamic prediction mathematical model of coal market price by applying grey system theory. Based on the value of coal price changing with time, they regarded the random process as a grey process only related to time changing within a certain range. The grey dynamic prediction model of coal market price is established based on grey system theory, which can be applied to any long interval series. The disadvantage is that only a rough prediction model is proposed, without considering the impact of various factors on coal prices. Chao [2] predicted thermal coal spot price from ARIMA, SVR and their combined models, and optimized the prediction effect of SVR model with PSO algorithm. The deficiency is that there is no further study of the structural and important changes in the factors affecting coal prices caused by possible future emergencies. Zhu [3] analyzed and predicted the price of coal in detail by means of statistics, comparative demonstration and other methods from four aspects affecting the supply and demand, value, import and policy of coal. The disadvantage is that only a lot of theoretical analysis is used, and no specific model is designed to predict.

All in all, the existing literature has its shortcomings and does not adequately take all factors into account. After studying a large number of literatures, we have carried on the innovation and the consummation to this question on this foundation.

3. EXTRACTION OF INFLUENCING FACTORS BASED ON PRINCIPAL COMPONENT ANALYSIS MODEL

3.1 Model Principle

Principal component analysis, it is to investigate a method of multivariate statistical correlation between multiple variables, study how to use a few principal components to reveal the internal structure of multiple variables [4], namely a few principal

components was derived from the original variables, to make them as much as possible to retain the information of the original variables, and unrelated to one another. Usually mathematical processing is the original P index as a linear combination, as a new composite indicator.

3.2 Research Ideas

First in China coal data are collected and summed up in 19 factors, respectively is: X_1 coke production, X_2 crude oil production, the X_3 gasoline production, X_4 kerosene, X_5 diesel production quantity, X_6 fuel oil production, gas production, by 8 X_7 capacity, X_9 hydropower generation, X_{10} fire power. X_{11} kerosene output current value (ten thousand tons), X_{12} kerosene production total value (ten thousand tons), X_{13} kerosene production year-on-year growth (%), X_{14} kerosene production cumulative growth (%), X_{15} state-owned economy energy industrial investment in fixed assets, coal CAI Xuan Ye X_{16} state-owned economy of investment in fixed assets, X_{17} state-owned economy gas production and supply industry of investment in fixed assets, X_{18} state-owned economy of oil and gas industry investment in fixed assets, X_{19} state-owned economy oil processing and coking industry [6] of investment in fixed assets [5].

Then, Excel is used to preprocess the collected data by deleting outliers and filling in averages to obtain sample data.

Using principal component analysis (PCA) of each variable mean standard deviation of μ_j and S_j , and the corresponding calculated correlation coefficient matrix R and its eigenvalue and eigenvector, and then to calculate the information contribution rate and cumulative contribution rate, and it is concluded that affect the price of coal the main component of the main influencing factors, finally it is concluded that the sample data comprehensive evaluation score of each case [6].

3.3 Problem Solving

There are 19 index variables for principal component analysis, which are $X_1, X_2, \dots, X_{19}$ respectively,

$$\tilde{a}_{ij} = \frac{a_{ij} - \mu_{ij}}{s_{ij}}, i = 1, 2, \dots, 19; j = 1, 2, \dots, 19$$

Among them:

$$\mu_j = \frac{1}{19} \sum_{i=1}^n a_{ij}; s_j = \sqrt{\frac{1}{n-1} \sum_{i=1}^n a_{ij}^2}, j = 1, 2, \dots, m$$

Corresponding to the

$$\tilde{x}_j = \frac{x_j - \mu_j}{s_j}, j = 1, 2, \dots, 19$$

Is the standardized index variable.

Calculate the correlation coefficient matrix R.

$$r_{ij} = \frac{\sum_{k=1}^{19} \tilde{a}_{ki} \tilde{a}_{kj}}{n-1}, i, j = 1, 2, \dots, 19$$

Where, r_{ij} is the correlation coefficient between the index and the JTH index.

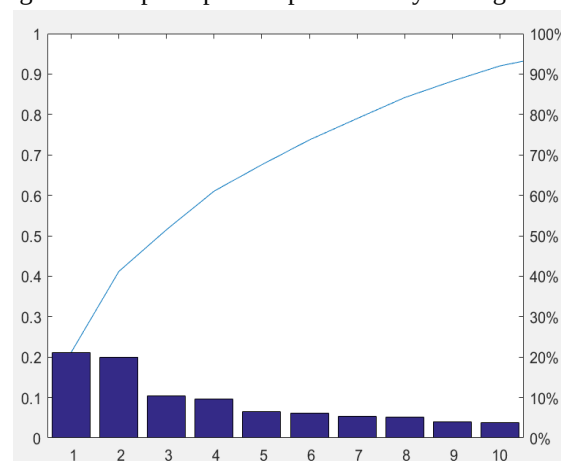
Calculate the eigenvalue and the eigenvector, and calculate the eigenvalue $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_{19} \geq 0$ of the correlation coefficient matrix R, And the corresponding eigenvectors $u_1, u_2, \dots, u_{19}$, while $\mu_j = [\mu_{1j}, \mu_{2j}, \dots, \mu_{19j}]^T$: Choose p ($p < 19$) principal components [7], and calculate the comprehensive evaluation value.

The information contribution rate and cumulative contribution rate of eigenvalue λ_j ($j = 1, 2, \dots, 19$) were calculated:

$$\alpha_p = \frac{\sum_{k=1}^p \lambda_k}{\sum_{k=1}^{19} \lambda_k}$$

Cumulative contribution rate of principal component y_i . When the cumulative contribution rate is close to 1 (generally 0.85, 0.9, 0.95), the first p indicator variables are selected as the p principal components, instead of the original 19 index variables, so as to carry out comprehensive analysis on the p principal components. MATBLE software was used for principal component analysis of 19 evaluation indicators. The first few characteristic roots and contribution rates of the correlation coefficient matrix are shown in Figure 1.

Figure 1 The principal component analysis diagram



The results are summarized in Table 1.

It can be seen that when the cumulative contribution rate of the seventh principal component reaches 89.5008% > 0.85, principal component analysis is very good. The following seven principal components are selected for comprehensive evaluation. As shown in Table 2

Table 1 Results of principal component analysis

The principal components	Characteristics of the root	Cumulative contribution rate	The principal components	Characteristics of the root	Cumulative contribution rate
1	2.99748	29.9748	5	0.71847	77.8850
2	1.67754	46.7502	6	0.68936	84.7786
3	1.30448	59.7951	7	0.47222	89.5008
4	1.09053	70.7003	8	0.32468	92.7476

Table 2 Ranking table of influencing factors

Factors affecting the	The sorting
Coke production	1
Natural gas production	2
Thermal power generation	3
Import and export of state-owned coal	4
Coal consumption storage ratio	5
Current value of kerosene output	6
Energy consumption pattern	7

As can be seen from the analysis results in table 3, the first principal component reflects the impact of coke production on coal price.

The second principal component reflects the impact of natural gas production on coal prices. The third principal component mainly reflects the influence of thermal power generation on coal price. The fourth principal component mainly reflects the impact of state-owned coal import and export on coal prices; The fifth principal component mainly reflects the impact of coal consumption and storage ratio on coal price. The sixth principal component mainly reflects the influence of the current value of kerosene output on the coal price. The seventh principal component mainly reflects the impact of energy consumption patterns on coal prices.

4. COAL PRICE PREDICTION BASED ON NEURAL NETWORK ALGORITHM

4.1 Model Principle

Step 1: the number of layers of the network.

This actually gives a basic principle for designing BP neural network. Given the training set $D = \{(x_1, y_1), (x_2, y_2), \dots, (x_m, y_m)\}$, $x_i \in R^d$, $y_i \in R^d$

Step 2: Number of neurons in the hidden layer.

The improvement of network training accuracy can be achieved by using a hidden layer to increase the number of neurons. This is much simpler to implement in terms of structure than adding more hidden layers [8].

Table 3 Average daily coal price on April 10, 2020 (yuan/ton)

date	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10
price	532.5	529.29	526.08	522.87	519.66	516.45	513.24	510

Assuming that the coal price from April 10, 2020 to April 17, 2020 is a linear regression model, the daily data changes of coal prices in Table 4 are obtained.

Table 4 Average daily coal price on April 17, 2020 (yuan/ton)

date	4.10	4.11	4.12	4.13	4.14	4.15	4.16	4.17
price	510	507.5	505	502.5	500	497.5	495	492.5

$$y = f(w_1x_1 + w_2x_2 - \theta)$$

Step 3: select the initial weight.

Because the system is nonlinear, the selection of initial values has a great influence on whether the learning can reach a local minimum, whether it can converge, and the length of training time.

Step 4: learning rate.

The learning rate determines the weight change per cycle. In general, a smaller learning rate is preferred to ensure the stability of the system.

Step 5: selection of expected error.

In the process of network training, the expected error value should also be determined by comparing the training to an appropriate value. The so-called "fit" is determined relative to the number of nodes of the required hidden layer, because the small expected error is obtained by increasing the node of the hidden layer and the training time.

4.2 Problem Analysis

Since the data are at least weekly intervals [9], this paper assumes that the coal price in each week is a linear model, and USES the interpolation method to perform data interpolation in units of days to calculate the coal price in each day from April 3 to April 30, 2020. Assuming that the coal price from April 3, 2020 to April 10, 2020 is a linear regression model, we can get:

$$y = -3.21x + 535.71$$

Where, y represents the price of coal and x represents the time. Therefore, the daily data changes of coal prices in Table 3 are obtained.

$$y = -2.5x + 512.5$$

Assuming that the coal price from April 17, 2020 to April 24, 2020 is a linear regression model, we can get:

$$y = -1.79x + 494.29$$

The daily data changes of coal prices in Table 5 are obtained.

Table 5 Average daily coal price on April 24, 2020 (yuan/ton)

date	4.17	4.18	4.19	4.20	4.21	4.22	4.23	4.24
price	492.5	490.71	488.92	487.13	485.34	483.55	481.76	480

Assuming that the coal price from April 24, 2020 to April 30, 2020 is a linear regression model, we can get:

$$y = -0.71x + 480.71$$

The daily data changes of coal prices in Table 6 are obtained.

Table 6 Average daily coal price on April 30, 2020 (yuan/ton)

date	4.24	4.25	4.26	4.27	4.28	4.29	4.30
price	480	479.29	478.58	477.87	477.16	476.45	475

The daily coal price from April 3, 2020 to April 30, 2020 solstice is obtained, and the prediction is made

by using the neural network model. The results are shown in Figure 2.

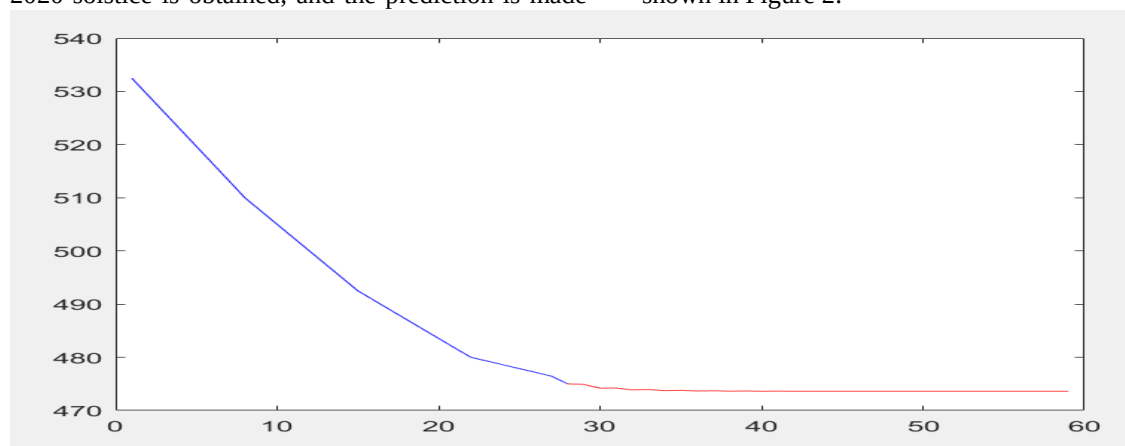


Figure 2 Coal price forecast for the next 31 days

Therefore, the price change table of may in Table 7 is obtained after linear regression method is adopted for

daily changes in coal price

Table 7 Prediction results

May, 2020			
day	Forecast price (yuan/ton)	day	Forecast price (yuan/ton)
On May 1	474.4	On May 17	461.6
On May 2	473.6	On May 18	460.8
On May 3	472.8	On May 19	460.0
On May 4	472.0	On May 20	459.2
On May 5	471.2	On May 21	458.4
On May 6	470.4	On May 22	457.6
On May 7	469.6	On May 23	456.8
On May 8	468.8	On May 24	456.0
On May 9	468.0	On May 25	455.2
On May 10	467.2	On May 26	454.4
On May 11	466.4	On May 27	453.6
On May 12	465.6	On May 28	452.8
On May 13	464.8	On May 29	452.0
On May 14	464.0	On May 30	451.2
On May 15	463.2	On May 31	450.4
On May 16	462.4		

5. CONCLUSIONS AND SUGGESTIONS

In light of this outbreak, since late march, China's epidemic prevention and control work has been positive, and work and production have resumed throughout the country [10]. On the other hand, the global economy will be further impacted by the

spread of the epidemic in foreign markets. China's major international importers of coal, such as Japan, Western Europe and South Korea, are suffering from severe covid-19, which has reduced the consumption of coal while reducing the level of economic activity. Major international coal exporters, such as Australia,

Russia and Indonesia, are experiencing relatively mild covid-19 and relatively low coal supply shock. Therefore, on the international market, coal exports are facing greater pressure from reduced demand and falling prices [11]. There are risks in international import, and the domestic coal supply exceeds the demand. The government can properly control the import of coal in a special period to ensure the stability of the domestic market.

Since coal and oil are energy substitutes for each other, according to the principle that the price of substitute products falls with each other, the oil price drops sharply, which will inevitably lead to a substantial reduction in coal demand, which in turn drives down coal prices. Due to the time-lag effect of changes in coal price and oil price, which is usually 3-6 months behind, according to the economic principle, domestic coal price will follow the international crude oil price, and the fall of international oil price will inevitably contain the fall of domestic coal price. Therefore, the current low oil prices on coal prices will gradually appear. The rapid decline of international oil prices has brought a certain impact to China's coal industry. As a strategic supplement to crude oil, coal-to-oil projects bear the brunt and have been severely tested in the wave of crude oil price decline. Therefore, when the price of coal rises and the price of its substitutes falls, the government can take relevant measures to encourage enterprises to use coal substitutes [12].

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and

acjyyb2018006).

REFERENCE

- [1] X. Chao, Prediction and empirical study of thermal coal price based on arima combination model, *China coal*, 2017, 43(11): 20-24.
- [2] J. M. Zhu, Analysis and forecast of factors influencing China coal price, *China coal*, 2017, 43(11): 20-24.
- [3] J. X. Dong, and H. Zhang, Grey prediction of coal market price, *Journal of Natural Science*, Harbin Normal University, 2005, 02: 20-21.
- [4] J. Lin, Z. Y. Ma, and H. H. Wang, Carbon emission trading price prediction based on grey b-p neural network, *Journal of Hebei University Of Environmental Engineering*, 2020, 30(01): 27-32+41.
- [5] B. Liu and D. Y. Gong, Coal market analysis and forecast for the first half of 2019, *Coal Economy Research*, 2019, 39(07): 29-33.
- [6] L. D. Chang and Z. J. Liang, Coal cost prediction based on BP neural network, *Coal Technology*, 2013, 38(04): 180-182. (in Chinese)
- [7] J. Fu, Research on thermal coal price prediction based on exponential smoothing method, *Coal Economy Research*, 2008, 38(07): 6-12.
- [8] L. L. Liang, Research on influencing factors and prediction of coal price based on BP neural network, *Xi 'an University of Science And Technology*, 2015.
- [9] H. Wang, Research on eu carbon emission permit price based on grey theory, *Harbin Institute of Technology*, 2014.
- [10] X. Qing, T. Peng, and Z. Cheng, Research on coal price prediction in Qinhuangdao -- based on factor analysis and support vector machine model, *Price Theory and Practice*, 2014, (02): 79-81.
- [11] G. Y. Yang and J. M. Zhu, Evaluation and analysis of excellent papers in mathematical modeling contest, *University of Science and Technology of China Press Hefei*, 2013.
- [12] S. K. Si and X. J. Sun, Mathematical modeling algorithm and application, *National Defense Industry Press Beijing*, 2015.

Comparison of Prediction of Time Series Data by Stepwise Regression and Holt Linear Trend

Zhi-Yong Qian¹, Jia-Ming Zhu^{1,*}, Cheng-Yu Hu², Chun-Li Wang³

¹School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

²School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

³Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: The prediction accuracy of multivariate regression and Holt linear trend method in time series data is compared, and the two methods are improved. Taking Beijing GDP as an example, the stepwise regression method is first used to screen the indexes that affect Beijing GDP, and the multivariate linear regression equation is established. Secondly, according to the GDP time series data of Beijing for 40 years, the linear trend fitting model of Beijing is constructed, and the GDP values of Beijing for the next five years are predicted in the short term. Finally, the two models are simulated in samples, and the results show that Holt linear trend is better than stepwise regression fitting, and the accuracy is higher. The model is improved by error analysis, and the prediction results have certain reference value for the Beijing Municipal Government to formulate the future economic policy.

Keywords: Time series; Stepwise regression; Holt linear trends; Predictive comparison

1. INTRODUCTION

Regression analysis is one of the commonly used models in the field of multivariate statistics. There are many explanatory variables which are not significant to the dependent variables in the multivariate regression model. When the independent variables are large, the precision of the equation is very important [1]. In the current common methods, the forward method can not reflect the change of the new variable, and the backward method can not reflect the change of the remaining variable after removing the variable, but the stepwise regression method combines the two

methods to consider the influence of the introduction of the variable on the remaining variable, so as to improve the accuracy of the equation. Holt linear trend is one of the commonly used prediction methods in the field of time series [2]. According to the correlation degree of time series itself, considering the influence of short-term fluctuation, horizontal trend and seasonal factors, the time series is smoothed by smoothing method, so as to extract the influence factors of each part and make the fitting prediction of the sequence. At present, there are many applied studies on multiple regression models, but the prediction of Beijing GDP is relatively small, and most scholars use the method of grey prediction, the prediction results are subjective, the data used are less, and the accuracy is low. Therefore, this paper takes the GDP sequence of Beijing for 40 years as an example, using stepwise regression and Holt linear trend to fit the prediction, respectively, to explore the difference in prediction accuracy and make improvements. The prediction results can be used as a reference for government departments to formulate economic policies and construction plans.

2. SELECTION OF INDICATORS

According to the existing research results, and combined with the data about Beijing in the National Bureau of Statistics, this paper selects six indexes of Beijing's total social commodity retail sales, local public budget expenditure and total import and export of goods from three aspects of residents' consumption, government investment and import and export trade as explanatory variables, as shown in the Table 1.

Table 1 Indicator variables affecting Beijing GDP

Model	Level I indicators	Level II indicators	Symbol notation
Forecast of Beijing GDP Based on Stepwise Regression	Consumer consumption	Total by year	X_1
		Average wage for employed workers	X_2
		Total retail sales of social goods	X_3
	Government investment	Local public budget expenditure	X_4
		Year-end balance of urban and rural savings	X_5
	Import and export trade	Total imports and exports of goods	X_6

3. DATA SOURCES AND PREPROCESSING

According to the annual data of population and local fiscal expenditure at the end of *GDP*, in Beijing, the time span is from 1978 to 2017. Due to the difference of each index in order of magnitude and dimension, the data need to be standardized pre-processed [3]:

$$X_i^* = \frac{X_i - E(X_i)}{\sqrt{D(X_i)}} \quad i = 1, 2, 3, \dots, n$$

X_i^* , $E(X_i)$, $D(X_i)$ Among them is the standardized index, the mean of the i index, and the variance of the i index [4].

4. A STUDY ON BEIJING GDP BASED ON STEPWISE REGRESSION METHOD

4.1 Theoretical Basis

A stepwise regression method is an excellent element selection method in multivariate regression analysis. According to the idea of input and output, the variables are first introduced one by one [5]. After each explanatory variable is introduced, the previously selected variables are tested F. If the previously introduced explanatory variables do not pass the test because of the introduction of subsequent variables, the original variables are eliminated when they are no longer significant [6]. The whole process goes back and forth until no significant variables are introduced or eliminated. The regression equation thus obtained ensures that the final regression subset is the optimal regression subset. By stepwise regression, we can screen out the important indexes that affect the prediction of Beijing *GDP*, and then get more accurate regression equation.

4.2 Research Methods and Ideas

A stepwise regression model is based on multiple linear regression models. Let the linear regression relationship between the y of the explained variables and the explained variables be as follows: $x_1, x_2, \dots, x_p$.

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p + \varepsilon$
 $\beta_0, \beta_1, \dots, \beta_p, x_1, x_2, \dots, x_p$ The formula is $p+1$ unknown parameter, Y is the explained variable, it is

the uncontrollable random variable, is the explanatory variable, is the general variable which can be accurately measured and controlled. Assuming that the random error satisfies:

$$\begin{cases} E(\varepsilon_i) = 0, i = 1, 2, \dots, n \\ cov(\varepsilon_i, \varepsilon_j) = \begin{cases} \sigma^2, i = j \\ 0, i \neq j \end{cases} \end{cases}$$

And

$$\begin{cases} \varepsilon \sim N(0, \sigma^2), i = 1, 2, 3, \dots, n \\ \varepsilon_1, \varepsilon_2, \varepsilon_3, \dots, \varepsilon_n, \text{Independent} \end{cases}$$

As for the solution of the model, we can use the OLS method to estimate the parameters:

$$Q(\hat{\beta}_0, \hat{\beta}_1, \dots, \hat{\beta}_p) = \min \sum_{i=1}^n (y_i - \beta_0 - \beta_1 x_{i1} - \beta_2 x_{i2} - \dots - \beta_p x_{ip})^2$$

$$\begin{cases} \frac{\partial Q}{\partial \beta_0} = -2 \sum_{i=1}^n (y_i - \beta_0 - \beta_1 x_{i1} - \beta_2 x_{i2} - \dots - \beta_p x_{ip}) = 0 \\ \frac{\partial Q}{\partial \beta_1} = -2 \sum_{i=1}^n (x_{i1} y_i - \beta_0 x_{i1} - \beta_1 x_{i1}^2 - \beta_2 x_{i1} x_{i2} - \dots - \beta_p x_{i1} x_{ip}) = 0 \\ \vdots \\ \frac{\partial Q}{\partial \beta_p} = -2 \sum_{i=1}^n (x_{ip} y_i - \beta_0 x_{ip} - \beta_1 x_{i1} x_{ip} - \beta_2 x_{i2} x_{ip} - \dots - \beta_p x_{ip}^2) = 0 \end{cases}$$

A multivariate linear regression model can be solved by importing relevant data into SPSS software.

4.3 Results Analysis

4.3.1 Normal test and correlation coefficient

Before regression fitting the data, we should first test whether the data obey the normal distribution, and the normality test of the data can be realized by using SPSS software. The test results show that the P value of each index is less than 0.05 of the significant level, so it is considered that the data obey the normal distribution and can be fitted by multiple linear regression [7]. The software also outputs the correlation coefficients between the indicators [8], as detailed in Table 2

Table 2 Pearson correlation coefficient between indicators

Pearson correlation coefficient	Y	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆
Y	1.000	0.832	0.881	0.976	0.993	0.891	0.861
X ₁	0.832	1.000	0.900	0.897	0.851	0.897	0.867
X ₂	0.881	0.900	1.000	0.998	0.690	0.995	0.931
X ₃	0.976	0.897	0.998	1.000	0.989	0.998	0.840
X ₄	0.993	0.851	0.690	0.989	1.000	0.782	0.889
X ₅	0.891	0.897	0.995	0.998	0.782	1.000	0.952
X ₆	0.861	0.867	0.931	0.840	0.889	0.952	1.000

From table 2, we can clearly see the correlation between the explanatory variables. When the number of samples is too large, it will lead to the correlation coefficient tends to 1, resulting in errors. While the number of samples selected in this paper is 40, the error is small, and the side shows that there is a strong correlation between the indicators. At this time, the

fitted multivariate linear regression model will produce an endogenous problem, that is, multiple collinearity, which will have a certain impact on the equation. So the stepwise regression method can avoid the interference of collinearity.

4.3.2 Variable screening

Software output results show that the first step of

stepwise regression introduces the local general public expenditure with the highest correlation with regional gross domestic product. from table 2, it can be seen that the correlation coefficient is as high as 0.993, which indicates that the government's financial input has a strong correlation to the local *GDP* growth. The second step introduces the average wages of the employed workers who are in the third place in the correlation with *GDP* [9], rather than the second in the total retail sales of social goods, because the total retail sales of social goods and the local general expenditure budget correlation coefficient is as high as 0.989, and the contribution to the *GDP* of the explained variable area is more overlapping, so it is not selected [10]. The average wage in the post and the local public expenditure budget correlation coefficient is only 0.690, the contribution to *GDP*

Table 3 Multiple linear regression results of Beijing *GDP*

Model variables	Regression coefficient	T statistics	P significant	ANOVA inspection	Adjusted R party
Constant term	28.318	0.700	0.488	2737.66	0.993
Gross retail sales of social goods (X_3)	1.413	37.261	0.000		
General local public budget expenditure (X_4)	0.002	3.892	0.000		

Combined with Table 3, the results of the multiple regression model of Beijing *GDP* are as follows:

$$y = 28.318 + 1.413x_3 + 0.002x_4$$

Analysis of the output results shows that the partial regression coefficient of the total retail sales of social goods is 1.413, which means that every unit of consumption of the whole social goods will lead to an average increase of 1.413 units in the *GDP* of Beijing. Adjusted R is 0.993, and the regression equation reduces the volatility of the explained variable by

does not overlap, so in the second step selected. The third step is to introduce the more relevant total retail sales of social goods, so continue. Each step of the introduction or elimination of variables to carry out a significant test of variables, non-significant variables may have information overlap with other variables, and finally selected the local general public budget expenditure and total retail sales of social goods as explanatory variables [11].

4.3.3 Parameter estimation and error analysis

Taking the local general public budget expenditure and the total retail sales of social commodities as the explanatory variables and the Beijing district *GDP* as the explanatory variables, the regression equation is estimated by using the *OLS* method. The model results of the software output are shown in Table 3.

99.3% in relative terms; in absolute terms, the standard deviation of *GDP* decreases from 2462.57 before regression to 207.14 after regression. ANOVA variance analysis results are much larger than the critical value, and the significance test values of each parameter tend to 0, which indicates that the equation fits the information to a higher degree, and the linear regression is more significant. Plot the residual sequence as shown in Figure 1.

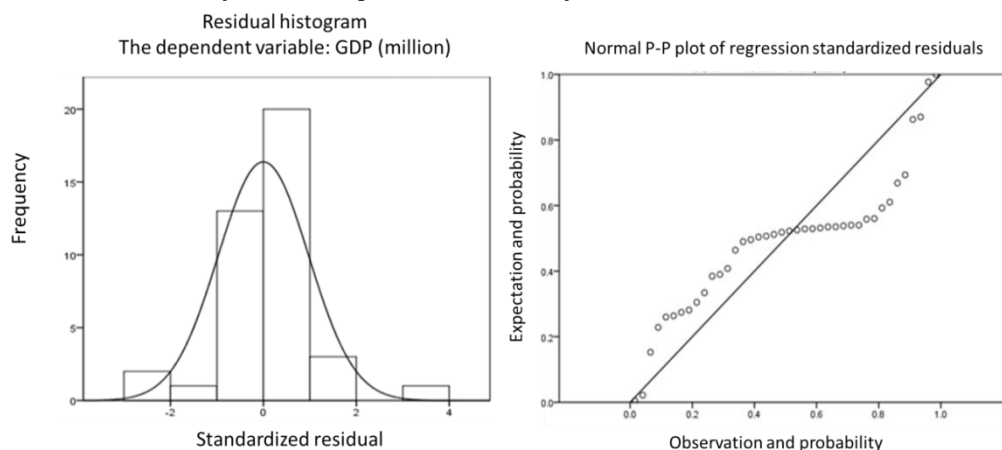


Figure 1 Histogram of residuals and P-P of model

From the residual histogram, it can be clearly seen that the residual sequence density function is approximately normal distribution, while the *P-P* diagram shows that the residual sequence is roughly distributed on both sides of the straight line and approximately normal distribution. This further shows that the fitting degree of the equation is better.

5. PREDICTION OF BEIJING *GDP* BASED ON

HOLT LINEAR TREND

5.1 Theoretical Basis

Holt linear trend is based on the exponential smoothing method, which is one of the common methods of trend analysis and prediction in the field of time series [12]. According to the characteristics of the sequence itself, exponential smoothing uses the smoothing technique to eliminate the influence of

short-term fluctuations, thus showing some trend law of the sequence [13]. The traditional moving average method thinks that the effect of the long-term observation value of the event on the recent trend value is consistent, while the exponential smoothing thinks that the short-term result has more influence, the long-term result has less influence, and the influence degree decreases exponentially with the increase of time. Holt the linear trend is based on the idea of exponential smoothing, the short-term fluctuation, trend factors and seasonal influence are considered synthetically, so that the sequence can be accurately predicted and analyzed [14].

5.2 Research Methods and Ideas

This paper uses the annual data of Beijing GDP from 1978 to 2017, and the data show that there is no serious periodic fluctuation effect. Therefore, this paper chooses to use Holt two-parameter exponential smoothing method to predict the GDP sequence of Beijing. The smoothing formula is:

$$\begin{cases} \alpha x_t + (1 - \alpha)(\tilde{x}_{t-1} + r_{t-1}) \\ r_t = \beta(\tilde{x}_t - \tilde{x}_{t-1}) + (1 - \beta)r_{t-1} \end{cases}$$

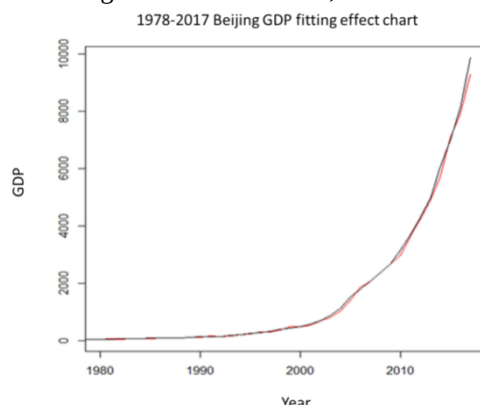
α, β in the formula, both smoothing coefficients are satisfied. $0 < \alpha, \beta < 1$, $\tilde{X}_t, X_t, r_t$ for the t period of the sequence of observations, for the t period of the sequence of estimates, for the sequence of the t period of the correction value, for the t period of value added or reduced value[15]. Let the last period of correction be equal, then using Holt two-parameter exponential smoothing method, the prediction results of the l period of the sequence are as follows: $\tilde{X}_T$

$$\tilde{X}_T = \tilde{X}_T + l \cdot r_T$$

The data is imported into R software, and the fitting of two parameter trends can be realized by using the HoltWinters function.

5.3 Results Analysis

Using R software to make the fitting command to the GDP data of Beijing from 1978 to 2017, the fitting effect diagram can be obtained, as shown in Figure 2.



2Figure 2 Holt The fitting effect of two parameter exponential smoothing on Beijing GDP

Figure 2 shows the GDP fitting effect diagram of Beijing for 40 years. The α and β are approximately 1, where the red line is the Holt linear trend fitting and the black line is the observed value. It can be found

that the two curves almost completely coincide, indicating that the fitting effect of the model is excellent [16]. The formula for fitting is:

$$\tilde{X}_T(l) = 9846.81 + 1729.03l$$

Using the Holt two-parameter exponential smoothing method to predict the trend of the next five years GDP in Beijing, the forecast results are summarized in Table 4.

4Table 4 Beijing GDP projections, 2018-2022

Year	GDP Forecast (Billions)
2018	11575.84
2019	13304.87
2020	15033.90
2021	16762.93
2022	18491.96

From the forecast results, it can be seen that if there is no other impact, the GDP of Beijing will grow steadily at a rate of 15% every year, and the forecast value of Beijing will reach 184.92 billion yuan by 2022. Therefore, the Beijing Municipal Government should make reasonable planning according to the expected growth rate, formulate relevant economic policies, and avoid the unhealthy development caused by economic overheating [17].

6. SUMMARY

Based on the GDP data from 1978 to 2017 in Beijing, Using SPSS, R software, a multivariate linear model based on stepwise regression and a Holt linear trend model are constructed. To compare their prediction accuracy on time series data, and a short-term forecast GDP the future value of Beijing, the prediction results have certain reference value. As opposed to the existing G M (1, 1) forecasts [18], Multivariate linear regression models remove irrelevant and collinear factors. To improve the accuracy of the model, And Holt linear trends remove the effects of short-term fluctuations by exponential smoothing, and then better fit the trend of the curve. But the two methods also have some defects:

I Holt the linear trend method may lose some data information by using the trimming technology, and not suitable for sequences with less sample size and sensitive to periodic changes.

II Multivariate regression models need to artificially set explanatory variables, which may leave out some significant variables, resulting in heteroscedasticity or autocorrelation of random error terms [19], that is, endogeneity problem, and low prediction accuracy. at this time, we can incorporate the weighted least square method to eliminate heteroscedasticity, or Box-Cox transform the data to eliminate the autocorrelation of variables, which makes the improved model more effective. On the whole, there is little difference between them in the short-term prediction accuracy of time series data, and there is some difference in the long-term [20]. Therefore, in order to predict the future data reasonably and accurately, the model must be improved and optimized according to the different data, so that it

can be better applied to the solution of practical problems.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No. 19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

- [1]Y. F. Gu, Z. D. Bao, Y. B. Lin, et al., The porosity and permeability prediction methods for carbonate reservoirs with extremely limited logging data: Stepwise regression vs. N-way analysis of variance, 2017, 42: 99-119;
- [2]A. Vijayakumar, Comparative study of Linear Trend Regression, Holt and Winter Models, with Application to Production of Indian Automobiles, 2010, 6(2): 36-47.
- [2]G. Nimmo, A. Pandey, C. Marshall, et al., Profound hypotonia, muscle weakness, global developmental delays with stepwise regression, and cerebellar atrophy: expansion of the LONP1 -related disease phenotype, 2017, 27: S117-S118.
- [3]R. J. Thomas and S. Peethamparan, Stepwise regression modeling for compressive strength of alkali-activated concrete, 2017.
- [4]S. Abraham, M. Raisee, G. Ghorbaniasl, et al., A robust and efficient stepwise regression method for building sparse polynomial chaos expansions, 2017, 332: 461-474.
- [5]R. Silhavy, P. Silhavy, and Z. Prokopova, Analysis and selection of a regression model for the Use Case Points method using a stepwise approach, 2017, 125: 1-14.
- [6]G. Nimmo, A. Pandey, C. Marshall, et al., Profound hypotonia, muscle weakness, global developmental delays with stepwise regression, and cerebellar atrophy: expansion of the LONP1 -related disease phenotype, 2017, 27: S117-S118.
- [7]Z. Li, J. M. Rose, and D. A. Hensher, Forecasting automobile petrol demand in Australia: An evaluation of empirical models, 2009, 44(1): 16-38.
- [8]A. C. L. Antunes and D. Jensen, Comparison of time-series models for monitoring temporal trends in endemic diseases sero-prevalence: lessons from porcine reproductive and respiratory syndrome in Danish swine herds, 2019, 15(1): 1-8.
- [9]R. J. Hyndman, M. L. King, I. Pitrun, et al., LOCAL LINEAR FORECASTS USING CUBIC SMOOTHING SPLINES, 2005, 47(1): 87-99.
- [10]A. L. DrPH, Using forecast modelling to evaluate treatment effects in single-group interrupted time series analysis, 2018, 24(4): 695-700.
- [11]D. Shi, C. Quek, R. Tilani, et al., Product Demand Forecasting with a Novel Fuzzy CMAC, 2007, 25(1): 63-78.
- [12]E. Vercher, A. Corberán-Vallet, J. V. Segura, et al., Initial conditions estimation for improving forecast accuracy in exponential smoothing, 2012, 20(2): 517-533.
- [13]H. Liang, Z. Guo, J. Wu, et al., GDP spatialization in Ningbo City based on NPP/VIIRS night-time light and auxiliary data using random forest regression, 2020, 65(1): 481-493.
- [14]B. Mahalingam and W. H. Orman, GDP and energy consumption: A panel analysis of the US, 2018, 213: 208-218.
- [15]G. A. Oladosu, P. N. Leiby, D. C. Bowman, et al., Impacts of oil price shocks on the United States economy: A meta-analysis of the oil price elasticity of GDP for net oil-importing economies, 2018, 115: 523-544.
- [16]K. Kunanuntakij, V. Varabuntoonvit, N. Vorayos, et al., Thailand Green GDP assessment based on environmentally extended input-output model, 2017, 167: 970-977.
- [17]S. Kumar and P. K. Muhuri, A novel GDP prediction technique based on transfer learning using CO 2 emission dataset, 2019, 253.
- [18]M. A. Williams, G. Baek, Y. Li, et al., Global evidence on the distribution of GDP growth rates, 2017, 468: 750-758.
- [19]Y. J. Zhang, N. Guo, C. C. Rong, et al., Effects of different TMS and TMG flow rate on the content of elements in the fabrication of GDP target, 2019, 450: 342-346.
- [20]O. E. Malay, Do Beyond GDP indicators initiated by powerful stakeholders have a transformative potential, 2019, 162: 100-107.

Evaluation of Sustainable Development in Anhui Province by TOPSIS-DEA Method Based on Entropy Weight Improvement

Jia-Ming Zhu¹, Na Sun², Meng Zhu, Ying-Ling Liu^{4*}

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

² School of Finance, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

³ Bengbu Zhongguang Technology Co., Ltd., Bengbu, Anhui, 233000, China

⁴ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: To evaluate the status of sustainable development in Anhui Province from 2008 to 2017, first introduce "Government fiscal revenue to GDP", "Government environmental protection investment to GDP", "Internal expenditure on R & D funds", and "Per capita GDP" "Environmental Quality of Anhui Province" as the evaluation index; Secondly, for "Environmental Quality of Anhui Province", the TOPSIS method improved by entropy weight is used to evaluate it, and the comprehensive evaluation value after the evaluation is used as the corresponding value of the indicator. Further analysis; finally, the CR2 model of DEA was used to evaluate the sustainable development status of Anhui Province, and analysis was made for the invalid years of DEA to make relevant suggestions.

Keywords: Sustainable development; Evaluation; Entropy weight; TOPSIS; DEA; Anhui province

1. INTRODUCTION

With the continuous development of the economy, the industrial industry is becoming more and more harmful to the environmental status. How to protect the ecological environment while meeting the needs of economic development has become very important, and the concept of sustainable development was born. Since the concept of sustainable development was formally proposed in the 1980s, it has aroused great attention from all countries in the world. In the report of the 19th National Congress of the Communist Party of China, the strategy of sustainable development, the strategy of rejuvenating the country through science and education, and the strategy of strengthening the country with talents, etc. were listed as strategies for China to establish a well-off society in an all-round way. Regional sustainable development limits the scope of sustainable development to a certain area. It is a new development strategy and concept. It emphasizes that in the process of regional economic development, all resources must be used rationally and environmental protection is emphasized. Harmonious symbiosis and regional sustainable development. Carrying out a sustainable development evaluation of a specific area

is helpful to determine whether the development of the area is sustainable. It is helpful for relevant departments to formulate relevant policies and measures for the development status of the area. action". Anhui Province is the rising star of the Yangtze River Delta Economic Zone in recent years. As a part of the Wanjiang urban belt, it will be one of the key areas for expanding domestic consumption and investment markets and initiating internal demand. Its sustainable development is of great significance.

2. LITERATURE REVIEW

Since the concept of sustainable development was proposed, many domestic scholars have conducted research on different levels such as "sustainable development connotation, sustainable development model, regional sustainable development evaluation, and application of sustainable development in different fields". Meng [1] pointed out that the sustainable development strategy, as a far-reaching development goal jointly determined by the heads of the United Nations, has taken gratifying steps in poverty eradication, economic and environmental coordination after entering the new century; Li [2] believes that the rapid development of the county economy in China also has problems such as ecological degradation and excessive consumption of resources. Based on the theory of regional economics, he explored its sustainable development assessment method using the ecological footprint method; Hu [3], Liu [4], Zhang [5], and Chen [6] respectively analyzed the sustainable development of basalt fiber industry, agro-ecological economy, and folk music art, and then they proposed the sustainability of the corresponding research object Development proposals. Regarding the relevant sustainable development status of Anhui Province, Wang [7] analyzed the external environment and the development constraints of the development of equity funds in Anhui Province, pointed out that there are still certain restrictions on the sustainable development of equity funds in Anhui Province, and proposed a rationalization for this Suggest; Wang [8] starting from the application of sustainable

development in cultural education, researched on the sustainable development countermeasures of the Anhui Province Farmer's Bookstore Project. For the evaluation of sustainable development in Anhui Province, many scholars are evaluating a specific sustainable development project: Tang [9] firstly used principal component analysis and cluster analysis to classify the experimental areas in Anhui Province, and found the similarities and differences of the same type of experimental areas. Then he provided reference basis for decision-making for the sustainable development practice of Anhui Experimental Zone; Yang [10] based on the RAGA projection pursuit model, combined with the development characteristics of the construction industry in Anhui Province, built an index evaluation system to evaluate the sustainable development level of Anhui Province and its central regions and other provinces and cities. Looking at the above-mentioned documents, many domestic scholars combined with China's development status, based on different perspectives of sustainable development research has certain guiding significance for the sustainable development of China and different projects. However, these scholars have less theoretical research on the sustainable development of Anhui Province and less evaluation of the overall development status of Anhui Province. This article evaluates the sustainable development status of Anhui Province from 2008 to 2017. Our specific approach is: First add evaluation indicators to build an index evaluation system, then use the TOPSIS method with improved

entropy weight to evaluate the environmental quality of Anhui Province, and use the comprehensive evaluation value after evaluation as the corresponding value of the index for further analysis. Finally, we use DEA's CR2 to evaluate the sustainable development of Anhui Province. To a certain extent, this article enriches Anhui Province's comprehensive sustainable development assessment theory and has a certain reference significance for Anhui's future sustainable development practice.

3. CONSTRUCTION OF DEA SUSTAINABLE DEVELOPMENT EVALUATION INDEX SYSTEM

3.1 Index Selection and Evaluation System Construction

The DEA method is a systematic analysis method for evaluating the relative effectiveness or benefit of decision-making units based on multiple input and output angles. Its basic idea originates from the research of productivity by Farrell [11-13]. In order to evaluate the sustainable development of Anhui Province, we selected the annual sustainable development system of Anhui Province from 2008 to 2017 as each DEA decision-making unit, which has specific inputs and outputs. The selection of input and output indicators follows the principles of "systematic, scientific, typical, dynamic and operable", combined with the contents of sustainable development in the economic, ecological and social aspects, we select 5 input / output indicators to build an evaluation index system for sustainable development in Anhui Province, as shown in Figure 1.

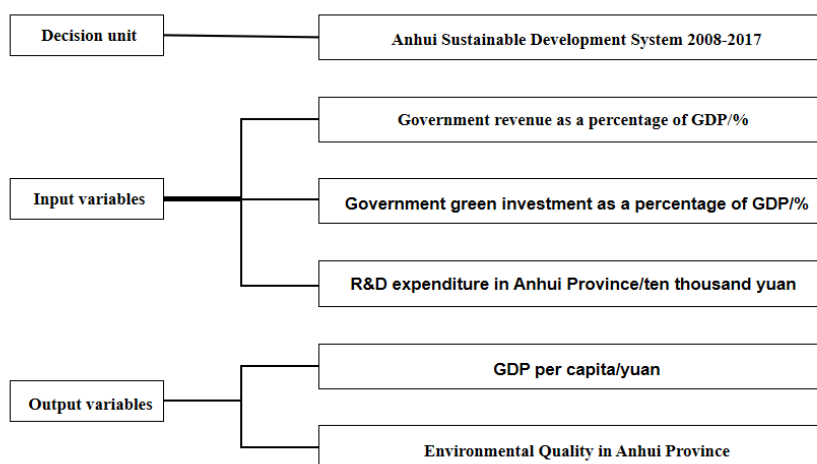


Figure 1 Anhui province sustainable development evaluation index system

3.2 Significance of Index Selection

3.2.1 Input variables

(1) The ratio of government revenue to GDP: This indicator represents the economic investment of Anhui Province to achieve sustainable development from an economic perspective. Assuming that GDP and government fiscal revenue-expenditure ratios are constant, the more government fiscal revenue, the greater the amount of economic investment they have to maintain sustainable development. Since the

annual fiscal revenue index is absolute, its proportion to GDP is selected as the input index variable;

(2) Government environmental protection investment as a proportion of GDP: This indicator represents the investment of the Anhui Provincial Government to achieve sustainable development of the ecological environment from the perspective of ecological environment. In the case of a certain GDP, the greater the government's environmental protection investment, the greater their support for the

development of the ecological environment, the more beneficial to the sustainable development of Anhui Province;

(3) Internal expenditure of R & D funds in Anhui Province: R & D expenditure refers to various expenses incurred by enterprises in the research and development of products, processes, materials, technologies, standards, etc. The internal expenditure of R & D funds in Anhui Province represents the social development of Anhui Province. Various expenses incurred during the process, the greater the amount of this indicator, the greater the investment in research and development of products and technologies in Anhui Province, the more it supports social development, and the more it is beneficial to the sustainable development of society.

3.2.2 Output variable

(1) GDP per capita: GDP per capita is the market value of output per capita in the economic activities of a country or region within a certain period of time, and represents the economic and social development level of a region. Under certain conditions, the higher the output level, the more beneficial it is for a region to achieve simultaneous development of scale and technology;

(2) Environmental quality status in Anhui Province: In the process of economic and social development, it is often accompanied by the deterioration of environmental quality status. Environmental quality status as a comprehensive indicator. When the

economic output status is certain, the better the environmental quality status, the better the sustainable development of a region. Therefore, Anhui environmental quality status can be used as an output indicator to measure whether it is sustainable development.

4. ANHUI PROVINCE ENVIRONMENTAL QUALITY ASSESSMENT

4.1 Data Selection and Processing

In the above index system, the environmental quality status of Anhui Province is a comprehensive index, neither quantitative data nor qualitative scores can be obtained directly. Therefore, we use the TOPSIS method with improved entropy weight to evaluate the environmental quality of Anhui Province, and use the comprehensive evaluation value after evaluation as the corresponding value of the index for further analysis. The TOPSIS method is a commonly used multi-objective or multi-attribute decision analysis method for finite schemes [14]. In traditional TOPSIS, the attribute weights are determined in advance, with strong subjectivity. TOPSIS with improved entropy weight uses entropy method to weight each attribute [15], which is relatively objective. Taking the years from 2008 to 2017 as the decision-making unit, and using the signs under the "Environmental Quality" indicator in the *Anhui Statistical Yearbook* as attributes, the evaluation data obtained after integration are shown in Table 1

Table 1 Anhui Province environmental quality assessment data

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
X1	30	28	27	28	28	29	26	22	21	17
X2	28	25	26	26	27	29	30	31	38	38
X3	82	77	81	80	79	99	95	80	77	88
X4	88.6	93.1	93.4	96.1	98.4	97.6	96.5	96.9	97	95.5
X5	54.8	54.7	54.1	53.6	53.4	53.9	53.7	54	53.6	54.1
X6	69.3	68.9	68.3	67.2	66.7	66.2	65.2	66.4	67.5	67.7

(X1 is the annual average concentration of sulfur dioxide ($\mu\text{g} / \text{m}^3$), X2 is the average annual concentration of nitrogen dioxide ($\mu\text{g} / \text{m}^3$), X3 is the annual average value of atmospheric particulate matter ($\mu\text{g} / \text{m}^3$), and X4 is the quality of drinking water Compliance rate (%), X5 is the average value of regional environmental noise (decibel (A)), and the average value of traffic trunk line noise (decibel (A))).

4.2 Research Methods

4.2.1 Find the normalized decision matrix

The decision-making unit is represented by i , and there are m decision-making units in total; the attributes are represented by the letter j , and there are n kinds. The correlation matrix of the multi-attribute decision problem in the article is as follows:

(1) For the benefit attribute, let the standardized matrix be:

$$\frac{a_{ij} - a_j^{\min}}{a_j^{\max} - a_j^{\min}} \quad (a_{ij} \text{ is the decision matrix})$$

(2) For cost attributes, let the standardized matrix be:

$$\frac{a_j^{\max} - a_{ij}}{a_j^{\max} - a_j^{\min}} \quad (a_{ij} \text{ is the decision matrix})$$

Among the above attributes, except that "drinking water source water quality compliance rate" is a benefit-type attribute, the other attributes are all cost-type attributes.

4.2.2 Weighting with entropy method [15]

(1) Calculate entropy weight w_j :

$$w_j = \frac{1 - H_j}{n - \sum_{j=1}^n H_j}$$

$$H_j = -\frac{1}{\ln n} \left(\sum_{i=1}^m f_{ij} \ln f_{ij} \right), i=1,2,\dots,m; j=1,2,\dots,n$$

$$f_{ij} = \frac{1+b_{ij}}{\sum_{j=1}^n (1+b_{ij})}.$$

(2) The weight of each evaluation index is obtained as:

$$W_j = (0.1370, 0.1734, 0.1810, 0.1825, 0.1692, 0.1569)$$

4.2.3 Construct a weighted canonical matrix

Let the weighted norm matrix $C = (c_{ij})_{m \times n}$, then

$$c_{ij} = w_j \cdot b_{ij}, i=1,2,\dots,m; j=1,2,\dots,n.$$

4.2.4 Determine positive and negative ideal solutions C^*, C^0

Positive ideal solution:

$$c_j^* = \max_i c_{ij} \quad (j \text{ is a benefit attribute}) \text{ or}$$

$$c_j^* = \min_i c_{ij} \quad (j \text{ is a cost attribute})$$

Negative ideal solution:

$$c_j^0 = \min_i c_{ij} \quad (j \text{ is a benefit attribute}) \text{ or}$$

$$c_j^0 = \max_i c_{ij} \quad (j \text{ is a cost attribute})$$

4.2.5 Calculate the relevant distance

The distance from the decision plan m_i to the positive ideal solution is:

$$s_i^* = \sqrt{\sum_{j=1}^n (c_{ij} - c_j^*)^2}, i=1,2,\dots,m;$$

The distance from the decision plan to the negative ideal solution is:

$$s_i^0 = \sqrt{\sum_{j=1}^n (c_{ij} - c_j^0)^2}, i=1,2,\dots,m.$$

4.2.6 Calculate the comprehensive evaluation value of each program

Comprehensive evaluation value:

$$z_i^* = s_i^0 / (s_i^0 + s_i^*), i=1,2,\dots,m.$$

Use MATLAB to find the distance and comprehensive evaluation value of each decision plan to the positive and negative ideal solutions as shown in Table 2.

Table 2 Distance value and comprehensive evaluation value

Decision unit	s_i^*	s_i^0	z_i^*	Decision unit	s_i^*	s_i^0	z_i^*
2008	0.2658	0.2744	0.5080	2013	0.2016	0.2912	0.5909
2009	0.2709	0.2553	0.4852	2014	0.2404	0.2415	0.5012
2010	0.2566	0.2039	0.4428	2015	0.2504	0.2026	0.4472
2011	0.2825	0.2004	0.4150	2016	0.2612	0.2542	0.4933
2012	0.2959	0.2259	0.4329	2017	0.2020	0.2666	0.5690

5. EVALUATION OF SUSTAINABLE DEVELOPMENT IN ANHUI PROVINCE BASED ON DEA

5.1 Research Ideas

Among the various models of DEA, model C²R has the characteristics of clear modeling ideas and simple form of theoretical improvement [12]. For the evaluation of sustainable development in Anhui Province, which is a multi-input and output evaluation, we finally choose the relatively effective C²R model as the research method. Combining the comprehensive evaluation value of the environmental quality status of Anhui Province and the *Anhui Statistical Yearbook*, we obtain the input and output index values of each decision-making unit.

5.2 Research Methods

There are N decision-making units ($N = 10$ in the article). Each decision unit has M inputs and S outputs, $x_{IJ}(I=1,\dots,M; J=1,\dots,N)$ represents the value of the I th input of the J th decision unit, $y_{RJ}(R=1,\dots,S; J=1,\dots,N)$ represents the value of the R th output of the J th decision unit, $u_I(I=1,\dots,M)$ represents the weight of the I -th input, and $v_R(R=1,\dots,S)$ represents the value of the R -th output. Let input and output vectors be $X_J, Y_J (J=1,\dots,N)$; input and output vectors are u and v , then

$$X_J = (x_{1J}, x_{2J}, \dots, x_{MJ})^T, Y_J = (y_{1J}, y_{2J}, \dots, y_{SJ})^T, v = (v_1, v_2, \dots, v_M)^T, u = (u_1, u_2, \dots, u_S)^T$$

Decision-making unit efficiency evaluation index:

$$\alpha_J^* = (v^T Y_J) / (u^T X_J), J=1,\dots,N.$$

The mathematical model for evaluating the efficiency J_0 of the decision-making unit is:

$$\max \frac{v^T Y_{J_0}}{u^T X_{J_0}},$$

$$\text{s.t.} \begin{cases} \frac{v^T Y_J}{u^T X_J} \leq 1, J=1,2,\dots,N, \\ v \geq 0, u \geq 0, v \neq 0, u \neq 0 \end{cases}$$

Through Charnes-Cooper transformation, let

$$\varepsilon = b^* u, \mu = b^* v, b^* = \frac{1}{u^T X_{J_0}}. \text{ Convert the above}$$

formula into an equivalent linear programming problem is as follows:

$$\max U_{J_0} = \mu^T Y_{J_0},$$

$$\text{s.t.} \begin{cases} \varepsilon^T X_J - \mu^T Y_J \geq 0, J=1,2,\dots,N \\ \varepsilon^T X_{J_0} = 1, \\ \varepsilon \geq 0, \mu \geq 0 \end{cases}$$

After introducing the relaxation variables s_i^+ and s_i^- , the dual form is as follows:

$$\begin{aligned} \min \theta, \\ s.t. \begin{cases} \sum_{j=1}^N \lambda_j X_j + s_i^+ = \theta X_{j_0}, \\ \sum_{j=1}^N \lambda_j Y_j + s_i^- = Y_{j_0}, \\ \lambda_j \geq 0, j = 1, 2, \dots, N \end{cases} \end{aligned}$$

It is the input model of C²R [16-17]. Assuming that its optimal target value is θ , after calculation and judgment, we get the results shown in Table 3.

Table 3 Relative evaluation results of sustainable development in Anhui Province

Decision unit	θ	Relative effectiveness	Scale effectiveness	Technical effectiveness	Sustainable development trajectory
2008	1	DEA is valid	Scale effective	Effective	On track
2009	0.9615715	DEA is invalid	Invalid scale	Invalid	Inferior to trajectory
2010	1	DEA is valid	Scale effective	Effective	On track
2011	1	DEA is valid	Scale effective	Effective	On track
2012	0.9837399	DEA is invalid	Invalid scale	Effective	Inferior to trajectory
2013	1	DEA is valid	Scale effective	Effective	On track
2014	1	DEA is valid	Scale effective	Effective	On track
2015	0.9707998	DEA is invalid	Invalid scale	Invalid	Inferior to trajectory
2016	1	DEA is valid	Scale effective	Effective	On track
2017	1	DEA is valid	Scale effective	Effective	On track

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

We first uses entropy weight improved TOPSIS method to evaluate the environmental quality of Anhui Province, and finds that the three indexes of annual concentration of nitrogen dioxide, annual mean of atmospheric respirable particulate matter and water quality of drinking water source contribute greatly to the comprehensive evaluation value. Secondly, using the evaluated comprehensive evaluation value as the corresponding value of the index, and using the DEA CR2 model to evaluate the sustainable development of Anhui Province, it can be seen that in 2008-2017, except 2009, 2012, 2015, the results of sustainable development in Anhui Province are DEA effective. Its technology and scale are effective and in place Based on the input-output status of these years, the results of the evaluation of the sustainable development status of Anhui Province in 2009, 2012 and 2015 are DEA invalid and the technology is invalid in most of these invalid years, indicating that the resource mix in these years is not optimal in input-output, and the relevant departments can introduce relevant policies to ensure the optimal use of resources and achieve the sustainable development of Anhui Province in combination with the input surplus or output deficiency. Further combined with DEA effective years, we found that among the input indexes of the year, the proportion of government revenue, the proportion of environmental protection investment and the expenditure of R&D funds are large, and the expenditure index can keep relatively consistent with it, which indicates that the investment of these resources has realized the scale and technology effectiveness utilization under the joint action of the government, relevant departments and related subjects; Based on the DEA invalid years,

it is found that the government's investment in environmental protection is not directly proportional to the government's revenue, and the ratio between the government's investment in environmental protection and the fiscal revenue is smaller. On the one hand, the reason why these years are not on the track of sustainable development is mainly due to the government's environmental protection Besides, for the output index, the comprehensive evaluation value of environmental quality condition in Anhui province is relatively small, that is, the environmental quality condition is poor, and the main cause of environmental quality condition in Anhui province is the large emission of nitrogen dioxide and atmospheric inhalable particles, and the serious pollution of water resources environment. In summary, it can be seen that the reason of non-sustainable development in Anhui Province is focused on the vulnerability of "environmental sustainable development".

6.2 Recommendations

In order to further enhance the possibility of sustainable development in Anhui Province, we put forward the following suggestions in the light of the above analysis:

(1) Increase investment in environmental protection. The sustainable development of environment is an important prerequisite for the sustainable development of a region. The government should increase the relative proportion of environmental protection investment and increase investment in environmental protection related departments and enterprises, environmental protection management, environmental protection facilities, environmental management research and research institutes and other environmental protection funds, which is the key to environmental governance. For the investment

of environmental protection departments and enterprises, the relevant government personnel should adhere to the principles of fairness, efficiency and incentive to prevent the emergence of "rent-seeking", resulting in inappropriate allocation of funds and resources and government failure. Investment should also ensure that the most basic environmental governance layer is adequately funded, on the one hand, these Funds can be used to purchase environmental management equipment, on the other hand, to ensure or even raise the wages of basic environmental management personnel is conducive to the recruitment of these personnel. In the era of big data, digitization, intelligence and other emerging technologies, the services these technologies can provide play an important role in environmental governance. According to Anhui Province, the government should focus on ensuring "annual concentration of nitrogen dioxide, annual mean of atmospheric respirable particulate matter, and drinking water quality up to the standard rate" of scientific research investment in environmental governance.

(2) Rational utilization of environmental protection resources. Environmental resources include a wide range of environmental funds and all available to improve environmental quality of the series of technologies, systems and so on. In order to make rational use of environmental protection resources, first of all, the relevant departments of environmental protection should make the use of environmental protection funds to achieve "utility maximization", that is, through the design of effective environmental protection programs, the overall planning of the use of environmental protection funds, so that a certain amount of funds through combination optimization to produce relative maximum utility or in the case of achieving a certain utility to minimize the use of funds. In addition, the use of funds in environmental protection departments should be open and transparent: on the one hand, environmental protection departments should improve internal control degree; on the other hand, attention should be paid to external forces for supervision. Secondly, the monitoring department should strengthen the monitoring of environmental quality in all regions, especially in areas with poor environmental quality for several consecutive years. They should pay attention to observing the trend of environmental change, and timely release the monitoring data with the help of online platforms such as the Internet, and make regular summary reports on environmental quality issues. When the environment changes, they can communication with government departments, at the same time, combined with the environmental quality of different cities and counties in Anhui Province to formulate corresponding policies, so as to achieve the scale and technical use of environmental protection resources.

(3) Multi-subjects participate in the construction of environmental protection. In addition to the active participation of the government and environmental protection departments, enterprises and residents should also participate in the construction of environmental protection. Enterprises and residents should always adhere to and spread the concept of "low carbon, economy, environmental protection", and the implementation of the concept of environmental protection into daily behavior. For residents, they can minimize the use of daily non-environmental items such as plastic bags, cars, shopping can be replaced by paper bags, cloth bags, etc., close travel can use walking, electric vehicles, bicycles instead of cars; in addition, residents can use creativity to transform the items," change from environmental protection to environmental protection "and through the Set up daily environmental protection goals to restrain and motivate individual behavior. For the non-environmental behavior of enterprises, even if it can bring short-term great benefits should be resolutely abandoned, from the balance of long-term and short-term benefits, to ensure the long-term operation and sustainable development of enterprises. The government should take active measures to encourage the environmental protection behavior of all social subjects and cooperate with the introduction of relevant laws and policies to ensure and restrain.

(4) Improve the relevant legal and policy systems. First of all, the relevant laws and policies on the investment and use of environmental protection funds should be perfected to ensure the rational and transparent use of environmental protection funds. Secondly, government departments should make relevant policies according to the environmental quality situation of each region, and strictly supervise the areas with relatively backward environmental quality situation. In addition, for the behavior of residents and enterprises, should introduce relevant policies to encourage their environmental behavior, environmental behavior to give a certain reward, non-environmental behavior to give corresponding punishment. Finally, the government should adapt to local conditions and formulate different environmental policies for different regions, especially in the annual concentration of nitrogen dioxide. The three aspects of the annual mean of atmospheric respirable particulate matter and the water quality of drinking water source reach the standard rate pay attention to the perfection of legal policy.

(5) Focus on the integration of economic, ecological and social sustainable development. Although the main reason for the non-sustainable development of Anhui Province lies in the non-sustainable development of the environment, sustainable development is the unity of economy, ecology and society. While ensuring the environmental

development, we still need to vigorously develop the economy. The economy is the basis of regional prosperity. Only on the basis of economic and ecological development can society progress. As a rising star of the Yangtze River Delta economic region, Anhui Province still has relatively backward in economic development and uneven in regional development. On the one hand, the government should increase financial expenditure and support local characteristic industries in combination with regional characteristics Development, at the same time encourage R&D expenditure within the province, increase the intensity of industrial innovation; on the other hand, for the imbalance of economic development in the province and region, the government should pay attention to coordination and balance, for the relatively backward areas, increase policy support, increase investment in funds, talents and other investment, and promote regional innovation and development.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

REFERENCES

[1]C. M. Meng, Development of circular economy to enhance sustainable development, Shanxi Science and Technology Journal, 2010.
 [2]Z. J. Li, Evaluation of sustainable development of county economy, Journal of Changjiang University (Natural Science Edition), 2011, 8(12): 258-260.
 [3]X. Q. Hu, Characteristics and sustainable development of continuous basalt fiber industry in China, High-tech fibres and applications, 2012, 37(06): 19-24, 33.
 [4]Y. X. Liu, Measures to achieve sustainable development of agricultural economy in China,

Beijing Agriculture, 2014, 36: 313.

[5]F. Zhang, Analysis on the development path of ecological agriculture economy from the perspective of sustainable development, Shanxi Agricultural Economic, 2017, 24: 18.

[6]Y. M. Chen, A study on "Six Joint Forces" for the sustainable development of folk music art, Guizhou Ethnic Studies, 2018, 39(12): 113-116.

[7]L. Wang, Thoughts on sustainable development of Anhui equity investment fund, Financial Cross, 2011, 03: 43-45.

[8]J. Wang, A Study on the countermeasures of the sustainable development of Anhui Nongjia Book House Project, Anhui University, 2015.

[9]Tang, A study on classification and evaluation of construction of experimental area of Anhui province, Journal of Anhui Agricultural University (Social Sciences Edition), 2014, 23(1): 38-41, 110.

[10]F. Yang, Study on sustainable development evaluation of Anhui construction industry based on RAGA projection tracking model, Anhui Construction University Hefei, 2015.

[11]M. J. Farrell, The measurement of productive efficiency, Journal of the royal statistical society, 1957, 120(3): 253-290.

[12]D. C. Tang and Z. J. Li, Review on the application of DEA methods in the evaluation of sustainable development, Ecological Economy, 2019, 35(7): 56-62.

[13]S. K. Si and Z. L. Sun, Mathematical modeling algorithm and application, Defense Industry Press Beijing, 2015.

[14]Q. F. Fu, Study on TOPSIS law, Journal of Xi'an University of Science and Technology, 2008, 1: 190-193.

[15]H. Zhang, The application of TOPSIS model based on entropy weight improvement in comprehensive evaluation of Suzhou River water quality, Northwest Hydropower, 2019, 3: 12-15.

[16]J. M. Zhu, L. Wang, J. B. Liu, et al., Eradication of Ebola based on dynamic programming, Computational and Mathematical Methods in Medicine, 2016, 31: 1-9.

[17]J. M. Zhu, W. Y. Xia, J. J. Sun, et al., The spread pattern on Ebola and the control schemes, Int. J. of Innovative Computing and Applications, 2018, 9(2): 77-89.

Quantitative Analysis of Garbage Classification Based on Least Square Method

Meng-Qi Zheng¹, Jia-Ming Zhu^{1,*}, Chun-Li Wang²

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

² Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: Questionnaire design and distribution were carried out for garbage classification, and 305 valid questionnaires were collected to fit the analytic hierarchy process model and matter-element model. Five garbage classification schemes were analyzed. Ten evaluation indexes closely related to garbage classification were quantified and evaluated, and scoring ranges of each index under different grades were obtained. Shanghai was selected as the research object, and the total resident population and garbage from 1990 to 2017 were obtained through China Statistical Yearbook. Using R software to fit the time series model, the total garbage in Shanghai has been growing except for fluctuation in 2000. Then fitting the linear regression model, the total garbage in the next three years is predicted to be in a stable growth state. Then establish four kinds of supervision and management mechanisms among the public, responsibility and management subjects, establish measurement and charging models for different classified wastes, and determine different charging coefficients, then establish charging "garbage bag" model, different garbage cans, garbage bag capacity, and charging different, and at the same time, take different charges for different groups.

Keywords: Garbage classification; Time series model; Unitary linear regression; Collection of "garbage bags"

1. INTRODUCTION

In recent years, general secretary xi has always stressed the importance of the ecological environment and put forward the scientific conclusion that "green mountains are better than green waters and mountains are better than gold and silver". Since 2018, China has refused to accept foreign garbage, which is a good development trend. At present, China produces about 400 million tons of household garbage in a year, which is still increasing year by year. Under this background, China began to carry out the pilot program of garbage classification and treatment in the coastal areas, so that each piece of garbage can be placed in its place, and refined recycling can be carried out to turn the garbage into treasure and gradually spread to the whole country. Thus, the struggle between China and the household garbage started. "Garbage classification" is to store, put and transport garbage according to the characteristics of

garbage, so that garbage has resource value and economic value and strives to make the best use of everything. In garbage classification, we should pay attention to: garbage can be classified according to different standards, which can be determined according to the positioning of the city; the annual output of garbage is correlated with the economic status and population of the city. The implementation of the garbage separation plan requires us to establish a sound reward and punishment mechanism, so that garbage classification gradually becomes a habit of people's life.

2. RESERCH REVIEW

Because of the seriousness and urgency of garbage classification, many experts and scholars have studied and analyzed this problem. Zheng [1] studied the garbage treatment in Zhong-shan city through practical analysis, and put forward Suggestions on the development of reduction, recycling, innocancy and economization of garbage classification treatment. According to the garbage classification measures, Wang [2] studied the urgency of their implementation, and showed the approaches and countermeasures of garbage classification. Jiang [3] used differential equations to establish the garbage charging standard model in the article "pricing model and policies for the classification and recycling of urban household garbage", and obtained the price adjustment scheme of adding 58 yuan per ton. From the existing literature on garbage classification and disposal, they make a lot of statements, but lack specific data and models. In this case, this paper is to supplement the existing literature.

3. CONSTRUCTION OF EVALUATION INDEX SYSTEM BASED ON QUESTIONNAIRE SURVEY

Through the questionnaire survey to each index score, including questionnaire design, questionnaire distribution, data collection and analysis; According to garbage classification to meet external environment factors (A1), capital (A2), the processing technology is used (A3) three criteria, build again pollution degree, the degree of improvement, but practicality, garbage harmless, implementation cost and investment cost, waste secondary utilization degree, management difficulty, equipment, residents recognition difficulty 10 indexes of garbage classification index system [4].

First, consistency test was conducted on the results.

After passing the test, the weight value was normalized to eliminate the influence of dimension.

The results are shown in Table 1

Table 1 weight of garbage classification scheme evaluation index

The evaluation index	(B ₁)	(B ₂)	(B ₃)	(B ₄)	(B ₅)	(B ₆)	(B ₇)	(B ₈)	(B ₉)	(B ₁₀)
The weight	Λ_1	Λ_2	Λ_3	Λ_4	Λ_5	Λ_6	Λ_7	Λ_8	Λ_9	Λ_{10}
Normalized weight value	0.118	0.106	0.114	0.122	0.041	0.055	0.115	0.113	0.105	0.113

4. DETERMINATION OF GARBAGE CLASSIFICATION SCHEME

Different methods of garbage classification will determine different garbage classification schemes

and have a great impact on the effect of the schemes. Through qualitative analysis and evaluation system, five garbage classification schemes as shown in table 2 will be summarized [5]

Table 2 Five garbage classification schemes

plan	Category description
S ₁	Kitchen waste, other garbage
S ₂	Recyclable garbage, other garbage
S ₃	Wet garbage, dry garbage, recyclable garbage, hazardous garbage
S ₄	Kitchen waste, recyclable waste, toxic waste, other waste
S ₅	Kitchen waste, paper waste, glass waste, metal waste, hazardous waste, other waste

Through literature reading, the evaluation indexes used for garbage classification were divided into 10 categories and corresponding grades were divided into four categories. Matter-element analysis model was established to score the indexes under different schemes, and the scores obtained were taken as the quantitative values of each index [6].

At the same time, through the historical data, we can know the classical domain of different schemes under different indicators and the node domain of overall indicators.

In combination with:

$$K_j(P) = \max[X_1(p), K_2(p), \dots, K_n(p)]$$

In each different scheme, different values corresponding to different indicators can be calculated. At this time, $K_j(P)$ represents the comprehensive correlation degree of unevaluated event P to the JTH evaluation level.

Then, the comprehensive correlation degree of each indicator is obtained, and the best garbage classification scheme is given based on the real life. Taking Shanghai as an example, the correlation function value of each indicator corresponding to each level of each scheme is obtained, as shown in Table 3.

Table 3 correlation function values of each index corresponding to each program and each grade in Shanghai

plan	level	Correlation function value									
		B ₁	B ₂	B ₃	B ₄	B ₅	B ₆	B ₇	B ₈	B ₉	B ₁₀
S ₁	I	0.054	0.020	-0.579	0.119	-0.635	-0.744	0.021	-0.670	-0.540	-0.670
	II	-0.951	-0.980	-0.317	-0.883	-0.406	-0.547	-0.979	-0.310	-0.283	-0.309
	III	-0.977	-0.994	0.503	-0.950	0.363	0.187	-0.997	0.302	0.466	0.301
	IV	-0.989	-0.996	-0.310	-0.974	-0.277	-0.212	-0.996	-0.264	-0.315	-0.266
S ₂	I	-0.985	-0.985	-0.320	-0.950	0.015	0.010	-0.984	-0.109	0.080	-0.106
	II	-0.975	-0.976	0.503	-0.921	-0.984	-0.981	-0.975	0.103	-0.920	0.105
	III	-0.945	-0.949	-0.320	-0.809	-0.993	-0.993	-0.956	-0.517	-0.974	-0.520
	IV	0.057	0.057	-0.579	0.202	-0.999	-0.992	0.058	-0.691	-0.990	-0.693
S ₃	I	0.052	-0.168	0.174	-0.370	-0.233	-0.360	-0.169	0.070	-0.281	0.071
	II	-0.954	0.302	-0.833	0.079	0.275	0.164	0.307	-0.933	0.303	-0.944
	III	-0.985	-0.323	-0.943	-0.046	-0.444	-0.097	-0.325	-0.969	-0.467	-0.978
	IV	-0.996	-0.563	-0.960	-0.386	-0.660	-0.421	-0.568	-0.988	-0.673	-0.983
S ₄	I	0.057	0.021	-0.391	-0.377	-0.458	-0.610	0.022	-0.357	-0.411	-0.362
	II	-0.953	-0.988	-0.010	0.077	-0.123	-0.319	-0.982	0.100	-0.488	0.105
	III	-0.980	-0.987	0.013	-0.048	0.106	0.478	-0.993	-0.058	0.086	-0.060
	IV	-0.988	-0.994	-0.390	-0.382	-0.366	-0.343	-0.997	-0.405	-0.365	-0.400
S ₅	I	0.053	0.017	-0.959	0.127	-0.979	-0.995	0.014	-0.979	-0.990	-0.983
	II	-0.950	-0.985	-0.939	-0.880	-0.959	-0.989	-0.970	-0.968	-0.978	-0.917
	III	-0.978	-0.988	-0.831	-0.959	-0.916	-0.977	-0.991	-0.904	-0.953	-0.902
	IV	-0.9878	-0.973	0.169	-0.977	0.084	0.015	-0.992	0.089	0.034	0.097

Table 4 comprehensive correlation degree and evaluation grade of each classification scheme in Shanghai

plan	K ₁ (x)	K ₂ (x)	K ₃ (x)	K ₄ (x)	K ₅ (x)
S ₁	-0.315	-0.619	-0.256	-0.610	III

S ₂	-0.501	-0.560	-0.770	-0.375	IV
S ₃	-0.101	-0.278	-0.591	-0.725	I
S ₄	-0.246	-0.383	-0.311	-0.578	II
S ₅	-0.502	-0.949	-0.940	-0.410	IV

According to the evaluation result Table 4, we can get $S_3 > S_4 > S_1 > S_2 > S_5$, the plan is divided into wet garbage, dry garbage, recyclable garbage and hazardous garbage. Shanghai has been known as the magic capital of "light on the red carpet" since the last world. There is a lot of organic garbage such as food consumed every day, which can be divided into wet garbage.

This kind of classification not only contributes to the recycling of garbage, but also reduces the classification and transportation costs, as well as the Table 5 total population and total garbage in Shanghai over the years.

year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Garbage/ton	279	296	301	335	358	372	419	454	470	500
Population/ten thousand	1334	1350	1365	1381	1398	1414	1451	1489	1527	1567
year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Garbage/ton	641	644	467	585	610	622	658	702	678	710
Population/ten thousand	1609	1668	1713	1766	1835	1890	1964	2064	2141	2210
year	2010	2011	2012	2013	2014	2015	2016	2017	—	—
Garbage/ton	732	704	716	735	743	790	880	900	—	—
Population/ten thousand	2303	2347	2380	2415	2426	2415	2420	2418	—	—

Source: national bureau of statistics

5.2 Research Methods

Set the total garbage production as the dependent variable y and the total resident population of Shanghai as the independent variable x , then the regression model of multiple linear regression model is [7]:

$$y = b_0 + b_1x + e.$$

Where, b_0 is the constant term, b_1 is the regression coefficient, and e is the error term.

Parameter estimation by least square method:

$$\sum y = nb_0 + b_1 \sum x. \quad \sum xy = b_0 \sum x + b_1 \sum x^2.$$

Goodness of fit index:

$$R^2 = \frac{\sum(\hat{y} - \bar{y})^2}{\sum(y - \bar{y})^2}.$$

Based on the above data, R language is used to carry out time series model fitting, and the fitting model is obtained, as shown in Figure 1.

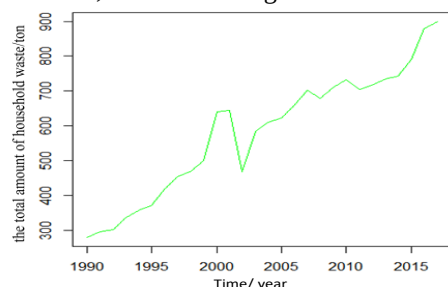


Figure 1 the relationship between a year and the total amount of household waste.

5.3 Result Analysis

As can be seen from figure 1, from 1990 to 2015, the total amount of household waste in Shanghai increased gradually every year. But in 2000, before

safety and secondary pollution of garbage classification.

5. FORECAST OF THE TOTAL AMOUNT OF GARBAGE IN SHANGHAI IN THE NEXT FEW YEARS

5.1 Data Sources

Shanghai was selected as the target city for the data, and the total resident population and total garbage production data of Shanghai from 1990 to 2017 were obtained by referring to the data, as shown in Table 5.

and after the curve produced a big fluctuation, can according to the actual situation to unscramble: in 2000, Shanghai is one of the garbage classification pilot cities in China, because of classifying rubbish, make the amount of garbage that in Shanghai presents cliffs fell, but then failed to adhere to the policy [8] they sort the garbage, garbage output also increased year by year. According to the above data, the model is fitted by EXCEL, and the fitting model is obtained, as shown in Figure 2.

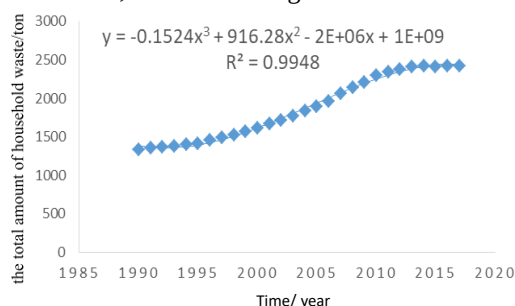


Figure 2 the relationship between the total population of Shanghai and the year

Regression model is as follow:

$$y = -0.1524x^3 + 916.28x^2 - 2E+06x + 1E+09$$

The coefficient of determination: $R^2 = 0.9948$, indicating that the goodness of fit of the model is good, which can well reflect the relationship between the total population of Shanghai and the year.

The time series model was established to fit the model of the total population of Shanghai [9], and the total population of Shanghai was predicted to obtain the predicted total population of Shanghai and

prepare for the prediction of household garbage, as shown in Figure 3

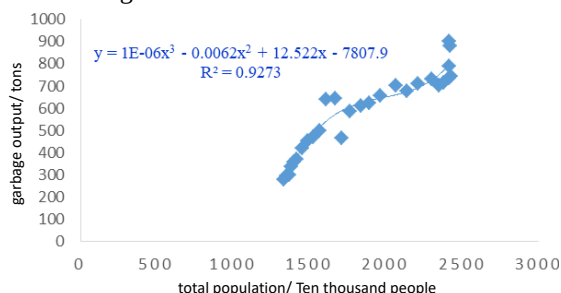


Figure 3 Relationship between total population and garbage output of Shanghai

The regression model is as follow:

$$y = 1E-06x^3 - 0.0062x^2 + 12.522x - 7807.9$$

The coefficient of determination $R^2 = 0.9273$ indicates that the model has a good goodness of fit and can well reflect the relationship between the total population and the total waste production in Shanghai.

6. DESIGN OF GARBAGE CLASSIFICATION SCHEME IN THE COMMUNITY

6.1 Construction of Classification System

Garbage classification is every citizen's unavoidable responsibility, so in the establishment of garbage classification management oversight mechanism, taking into account the different levels of crowd, combined with the reality will be divided into four kinds of supervision system [10], respectively, the main responsibility for the mutual supervision and management of responsibility between the class between the supervision and management of the supervision and the masses of the supervision of management and responsibility.

6.2 Method Design

(1) The meter charge model

$$y = \sum_{i=1}^m a_i x_i + b.$$

$$\text{Where } a_i = \frac{Y_s}{T}, b = (1+p) \frac{Y_0}{S_m}.$$

Where m is the type of garbage, x_i is the weight of garbage, a_i is the unit price of garbage collection, Y_0 is the annual operation and management cost, S_m is the maximum emissions, and p is the annual profit rate.

Finally, the integration can be obtained:

$$y = \sum_{i=1}^m a_i x_i + (1+p) \frac{Y_0}{S_m}.$$

The first step is to determine the type of garbage. In combination with the above formula, the unit price of garbage under this type is determined. The charging coefficients of different garbage types are not consistent, for example, the charging coefficient of hazardous garbage will be high [11].

(2) Charging "garbage bag" model

Garbage bags or garbage cans of different colors will

be distributed to the community or unit, and different categories of garbage will be put into the garbage cans of the specified colors. Then, fees will be charged according to the price of garbage bags of different colors designed before, combined with the capacity.

(3) Differentiated charges

Communities and units should formulate different charging policies according to different groups of people [12]. For example, residents enjoying subsistence allowances or national poverty policies can get discounts or even no fees.

7 CONCLUSION

Garbage classification is becoming more and more important in our life. With the official implementation of the garbage classification policy, the improvement of all aspects of the policy has been put on the agenda. Through the analysis of the article, it can be found that the total amount of people's garbage has been steadily increasing with the passage of time. These increased wastes need to be properly disposed of, and different garbage, different populations and different regions should be set up with different garbage disposal policies, so as to achieve fair treatment. This is not only to protect the environment, but also to protect human beings.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjybyb2018006).

REFERENCE

- [1]J. B. Zheng, Discussion on the development direction and Suggestions for the classified treatment of urban household waste, Energy conservation and environmental protection, 2019, 1: 38-39.
- [2]C. Wang, Research on the classification and treatment of urban household garbage and countermeasures, Green environmental protection building materials, 2018, 9: 56 + 59.
- [3]Y. Teng and Jiang, Pricing model and countermeasures for the classification and recycling of urban household garbage, China comprehensive resource utilization, 2008, 36(9): 135-137.
- [4]X. Y. Meng, Research on the classification behavior of household garbage based on structural equation, Resources science, 2019, 41(6): 1111-1119.
- [5]H. B. Chen, J. C. Zhou, H. L. Zhang, et al., Application of matter-element analysis model in the

evaluation of domestic garbage classification and collection scheme, *Environmental engineering*, 2013, 31(5): 121-126.

[6]J. Q. Wang, X. Yin, Y. W. Chen, et al., Classification and treatment model of domestic garbage in China under the garbage classification and charging system, *Science and technology vision*, 2017, 32: 1-6.

[7]Q. Q. Du, Implementation progress, dilemma analysis and Suggestions of China's urban domestic garbage classification, *Scientific development*, 2018, (8): 72-78.

[8]X. R. Li, F. Bi, Z. D. Han, et al., Garbage source classification performance, impact factor, and management strategy in rural areas of China: A case study in Hangzhou, *Waste management New York*, 2019, 89.

[9]X. Y. Meng, X. C. Tan, W. Y. Wang, et al., Investigation on decision-making mechanism of residents' household solid waste classification and recycling behaviors, *Resources, Conservation & amp, Process*, 2019, 140.

[10]W. Zhen, A preliminary study on the whole-process classification and supervision system of household garbage, *Environmental sanitation engineering*, 2008, 26(5): 1-3.

[11]X. F. Hu and L. T. Cai, Thinking on promoting the classification and reduction of household waste by using price and fee policy, *Sichuan cement*, 2018, (11): 110.

[12]Y. T. Jiang, Pricing model and countermeasures for the classification and recycling of urban household garbage, *China comprehensive resource utilization*, 2008, 36(9): 135-137.

Quantitative Analysis of Waste Clothing Recycling Based on the Perspective of Recycling Box

Jie Zhang¹, Jia Ming Zhu^{1,*}, Deng Sheng Liu², Chun Li Wang²

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

² Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: Based on the investigation of the residents in Bengbu City, Anhui Province, this paper investigates the recycling situation of the waste clothing on the spot, and studies the use of the waste clothing boxes, using the methods of statistical analysis, correlation analysis, and binary Logistic model and so on. The main research results are as follows: whether there is a recycling box plays a significant intermediary role in the relationship between the willingness to donate clothes and the use degree of the box; the residents' willingness to use the recycling box is relatively low; the willingness to use the recycling box is mainly affected by the period of discarding clothes, the amount of discarding clothes, gender, education background and the degree of influence of these factors; The research results can be used as a reference for relevant departments to formulate policies.

Keywords: Waste clothing recycling; Clothes recycling box; Statistical analysis; Binary Logistic model; SPSS

1. INTRODUCTION

With the development of economy and the improvement of living standard, people are constantly pursuing high quality life. In the case of more and more abundant living material resources, there are more and more waste clothes [1], and the disposal of waste clothes has become a perplexing problem. According to the data, more than 20 million tons of waste textile products are produced every year in China. The disposal of these wastes clothing needs a lot of resources. In addition, China is also a big country in textile and garment production. Due to the shortage of textile raw materials, China is facing the contradiction between the shortage of textile raw materials and the waste of waste clothing textiles. Recycling of waste clothing will save fabric resources, reduce the cost of waste disposal, reduce the pollution of discarded clothing on the land, reduce domestic waste, and help to build a resource-saving and environment-friendly society.

Under the multiple backgrounds, how to recycle the waste clothing better is becoming an urgent problem. In this paper, the search team recycle data through the field survey of Bengbu City's waste clothing, then

analyze the data and built model, use SPSS programming to get the solution, etc., draw conclusions and give relevant suggestions.

2. LITERATURE REVIEW

The recycling of waste clothing is a problem all over the world, which is deeply concerned by people all over the world. In recent years, Europe, America and other countries have taken actions to achieve the sustainable development of waste clothing recycling. Furferi et al. [2] proposed a real-time, fully automatic color classification tool for wool fabric recycling, which can correctly classify clothes according to the selection criteria provided by human technology. The tool has been verified with a set of 5000 clothes to be recycled in different colors. The classification error is less than 5%, which is lower than the classification error caused by the use of expert manual operation. Binotto et al. [3] studied and discussed some fashion brands, and discussed how to use recycling and traditional process practice to solve the problem of clothing waste, and provided alternative solutions for fashion and material value, to solve the indicative meeting theme, and process as a sustainable activity in practice. In terms of the investigation on the disposal of waste clothing, Hyuncmee et al. [4] conducted a study on 232 college students, and investigated the factors affecting their clothing disposal behavior. The results show that the behavior of resale and donation is explained by environmental factors, and the behavior of reuse and resale is explained by economic factors. Charity motive donation behavior and convenience motive discarding behavior. Vaida, et al. [5] based on statistical data analysis and business case study, evaluated the textile waste produced by Lithuanian clothing industry. The research results showed that the amount of cutting waste accounted for 20-25% of the total amount of production materials. Lithuanian clothing enterprises did not classify the waste, most of which were in landfill.

China's waste clothing recycling industry started relatively late compared with Europe and the United States, but in recent years, by learning from foreign waste clothing recycling and treatment mode, in-depth investigation and Research on domestic waste clothing treatment, China's waste clothing

recycling has made great progress. Lin [6] introduced the development of recycling treatment and utilization of waste clothing in Europe, America and other countries, analyzed the basic situation of generation and treatment of waste clothing in China, and put forward suggestions for the existing problems. Wang [7] Based on the field survey of China's waste textile recycling enterprises, through understanding the development status, and from the perspective of enterprises and the government, put forward suggestions and strategies for the recycling of waste textile clothing, so as to promote the development of waste textile. Lu [8] proposed that waste clothing can be transformed and designed into new storage bags, pen holders and storage boxes, carpets and cushions, ornaments and decorative paintings, etc., conducted field research on the recycling and transformation of waste clothing, and analyzed the feasibility of the recycling of waste clothing. Fan et al. [9] took Guangzhou as an example, through a questionnaire survey, using the method of combining qualitative analysis and quantitative analysis, analyzed the attitude of the public towards the recycling and treatment path of waste clothing, and put forward some suggestions to promote the development of waste textile and clothing recycling industry in China. Most of the above studies are about the treatment of waste clothing and how to use them, but the basic recycling methods and the use of waste clothing recycling boxes are few. This paper focuses on the use of waste clothing recycling boxes.

3. RESEARCH IDEAS

Table 1 Intermediate effect results

Observational variable	Latent variable	Estimate	S.E.	C.R.	P
Use degree of clothes box	Are you willing to donate clothes	0.264	0.062	4.247	***
Use degree of clothing image	Is there a recycle bin around	0.173	0.081	2.126	0.034
Is there a recycle bin around	Are you willing to donate clothes	0.189	0.074	2.549	0.011

Whether there is a recycling box around plays a significant mediating role in the relationship between the willingness to donate clothes and the use degree of the box. The mediating effect is $0.25 * 0.17 / 0.19 = 22.4\%$, which means that placing old clothes recycling boxes around the house plays a significant role in improving people's willingness to use clothes recycling boxes.

4.2 Statistical Analysis of the USE Degree of the USED Clothes Recycling Boxes

Using MATLAB software to draw the use degree of waste clothes box, as shown in Figure 2 below.

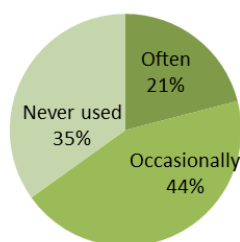


Figure 2 Analysis of the use degree of the clothes box

We take the residents of Bengbu City in Anhui Province as the survey objects. First of all, set up the related questionnaire, through the way of offline and online survey, through multi-stage stratified sampling and random number table method to ensure the representativeness of the sample, and analyze the validity and reliability of the questionnaire to ensure the validity of the questionnaire. Then, the data obtained from the survey are analyzed and the model is established, and the analysis conclusion is drawn. Finally, we combined with the second-hand data to draw the final conclusions and recommendations.

4. STATISTICAL ANALYSIS OF THE RECYCLING BOXES OF WASTE CLOTHES

4.1 Discussion on the Importance of Recycling Clothes Box

The intermediary effect model of Amos software output is shown in Figure 1 and table 1.

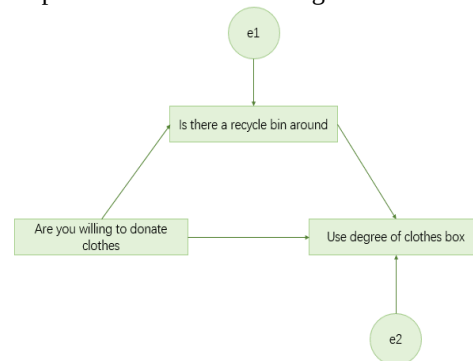


Figure 1 Amos diagram of intermediary effect

As can be seen from Figure 2 above, people's willingness to use clothing recycled boxes is not very high. Only 22.03% of the people often use clothing recycled boxes, 31.61% of the people never use them; 46.36% of the people occasionally use clothing recycled boxes. In order to further understand the reasons for not using the waste clothes box and its related influencing factors, the following analysis is carried out.

4.3 Analysis of the Reasons for Not Using the Waste and Recycled Clothes Box

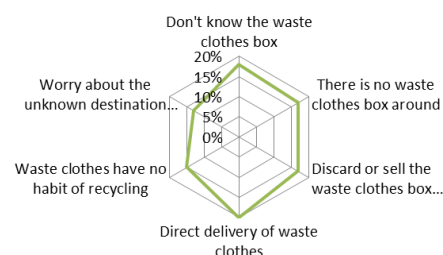


Figure 3 Analysis of the use degree of the clothes box

It can be seen from Figure 3 that the main reason why people don't use the old and recycled clothes box is that there is no old and useless clothes box nearby. The second reason is that the old and useless clothes are directly sent to people for recycling. However, it is the least influential factor to worry that the old and useless clothes are put into the old and useless clothes

Table 2 Similarity between value vectors

Influence factor	Convenience	System standardization	Handling transparency	Compensability	Personal ideas	Nature of organization
Convenience	1.000	0.158	-0.586	-0.084	0.386	0.626
System standardization	0.158	1.000	-0.253	-0.237	0.291	0.538
Handling transparency	-0.586	-0.253	1.000	-0.684	0.445	0.069
Compensability	-0.084	-0.237	-0.684	1.000	-0.952	-0.775
Personal ideas	0.386	0.291	0.445	-0.952	1.000	0.917
Nature of organization	0.626	0.538	0.069	-0.775	0.917	1.000

For example, if R is a positive number and $R < 0.3$, it means that there is a weak positive correlation between variables. From table 2 above, it can be seen that there is a high correlation between some influencing factors, which can be controlled to improve residents' willingness to use waste clothing boxes.

5. A STUDY ON THE WILLINGNESS TO USE THE OLD CLOTHES BOX BASED ON BINARY LOGISTIC

We use the method of descriptive statistical analysis to study the importance of the recycling suitcase, the degree of use of the recycling suitcase, the reason analysis of not using the waste recycling suitcase, and analyze roughly the factors influencing the use of the recycling suitcase. However, in fact, it is of great significance to study the influence of various factors on the use intention of waste and recycled clothing boxes. Therefore, it is necessary to establish a measurement model, which integrates many factors for investigation. Through the establishment of binary selection model, analyze quantitatively the influence of gender, age, education background, income, classification of waste clothing, disposal of waste clothing, whether free donation and other factors on the use of waste clothing boxes, and then determine the significant characteristics of potential users of waste clothing boxes.

5.1 Model Preparation and Selection

The binary choice model [10] is a model established by one of the two alternatives. Considering that there are only two answers to the question of whether to use the waste clothes box, which is a binary dependent variable, we establish a binary selection model.

The binary choice model can be divided into linear probability model, probit model and logit model. If the linear probability model is a linear relationship between the explained variable and the explained variable, the general least square method (OLS) or weighted least square method (WLS) is used to

box and are used by other people.

4.4 Person Correlation Analysis of the Factors Affecting the USE OF Recycling Bins

According to the questions set in the questionnaire, the factors that affect the use of the recycling suitcase were analyzed by person correlation analysis, as shown in Table 2 as below.

estimate the parameters. However, this paper adopts a broader logistic regression for the following reasons: First, the partial regression coefficient in logistic regression can calculate its or value (odds ratio), which is more close to the actual interpretation meaning, and this interpretation is far less intuitive and useful than the former; second, probit regression is stopped on the basis of the practice of normal dispersion, and logistic regression is based on the theory of binomial dispersion. Because there are many categorical variables and few continuous variables in the questionnaire, we think it is more appropriate to adopt logistic regression.

5.2 The Establishment of Binary Logistic Model

The binary selection behavior of the i th individual "use recycle bin" is expressed as a dependent variable. When "yes" is selected, the value of Y_i is 1; when "no" is selected, the value of Y_i is 0.

A binary logistic model is constructed with all the variables that need to be considered, as follows:

$$P(Y=1) = \frac{\text{EXP}(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)}{1 + \text{EXP}(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)} \quad (1)$$

Into

$$P(Y=1) = \frac{1}{1 + \text{EXP}(-\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)} \quad (2)$$

Continue to simplify

$$\text{logit } P(Y=1) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n \quad (3)$$

Same as linear regression model, β_0 is a constant term (or intercept), β_i is X_i Partial regression coefficient corresponding to i ($i = 1, 2, \dots, n$), X_i is the influencing factors.

5.3 Solution of Residents' Willingness to Use Recycling Suitcases

Using the method of backward step-by-step screening, the independent variables that have no significant influence on the dependent variables are deleted from the regression equation initially established according to the probability value of statistics estimated by the maximum likelihood, and the significance level is

given as 5%. After multiple rounds of screening and elimination of insignificant variables, the regression Table 3 final regression results of logistic model

results are as follows:

Variable	regression coefficient	Wals	P-value	OR{Exp(B)}
Constant term	-0.256	2.143	0.184	0.738
Gender	0.291	19.672	0.001	1.719
Age	0.193	15.752	0.002	1.445
education	0.218	17.784	0.005	1.595
income	0.176	18.885	0.001	1.632
How long does the dress update	-0.213	10.134	0.001	0.848
Whether willing to donate free of char	0.403	21.362	0.004	2.123

$R^2 = 0.1986$ $P(\text{likelihood Ratio test}) = 0.004$

It can be seen from table 3 above that the p value in the likelihood ratio test used in the model is 0.004, which is far less than the significance level of 5%. It can be considered that the overall significance of the explanatory variables is good.

5.4 Interpretation of Resident' Willingness to Use the Recycling Suitcase

OR {EXP (B)} is the ratio of occurrence. When the probability of residents using waste clothing boxes to volunteer is small (some think it is less than 0.1), it can be approximately considered that the ratio of EXP (B) to the probability of occurrence is very close. Therefore, the EXP(B) value can be interpreted as that the probability of residents using the recycling suitcase is a multiple of EXP(B) before the corresponding independent variable changes. The following conclusions can be drawn from table 3 above.

(1) Gender

On the 5% significance level, the coefficient of gender was 0.291 after significance test. It shows that there is a gender difference in the use of waste clothing boxes by residents when other conditions are firm. From the EXP(B) value, the probability of women using recycled suitcases is 1.649 times higher than that of men, and the enthusiasm of women to use recycled suitcases is relatively high. Therefore, the results of the model show that the gender of consumers is positively related to the use of recycling bins.

(2) Age

The results of model estimation show that the age status of consumers has passed the significance test of the model coefficient, with a coefficient of 0.193, which shows that different age groups affect the willingness to use recycling bins. From the EXP(B) value, 38-47 year olds were 1.445 times more active than the reference group.

(3) Education background

The regression coefficient of academic degree is positive, and it has passed the significance test. The regression coefficient is 0.218, which shows that the group with university degree or above is more willing to use the recycling suitcase. From the EXP(B) value, compared with the reference group (high school / junior high school / primary school), the use intention of people with bachelor degree is 1.595 times of the

latter. People with high education have a certain understanding of the use of recycling suitcases and realize the value of them. Even if it is not used, there is a strong desire.

(4) Income

The regression coefficient of income was positive, and passed the significance test, the regression coefficient was 0.176, indicating that the group with high income was more willing to use the waste clothes box than the group with the benchmark (income of 3000 yuan). It can be seen that the residents who use the recycling suitcase are more interested in energy conservation and emission reduction, and have a high concept of environmental protection.

(5) How long does the clothes update

The regression coefficient of how long the clothes need to be renewed is negative and has passed the significance test. The regression coefficient is -0.213. From the EXP (B) value, the two-year renewal population of clothes is 0.848 times of the benchmark population (0.5 years). It shows that the residents who have a long time to renew their clothes do not have much intention to use the waste clothes boxes.

(6) Are you willing to donate free of charge

The regression coefficient of willingness to donate is positive, and it has passed the significance test. This also shows that the residents who use the recycling bins are closely related to their psychological thoughts. With a certain idea, they may give practical actions, which is also the most significant feature of using the recycling bins.

6. CONCLUSION

With the increase of residents' income, there will be more and more waste clothes. The recycling boxes of waste clothes play a very important role in the recycling of clothes, but people need to pay more attention to the recycling boxes of waste clothes[11]. People's willingness to use the waste clothes recycling box is not strong, but it is affected by such variables as the period, quantity, gender and education background of the discarded clothes; whether to donate free is the most significant feature of using the waste clothes recycling box. In the future, the research on the recycling of waste clothing should start from reducing the influencing factors [12], enhancing people's awareness of recycling, and ensuring the transparency [13] and efficiency [14] in

the whole recycling process [15].

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This work is supported by the project of Innovation training program of Anhui University of Finance and economics provincial innovation and entrepreneurship training program (NO.S201910378493). Besides, This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjybyb2018006).

REFERENCE

- [1]Y. W. Guo, Y. Yao, X. J. Wan, and B. Li, A preliminary study on the recycling status of waste clothing in Shanghai, Science and technology information, 2013, (27): 235-236.
- [2]R. Furferi and L. Governi, The recycling of wool clothes: an artificial neural network colour classification tool, International Journal of Advanced Manufacturing Technology, 2008, 37(7-8): 722-731.
- [3]C. Binotto and C. Van Lunn, Silk purse, sow's ear: transforming second-Hand clothing into luxury fashion through craft practice, Making Futures Journal, 2014.
- [4]H. P. Hyuncmee, Factors motivating and influencing clothing disposal behaviors, International IJC, 2013, 37(1): 105-111.
- [5]D. Vaida, M. Gené, M. Juciene, et al., Investigation

of current state of pre-consumer textile waste generated at Lithuanian enterprises, International Journal of Clothing Science & Technology, 2017, 29(4): 00-00.

[6]S. D. Lin, Progress and suggestions on recycling of waste clothing, Synthetic fiber, 2011, 40(08): 17-22.

[7]H. Wang, Investigation and Research on recycling of waste wool textile, Light textile industry and technology, 2012, 41(04): 50-53.

[8]H. M. Lu and Y. Y. Qiu, Transformation and redesign of waste clothing, Textile industry and technology, 2018, 47(z1): 29-31.

[9]F. J. Fan, J. J. Zhang, Y. X. Wu, et al., Study on the recycling and treatment mode of waste textiles and clothing -- Taking Guangzhou as an example, Textile guide, 2016, (08): 28 + 30-32.

[10]D. K. Dong, Y. P. Lu, and L. Zhang, Empirical research on satisfaction of residential property service based on binary logistic regression, Journal of Changchun University, 2019, 29(01): 7-11.

[11]Y. L. Huang, Research on recycling and classification of waste clothing, Wuhan Textile University, 2011.

[12]Z. Z. Wang, Research on the management of waste clothing recycling, Fujian Normal University, 2016.

[13]K. K. Lu, Research on the recycling strategy of old clothes, Yangzhou University, 2014.

[14]J. M. Zhu, L. Wang, and J. B. Liu, Eradication of Ebola based on dynamic programming, Computational and Mathematical Methods in Medicine, 2016, (31): 1-9.

[15]J. M. Zhu, W. Y. Xia, J. J. Sun, et al., The spread pattern on Ebola and the control schemes, Int. J. Innovative Computing and Applications, 2018, 9(2): 77-89.

Quantitative Analysis on the Development Potential of Rural Commercial Pension Insurance in Six Provinces of Central China

Cheng-Wei Sun¹, Jia-Ming Zhu^{1,*}, Sheng-Qun Xia¹, Chun-Li Wang²

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

² Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: In view of the development potential of rural commercial endowment insurance in six provinces in central China, we first obtained 17 provincial index data such as GNP, rural residents' consumption levels, and rural population from the website of the National Bureau of Statistics. Secondly, we adapted Factor Analysis on 17 indicators of provinces, select 5 factors from them, and the cumulative contribution rate of the factors can reach 98%. Afterwards, calculate the score function of the factors by regression method, and use the comprehensive factor score formula to give the ranking of the development potential of the 6 provinces in the central region. Finally, based on the calculation of the scores of 5 factors of 6 provinces through the factor score function, on the basis of calculating the absolute value distance of each province, the 6 provinces are divided into three categories and reasonable suggestions for developing rural commercial pension insurance are given.

Keywords: Rural commercial pension insurance; Factor analysis; Cluster analysis; Python

1. INTRODUCTION

More and more countries in the world have entered an aging society. The elderly population in rural areas of China is about 300 million, accounting for two-thirds of the total elderly population. This shows that rural areas are seriously aging areas, and society and the government should pay close attention to them. Commercial pension insurance is a major pillar of residents' pension. Rural residents do not have enough knowledge about commercial pension insurance, and the development of insurance in various regions is uneven. The rural economic development level in central China is relatively low, and the penetration rate of commercial pension insurance for residents is lower, which will have a greater impact on the retirement of rural residents. This paper will evaluate the development potential of

rural commercial pension insurance in six provinces in central China through factor analysis and cluster analysis, and give reasonable suggestions.

2. EVALUATION SYSTEM

2.1 Analyze Influential Factors

At present, the main factors that affect the purchase of commercial pension insurance by rural residents in central China are: education, work, income, and whether they hold financial products. Among them, the probability of rural residents purchasing commercial pension insurance is positively correlated with education, work, and income. The mechanism of influence can be summarized as: the higher the academic qualifications, the easier it is to accept the emerging insurance product of commercial pension insurance, and a more comprehensive understanding of the relevant provisions of commercial pension insurance, so the probability of purchasing commercial pension insurance will also increase [1]. In addition, the mechanism of whether holding financial products affects the purchase of commercial pension insurance by rural residents can be summarized as: compared with other financial products with high yields and strong liquidity, most people are reluctant to invest money in investment cycles and financial products with low yields. Since the income level and cultural education level have a significant impact on the purchase of commercial pension insurance by rural residents, in order to study the development potential of commercial insurance in the six provinces in central China, some indicators that reflect the local economic level [2], education level and social development status need to be selected from the macro level.

2.2 Establish an Indicator System

The following selection of 17 indicators from 4 aspects can build an evaluation indicator system of factors affecting the development potential of rural commercial pension insurance, as shown in Figure 1.

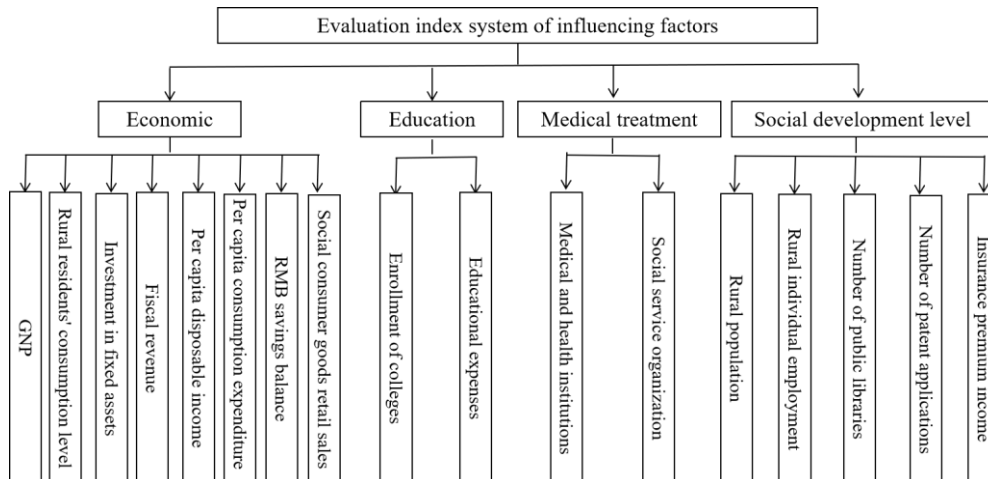


Figure 1 Evaluation index system of influencing factors

3. DATA SOURCES AND DATA PROCESSING

This article obtained data from the six provinces of Shanxi, Anhui, Jiangxi, Henan, Hubei, and Hunan in 2016 from the website of the National Bureau of Statistics. They include 17 indicators such as gross national product, consumption level of rural residents, Table 1 Various indicators

Province	Shanxi	Anhui	Jiangxi	Henan	Hubei	Hunan
Regional GDP/100 million yuan	13050	24408	18499	40472	32665	31551
Rural residents' consumption level/Yuan	9226	8565	11320	9291	10860	10461
Rural population/10 thousand people	1612	2975	2209	5039	2525	3331
Number of rural individual employees /10 thousand people	119	66	140	122	428	67
Social fixed asset investment (100 million yuan)	14198	27033	19694	40415	30012	28353
Revenue/100 million yuan	1557	2673	2151	3153	3102	2698
Per capita consumption expenditure/Yuan	12683	14712	13259	12712	15889	15750
Per capita disposable income/Yuan	19049	19998	20110	18443	21787	21115
RMB savings deposits/100 million yuan	16145	16599	12791	24417	19248	18414
Total retail sales of social consumer goods /100 million yuan	6481	10000	6635	17618	15649	13437
Number of medical and health institutions	42204	24385	38272	71271	36354	61055
Community service agency	5294	8086	3564	4812	14152	13402
Insurance premium income/10 thousand people	698	874	609	1552	1048	885
Number of public libraries	127	123	113	158	112	137
Number of patent applications	3786	49791	12594	17457	19574	18249
Number of students enrolled in universities /10 thousand people	20	31	30	55	39	35
Educational expenses/10,000 yuan	7942196	12357931	10468837	18902582	13009264	3781959

4. RANKING

4.1 Research Ideas

In order to study the development potential of rural commercial endowment insurance in the six central provinces, we first introduce the factor analysis method, combined with the data in Table 1, using the factor analysis method to model the research, you can find the main influencing factors of development potential, and comprehensively influence the development potential of rural commercial pension insurance in six provinces is ranked.

4.2 Analysis

Standardize the 17 indicators in 6 provinces. Let the value of j-th indicator of i-th province be a_{ij} , convert

rural population, rural individual employment, and investment in fixed assets of the whole society. The data covers the economic development level, education level, medical and health level of various regions, etc. The index data is shown in Table 1.

each index value a_{ij} into a standardized index $\hat{a}_{ij}$, and $\hat{a}_{ij} = \frac{a_{ij} - \bar{\mu}_j}{s_j}$, $i = 1, 2, \dots, 6$, $j = 1, 2, \dots, 17$.

Calculate the correlation coefficient matrix R. Correlation coefficient matrix $R = (r_{ij})_{17 \times 17}$, and $r_{ij} = \frac{\sum_{k=1}^6 \hat{a}_{ki} \cdot \hat{a}_{kj}}{5}$, $i, j = 1, 2, \dots, 17$. In the formula, $r_{ii} = 1$; $r_{ij} = r_{ji}$, and r_{ij} is the correlation coefficient between the i-th index and the j-th index [3].

Calculate the eigenvalues of the correlation coefficient matrix R. $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_{17}$ and its corresponding standard feature vector $\eta_1, \eta_2, \dots, \eta_{17}$, its elementary load matrix is $A = [\sqrt{\lambda_1} \eta_1, \sqrt{\lambda_2} \eta_2, \dots, \sqrt{\lambda_m} \eta_m]$.

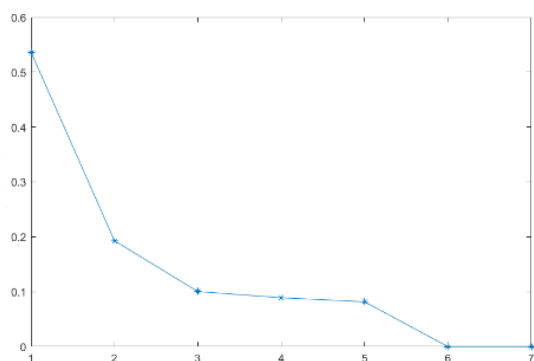


Figure 2 The gravel map

Figure 2 shows the contribution rate of each factor, select the main factor and perform factor rotation. It can be found that the contribution rate of the second factor decreases rapidly compared to the contribution rate of the first factor, the contribution rate of the sixth factor almost drops to zero, and the contribution rate of the third, fourth, and fifth factors is almost flat. Therefore, this paper chooses 5 factors to build the

Table 2 Factor score table of six provinces

Province	F_1	F_2	F_3	F_4	F_5
Shanxi	-4.2781	-5.1779	4.0806	1.7621	0.5611
Anhui	-0.1770	-2.4101	-2.9699	0.7587	-2.1272
Jiangxi	-3.2421	-4.0641	2.5532	1.6172	1.0013
Henan	-1.0564	4.4839	-0.4770	-1.9822	1.0704
Hubei	5.2474	3.3830	-1.0901	-2.5576	-0.9768
Hunan	3.5061	3.7850	-2.0968	0.4081	0.4712

According to the comprehensive factor scoring formula: $F = \sum_{i=1}^5 \theta_i F_i$, where θ_i represents the ratio of the contribution rate of the i -th factor to the cumulative contribution rate of the five factors, and

model [4].

The factor score function is $\widehat{F}_{ij} = \beta_{j1}X_1 + \dots + \beta_{jp}X_p, j = 1, 2, \dots, m$, the coefficient of the factor score function can be calculated by the following formula:

$$\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_p \end{bmatrix} = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \dots & \alpha_{1m} \\ \alpha_{21} & \alpha_{22} & \dots & \alpha_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \alpha_{p1} & \alpha_{p2} & \dots & \alpha_{pm} \end{bmatrix} \begin{bmatrix} F_1 \\ F_2 \\ \vdots \\ F_p \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_p \end{bmatrix} \quad (1)$$

$$\begin{bmatrix} \beta_{11} & \beta_{21} & \dots & \beta_{m1} \\ \beta_{12} & \beta_{22} & \dots & \beta_{m2} \\ \vdots & \vdots & \ddots & \vdots \\ \beta_{1p} & \beta_{2p} & \dots & \beta_{mp} \end{bmatrix} = R^{-1}A \quad (2)$$

4.3 Results

Calculate the scores of 5 factors in 6 provinces by regression method, as shown in Table 2, and conduct a comprehensive ranking.

the rural areas of the six central provinces can be obtained. The comprehensive factor scores and ranking of commercial pension insurance development potential [5], as shown in Table 3.

Table 3 Results of comprehensive factor scores for the development potential of rural commercial pension insurance in the six central provinces

Province	Hubei	Hunan	Henan	Anhui	Jiangxi	Shanxi
Score	3.0489	2.4738	0.1616	-0.9637	-2.0403	-2.6803
Sort	1	2	3	4	5	6

5. CLASSIFICATION

5.1 Research Ideas

To classify things with a quantitative method, it is necessary to describe the similarity between things with a quantitative method [6]. A thing often needs to be characterized by multiple variables. If a group of sample points to be classified needs to be described by p variables, then each sample point can be regarded as a point in space [7]. Therefore, it is natural to think that distance can be used to measure the similarity between sample points. This paper uses the score matrix of 6 provinces and 5 factors to calculate the absolute distance between each province to describe the similarity between provinces, and then uses the shortest distance method to cluster 6 provinces into 3 categories.

5.2 Method

The absolute distance is used to measure the distance between the provinces. The distances of the six central provinces are shown in the following matrix:

$$\begin{pmatrix} 0 & 17.6110 & 4.2622 & 21.6946 & 29.1146 & 24.3746 \\ 17.6110 & 0 & 14.2291 & 16.2048 & 17.5642 & 13.7067 \\ 4.2622 & 14.2291 & 0 & 17.4324 & 25.7327 & 20.9928 \\ 21.6946 & 16.2048 & 17.4324 & 0 & 10.6404 & 9.8644 \\ 29.1146 & 17.5642 & 25.7327 & 10.6404 & 0 & 7.5575 \\ 24.3746 & 13.7067 & 20.9928 & 9.8644 & 7.5575 & 0 \end{pmatrix} \quad (3)$$

Through cluster analysis, the six provinces in the central region are classified into three categories. The first category is the province with better economic and educational levels, including Hubei, Hunan, and Henan. The second category is Anhui, a province with a relatively backward economic development level and a relatively good education level. The third category is provinces with poor economic and educational development, including Shanxi and Jiangxi.

5.3 Result Analysis

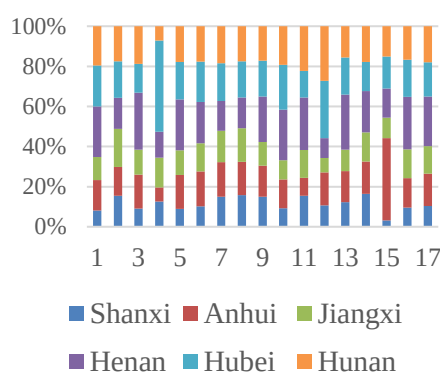


Figure 3 Comparison of indicators in six provinces

By observing the proportion of each indicator in each province in Figure 3, we can see that Hunan, Hubei, and Henan are relatively developed in terms of economy and education. The economic development of Anhui Province is basically the same as that of Jiangxi Province and Shanxi Province, and it is more developed than Jiangxi Province and Shanxi Province in education. Jiangxi Province and Shanxi Province are lagging behind in economic and educational levels compared to other central provinces [8]. Considering the regional differences, this article proposes different suggestions for different regions. Aiming at provinces with better economic level and better education development, it is necessary to do a good job in publicizing commercial pension insurance. For areas with backward economic development, we must increase economic construction. For areas with backward education, we must vigorously develop local education, promote the implementation of compulsory education, reduce dropouts, and also do a good job in promoting public pension insurance to deepen public support for commercial pension Insurance awareness.

6. CONCLUSIONS AND SUGGESTIONS

6.1 Conclusions

Comprehensive factor analysis and cluster analysis give a quantitative analysis of the development potential of rural commercial endowment insurance in six central provinces of China [9-11]. By collecting the most relevant latest data and using statistical methods for modeling research, the final development Scoring and ranking, and categorizing and pointing out the reasons, have certain significance for promoting the development of rural commercial pension insurance in the six provinces of the Ministry.

6.2 Suggestions

First, improve the education level. Improve the quantity and quality of teachers in our country, and improve the educational level of rural teachers. China's local economic level determines that the distribution of educational resources is not comprehensive enough. Economically developed areas can provide more resources for education, attract better teachers, and build a better hardware environment. Economic development will also allow

families to have more resources to support their children's education, and of course competition is more intense. Secondly, the demand for talents in economically developed areas will be greater than in undeveloped areas, which is the economic siphon effect. This requires developed areas to find ways to spend more on education and attracting talents, which objectively promotes the development of local education. The development of education is not only to educate the labor force and directly increase economic figures, but also to promote social progress from the social ecology, so that the economy can continuously improve and develop in a healthy social production.

Second, develop the rural economy. Rural economic development has the most opportunities and the greatest potential in the future. From a macro-level analysis, the strength of the country's policies on rural development, the number of preferential policies, and the strength of implementation are unprecedented. After the country achieves comprehensive poverty alleviation in 2020, a comprehensive and beautiful rural construction will be launched. The state has large preferential policies in taxation, credit finance, development funds, and rural financing systems. According to the characteristics of rural geographical location, cultural history, climate conditions, etc., we must create a characteristic industry in rural areas that meets its own conditions.

Third, increase the promotion of commercial pension insurance. Let the public enhance their understanding of commercial pension insurance and let the public fully understand the many advantages of commercial pension insurance compared to other financial products. Insurance companies should also research and develop commercial pension insurance that meets the needs of rural residents, and on the premise of ensuring low risk, maximize the income of rural residents investing in commercial pension insurance.

7. CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No. 19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

REFERENCES

- [1]Zhao Nan, "Research on Rural Commercial Pension Insurance in Baoding City," Hebei University, 2013.
- [2]Meng Hongfang, "Research on the investment environment of commercial housing in Taiyuan,"

Shanxi University of Finance and Economics, 2016.

[3]Lv Zhenru, Yan Lin, "Comprehensive evaluation of China's urbanization level from the perspective of circular economy," *Journal of Jinzhong University*, 2012, 29 (1): 43-48.

[4]Xing Xiangyang, Hao Suo, Quantitative analysis of the competitiveness of science and technology in western China.*Future and Development*, 2012, 35(2): 59-63.

[5]Liu Shuang, Xu Siyang, Yao Jun, "A Study on the Financing Effect of Direct Issuance of Listed Companies in China——Based on the Perspective of Small and Medium Investors," *Southern Finance*, 2017(11): 43-58.

[6]Lv Xiaohua, "Research and empirical analysis on the performance of listed companies," *University of International Business and Economics*, 2007.

[7]Yu Jianke, "Chongqing city residents' quality of life rating model," *Chongqing University*, 2014.

[8]Zhou Chengfu, Huang Xushu, "The effective demand of rural residents for commercial endowment insurance and analysis of its influencing factors——Taking Wuling Mountain area as a column," *Hebei Enterprises*, 2018(5): 39-42

[9]Zhu Jiaming, Xing Kang, "Research on the operating performance of China's listed pharmaceutical companies based on factor analysis," *Journal of Qinghai Normal University (Natural Science Edition)*, 2018, 34(3): 69-74.

[10]Wu Yue, Zhu Jiaming, "Comprehensive evaluation of Anhui logistics development level based on factor analysis and cluster analysis," *Journal of Wuhan University of Light Industry*, 2019, 38(6): 74-80.

[11]Zhu Jiaming, Miao Yu, Evaluation of regional economic development level of Anhui Province based on factor analysis method," *Journal of Jinzhong University*, 2019, 36(4): 36-39.

Research on Anhui Province CPI Index Based on Ridge Regression Analysis

Zhi-Yong Qian¹, Jia-Ming Zhu^{1,*}, Chao Dong², Chun-Li Wang³

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

² School of Business Management, Anhui University of Finance and Economics, Bengbu, 233030, China

³ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: This paper aims at the study of the influencing factors of consumer price index, and uses multiple regression and ridge regression methods to analyze. This paper selects eight main influencing factors from the statistical yearbook of Anhui Province 2003-2016, establishes multivariate linear regression equation with CPI index as independent variable, and uses SPSS software to test correlation. According to the analysis of the results, Anhui Province should increase cultural education propaganda, especially in rural areas, improve the cultural level of the province and promote development; secondly, it can develop new consumption projects and broaden consumer consumption channels; finally, it can vigorously publicize consumption diversification, change traditional consumption patterns, and promote high-quality economic development through consumption.

Keywords: Consumer price index; Multiple linear regression; Ridge regression

1. INTRODUCTION

The statistics of consumer price index of residents have investigated the final price of all products and services in society, which is closely related to the life of the people and the price system of the whole national economy, and its internal structure reflects the consumption situation of the residents and the tendency of economic development. Based on the relevant data from 1995 to 2017, Xiao-Han Ma first analyzed the overall trend of food price fluctuation in Anhui Province vertically, and the results showed that the trend of food price index and consumer price index fluctuated roughly the same and the fluctuation range gradually decreased and tended to stabilize. Then, using the relevant data of 2016, the horizontal empirical analysis of urban residents' consumption ELES showed that the marginal consumption tendency of urban residents was 46.50%, and the basic life of low-income groups was guaranteed. At the same time, the fluctuation of food price affected other types of consumption to some extent [1]. Based on a systematic review of the literature on food price fluctuation and consumer demand, Hong Peng examined the general trend of food price fluctuation in Anhui Province, and analyzed the overall food

price and the volatile components and trend components of individual food types by H-P filtering method, so as to better grasp the characteristics of food price. At the same time, the change of the ratio of food consumption to total consumption expenditure is analyzed, and the change of consumption quality and consumption structure of Anhui residents is explored [2]. This paper uses multiple regression analysis and ridge regression analysis to study the CPI index and composition of Anhui Province in recent years, and analyzes the main factors that affect the CPI. The results show that food and residential category have a great influence. Finally, relevant policy suggestions are put forward for reference.

2. RESEARCH METHODOLOGY AND DATA SOURCES

2.1 Construction of an Indicator System

According to the relevant data of total consumer price index in the statistical yearbook of Anhui Province from 2003 to 2016, using multivariate linear regression and ridge regression method, this paper studies the factors that affect the total consumer price index of Anhui Province, establishes the relevant regression equation, analyzes the main factors that affect the rise of CPI index through the results, and puts forward the corresponding improvement measures and relevant suggestions.

2.2 Data Sources and Selection

The *CPI* index refers to the consumer price index, through *CPI* which we can observe the influence of the changing level of consumer price on consumer money expenditure. The formula is:

$$CPI = \frac{\text{Commodity price}}{\text{Commodity base price}} * 100\%$$

To facilitate statistical calculations, the eight categories of commodity indicators composed of the CPI index are marked as follows:

- X1: food consumer price index (previous year=100);
- X2: Consumer Price Index of Tobacco, Alcohol and Supplies (previous year=100);
- X3: Consumer price index for clothing (previous year=100);
- X4: Consumer price index for household equipment, supplies and services (previous year=100);
- X5: Consumer price index for medical care (previous year=100);
- X6: Consumer Price Index of Transportation and

Communication (previous year=100);

X7: Consumer price index for entertainment education and culture (previous year=100);

X8: Residential consumer price index (previous

year=100).

The relevant data are shown in Table 1 by consulting the Price Index Module of Anhui Statistical Year book 2002-2016.

1Table 1 Price index of Anhui province

Year	Y	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈
2015	101.3	102.3	101.9	101.4	100.7	104.1	98.1	101.4	99.6
2014	101.6	102.5	97.5	101.0	101.3	101.6	99.2	102.4	102.0
2013	102.4	104.7	98.7	102.1	100.9	101.2	99.9	102.7	101.4
2012	102.3	103.8	103.3	102.5	101.6	101.5	100.7	101.7	101.0
2011	105.6	112.2	103.6	104.2	101.3	103.5	100.3	99.9	104.6
2010	103.1	106.6	102.0	98.1	98.9	103.3	99.6	100.5	105.5
2009	99.1	100.8	101.2	97.1	99.0	101.2	97.9	100.3	94.0
2008	106.2	114.3	103.3	98.9	102.2	102.2	99.7	100.1	104.5
2007	105.3	112.5	101.4	100.5	101.9	100.8	99.1	100.8	103.4
2006	101.2	101.6	100.6	99.8	101.0	100.5	99.8	100.8	103.8
2005	101.4	102.6	100.0	98.5	99.3	98.7	99.3	100.9	105.3
2004	104.5	110.8	101.0	97.7	98.0	100.6	100.1	100.2	105.6
2003	101.7	106.0	99.9	97.3	97.7	99.9	97.9	100.9	100.7
2002	100.5	99.7	101.2	97.7	98.0	99.3	97.3	104.1	102.7

3. ANALYSIS ON THE CHANGE OF CONSUMER PRICE INDEX OF ANHUI PROVINCE BASED ON MULTIPLE REGRESSION

3.1 Theoretical Basis

Multiple regression analysis refers to the analysis of the relationship between dependent variables and independent variables. The basic idea of regression analysis is: although there is no strict and deterministic functional relationship between independent variables and dependent variables, we can try to find out the mathematical expression that best represents the relationship between them. According to the equation of multiple regression, the

influence of different factors can be seen roughly, and the main driving force of CPI index can be analyzed [3].

3.2 Establishment of Multi-element Regression Equation Model

There is a linear relationship between the consumer price index of Anhui Province and the eight indexes as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8$$

By using the SPSS software to analyze the data, the following analysis results are obtained as Table 2.

2Table 2 Coefficient of multivariate linear regression equation

Model		Unstandardized coefficient		Standardized coefficient	t	Significant
		B	Standard error	Beta		
1	(constant)	-7.740	6.002	—	-1.290	0.254
	X ₁	0.369	0.008	0.850	46.185	0.000
	X ₂	0.063	0.017	0.052	3.688	0.014
	X ₃	0.032	0.021	0.034	1.550	0.182
	X ₄	0.107	0.024	0.081	4.375	0.007
	X ₅	0.063	0.022	0.047	2.924	0.033
	X ₆	0.078	0.040	0.038	1.929	0.112
	X ₇	0.227	0.033	0.128	6.973	0.001
	X ₈	0.137	0.011	0.203	12.185	0.000

The equation is derived from the coefficient table as follows:

$$Y = -7.74 + 0.369X_1 + 0.063X_2 + 0.032X_3 + 0.107X_4$$

$$+ 0.063X_5 + 0.078X_6 + 0.227X_7 + 0.137X_8$$

3.3 Examination of Equations

Goodness of fit test, as Table 3 shown.

3Table 3 Summary of models

Model	R	R party	Adjusted R party	Error in standard estimates
1	1.000 a	0.999	0.998	0.08676

In multivariate linear regression, the goodness of fit is judged by defining the R side of the sample determination coefficient. Usually, the closer the R side is to 1, the better the fitting effect is From Table 3

[4], we can see that the adjusted R is 0.998, which is close to 1, which indicates that the fitting effect of the regression equation is large probability.

The significance test, as Table 4 shown.

4Table 4 Variance analysis table

Table 7. Variance analysis table						
	Model	Square sum	Degree of freedom	Square	F	Significant
1	Regression	56.760	8	7.095	942.557	0.000 ^b
	Residual residual	0.038	5	0.008	—	—

	Total	56.797	13	—	—	—

Original assumption: $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$

Constructing F test statistics under normal assumption [5]:

$$F = \frac{SSR/p}{SSE/(n-p-1)}$$

When the original hypothesis holds, F obey the F distribution of degrees of freedom (p, n-p-1), then the significance test is carried out by F statistics. From the output results of the SPSS software, we can see that given the significance level $\alpha = 0.05$, at this time $P(F > F_{\alpha}) \approx 0$, so reject H_0 , think that at the confidence level of 95%, there is a significant linear relationship between Y and the whole $X_1, X_2, \dots, X_8$ [6].

Moreover, it can be seen from Table 2 that although the overall significance is better, the P value of X3 constant and X6 constant is larger, the significance of Y is poor, and the significance of independent variables is inconsistent with their corresponding dependent variables, so there may be multiple collinearity between the independent variables of the equation, so the ridge regression equation is used to correct the equation [7].

4. CORRECTION OF EQUATIONS BASED ON RIDGE REGRESSION ANALYSIS

4.1 Theoretical Basis

Ridge regression is a kind of partial estimation regression method which is specially used for collinear data analysis. In essence, it is an improved least square estimation method. By giving up the unbiasedness of least square method, it is more practical and reliable to obtain regression coefficients at the cost of losing some information and reducing accuracy [8].

4.2 Analytical Methodology

Let the matrix form of the multivariate linear regression model be $Y = X\beta + \varepsilon$, when the independent variable has multiple collinearity, $|X'X| \approx 0$, when a normal number matrix $kI (k > 0)$ is added, it is called:

$$\hat{\beta}(k) = (X'X + kI)^{-1}X'Y$$

for the ridge regression $\hat{\beta}$ estimate, where k called the ridge parameter. If the ridge parameter k changes in $(0, \infty)$, $\hat{\beta}(k)$ is a function of k. The curve on the plane coordinate graph is called the ridge trace [9]:

- (1) The ridge estimates for each regression coefficient are stable;
- (2) Unreasonable regression coefficient with least square estimation, and its ridge regression coefficient is reasonable [10];
- (3) There is no non-meaning economic value for the regression coefficient;

5Table 5 Analysis of ridge regression results

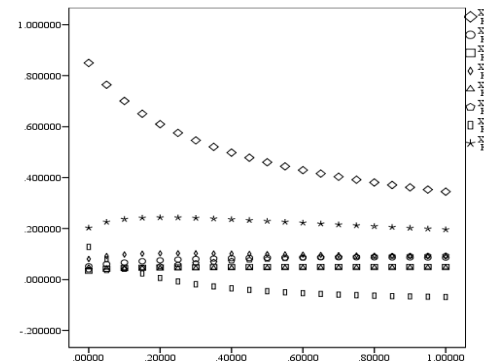
Mult R	0.98969	—	—	—	—
RSquare	0.97948	—	—	—	—
Adj RSqu	0.95553	—	—	—	—

(4) The sum of squared residuals does not increase much;

Finally, the relevant equations are obtained according to the output results.

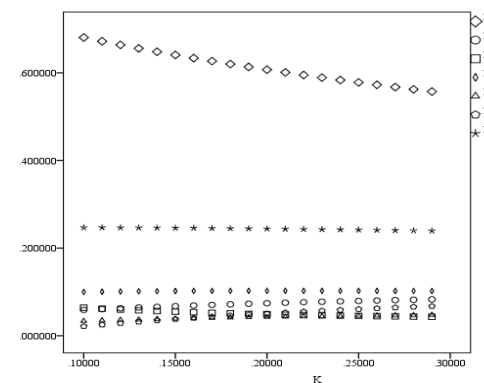
4.3 Establishment of Ridge Regression Equation

By using SPSS software table 1 variable data analysis, the ridge trace map is shown in Figure 1.



1Figure 1 Initial ridge chart

We can see that the ridge trace map is stable between $k=0.2$ and $k=0.4$. When the ridge parameter $k=0.2$, the ridge trace map is basically stable, and X7 tends to 0 quickly in the process of k change. Therefore, it can be judged that the influence of X7 on the dependent variable is very small [11]. So delete the variable X7, change the range of ridge parameters to $[0.1, 0.3]$, step size to 0.01, do a ridge regression again, get the ridge trace diagram as shown in Figure 2.



2Figure 2 Final ridge chart

When the ridge parameter $k=0.15$, the ridge trace graph is basically stable. Then, according to the corresponding R square value of 0.97948 in the SPSS output, the ridge parameter $k=0.15$ can be selected, and then given a given k value, the SPSS software can be reused to analyze the ridge trace graph. The results are shown in Table 5.

SE	0.44076	—	—	—	—
ANOVA table					
	df	SS	MS	F value	Sig F
Regress	7	55.632	7.947	40.90829	0.00012
Residual	6	1.166	0.194		
	B	SE(B)	Beta	B/SE(B)	—
X ₁	0.27792	0.02560	0.64104	10.85585	—
X ₂	0.08166	0.04723	0.06777	1.72899	—
X ₃	0.05188	0.01849	0.05515	2.80584	—
X ₄	0.13518	0.06128	0.10217	2.20594	—
X ₅	0.05238	0.02778	0.03916	1.88553	—
X ₆	0.07747	0.03495	0.03812	2.21659	—
X ₈	0.16599	0.03871	0.24622	4.28802	—
Constant	16.23194	12.41576	0	1.30737	—

According to the above table, the $X_1, X_2, \dots, X_8$ standard regression equation of Y pair is:

$$Y = 0.64104X_1 + 0.06777X_2 + 0.05515X_3 + 0.10217X_4 + 0.03916X_5 + 0.03812X_6 + 0.24622X_8$$

Unstandardized ridge regression equation:

$$Y = 16.23194 + 0.27792X_1 + 0.08166X_2 + 0.05188X_3 + 0.13518X_4 + 0.05238X_5 + 0.07747X_6 + 0.16599X_8$$

Among them, the independent variable statistic B/SE (B) has the smallest value of 1.72899, which is close to 2, so the 6 independent variables are all significant, so it can be judged that the modified model of ridge regression is significantly effective [12].

5. FRUIT ANALYSIS

5.1 Model Results Analysis

According to the above model, it can be seen that the main reasons for the change in the consumer price index are X₁ (consumer price index for food category), X₄ (consumer price index for household equipment, supplies and services category) and X₈ (consumer price index for residential category), of which the final requirement is the food consumer price index, which is the primary driving force of the CPI rise in Anhui Province, followed by the residential category consumer price index, which is the second driving force affecting the CPI change.

5.2 Policy Recommendations

(1) Increasing awareness of cultural education. A large expenditure on food consumption in Anhui Province, while less on education, culture and entertainment, is mainly due to the lack of attention paid to culture and education in rural areas. Therefore, the CPI index of our province can be raised by raising the cultural and educational key consciousness of urban and rural residents in our province, and the cultural level of the province can be raised to promote economic development [13].

(2) Add new points of consumption. At present, the main consumption items in the province are food, so it is necessary to provide new consumption items, one is to promote the balanced consumption of consumers, improve the CPI index, on the other hand, to develop

new project industries [14] to promote the economic development of the province and open up the direction of development.

(3) CHANGING consumption perceptions. With the development of economy, the residents, after meeting the basic consumption conditions, encourage the residents to consume in tourism, entertainment and other aspects, change the original consumption concept, change the savings into consumption, change the single into diversification, and promote the development through consumption, and improve the economy.

(4) Use consumption to promote high-quality economic development. The demand creates the industry, the industry pulls the demand, the Anhui Province economy high quality development needs the consumption to pull [15]. To increase the income of urban and rural residents and encourage residents to consume in many ways is conducive to the overall economic development of Anhui Province, to promote the further popularization of new high-tech industrial products, to achieve coordinated and efficient development in the structure of economic development, and to build a high-quality economic development system in Anhui Province.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No. 19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

- [1]D. Tomi, Statistical Capacity Building of Official Statisticians in Practice: Case of the Consumer Price Index. 2016, 32(4): 827-848;
- [2]P.M.L. Santos, M.L.S. Takemoto, R.A. Fernandes, et al. PRM27 Modelling the Brazilian Extended

Consumer Price Index for Pharmaceutical Products: Comparison Between Exponential Smoothing and Box-Jenkins Methods. 2011, 14(7): 425-426;

[3]T.H. Kim, Y. Park, J. Myung, et al. Food price trends in South Korea through time series analysis. 2018, 165: 67-73;

[4]C. Cuadrado, J. Dunstan, N. Silva-Illanes et al. Effects of a sugar-sweetened beverage tax on prices and affordability of soft drinks in Chile: A time series analysis. 2020, 245.

[5]Zhe Du, Hu Yongguang, N. Ali Buttar, Analysis of mechanical properties for tea stem using grey relational analysis coupled with multiple linear regression. 2020, 260.

[6]Xu Xiaoyuan, Yan Zheng, Probabilistic load flow calculation with quasi-Monte Carlo and multiple linear regression. 2017, 88: 1-12.

[7]C. Stokes, G. Masselink, M. Revie et al. Application of multiple linear regression and Bayesian belief network approaches to model life risk to beach users in the UK. 2017, 139: 12-23.

[8]T. Lemos, J.H. Kalivas, Leveraging multiple linear regression for wavelength selection. 2017, 168: 121-127.

[9]M. Ohishi, H. Yanagihara, Y. Fujikoshi, A fast algorithm for optimizing ridge parameters in a generalized ridge regression by minimizing a model selection criterion. 2020, 204: 187-205.

[10]Liu Yong, Gu Chuan-Qing, Variant of greedy randomized Kaczmarz for ridge regression. 2019, 143: 223-246.

[11]Ł. Górski, M. Jakubowska, Ridge regression with self-Paced learning algorithm in interpretation of voltammetric signals. 2019, 191: 73-81.

[12]H. Yildirim, M.R. Özkale, The performance of ELM based ridge regression via the regularization parameters. 2019, 134: 225-233.

[13]B. Lowe, Frank. Alpert, Forecasting consumer perception of innovativeness. 2015, 45-46:1-14.

[14]Xin Li, Wei Shang, Wang Shouyang et al. A MIDAS modelling framework for Chinese inflation index forecast incorporating Google search data. 2015, 14(2): 112-125.

[15]N. Abdel-Tawab, S. RamaRao, Do improvements in client-provider interaction increase contraceptive continuation? Unraveling the puzzle. 2010, 81(3): 381-387.

The Effect of Accelerated Depreciation Policy of Fixed Assets on Corporate Value

Jin Yang¹, Jia-Ming Zhu^{2,*}, Zi-Yue Zhang¹, Chun-Li Wang³

¹ School of Finance and Public Administration, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

² School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, Anhui, 233030, China

³ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: This article uses the A-share listed companies from 2012 to 2018 as a sample to construct a double differential model to test the policy effect of accelerated depreciation of fixed assets on corporate value. The results of the study indicate that the accelerated depreciation policy for fixed assets has significantly increased the value of enterprises. For smaller enterprises, the accelerated depreciation policy has improved the value of enterprises more than larger enterprises. The expansion found that the accelerated depreciation policy for fixed assets increased the cash flow of the enterprise, eased the pressure on the financing constraints of the enterprise, and promoted the transformation, upgrading and innovative development of the enterprise. This article not only enriches the research on the economic consequences of the accelerated depreciation policy for fixed assets, but also has certain reference significance for further improving the accelerated depreciation policy.

Keywords: Accelerated depreciation; Corporate value; Double difference

1. INTRODUCTION

Since 2012, China's economic development has gradually slowed down. The economic "new normal" requires my country to achieve structural optimization, industrial transformation and upgrading, and high-quality economic development. The contradiction urgently to be solved throughout is the problem of unbalanced development on the supply side and the demand side. In recent years, China's enterprises have entered a bottleneck due to the decline in labor dividends, low production efficiency, low levels of mechanization and intelligence, and the subsequent "supply-side reforms" appear to be particularly in keeping with the times. Required. In addition to starting with the market, the regulatory role of the government's "invisible hand" is also very important. In terms of tax collection and management, the state has also promulgated the policy of accelerated depreciation of fixed assets in the collection of corporate income tax, which aims to reduce the burden on enterprises and stimulate innovation.

2. LITERATURE REVIEW

Since the promulgation of the fixed asset accelerated depreciation policy, its policy effects have been closely watched by scholars. The existing research results mainly focus on the following aspects: (1) The impact of accelerated depreciation of fixed assets on enterprise innovation. Wu Hong, Zheng Jia-xing and others analyzed the listed companies in the manufacturing industry as a sample using the propensity score matching method. The research shows that the accelerated depreciation policy of fixed assets has an incentive effect on the investment of innovative financial resources of the enterprise, and the incentive effect on the investment of innovative talents is not obvious [1]. Li Hao-yang, Cheng Xiao-ke and others also believe that accelerated depreciation of fixed assets can promote R&D investment of enterprises, and this promotion effect is more obvious for enterprises with high tax rates and enterprises in regions with low marketization [2]. Han Ren-yue and Ma Hai-tao pointed out that the tax incentives for accelerated depreciation of fixed assets have no significant incentive effect on corporate R&D investment, and the superposition of multiple tax incentives will weaken the incentive effect [3]. (2) The impact of fixed asset accelerated depreciation policies on fixed asset investment. Cao Yue and Chen Wen-rui believe that the fixed asset accelerated depreciation policy has little effect on the scale of fixed asset investment [4], Liu Qi-ren, and Zhao Can believe that the fixed asset accelerated depreciation policy has a weaker investment sustainability effect and is subject to the company's financing strength [5]. However, Liu Xing, Ye Kangtao, and others, through the "quasi-natural" experiment, concluded that companies enjoying fixed asset accelerated depreciation policies have significantly expanded the scale of investment in fixed assets, and are more likely to occur in small-scale and non-state-owned enterprises with financing constraints [6]. (3) The impact of fixed asset accelerated depreciation policies on corporate income tax. Cen Wen-jing and Wang Zhi-yu pointed out that different depreciation methods have different tax saving effects [7]. In addition to pointing out the role of tax saving, Wan Ya-ping also expounded the accelerated depreciation policy for fixed assets in terms of timing and earnings

management [8].

To sum up, the current academic research on the effects of accelerated depreciation of fixed assets has been fruitful, but there is still no analysis of the impact of accelerated depreciation policies on corporate value. The only research on the relationship between the two is just to point out as the depreciation rate of fixed assets has a positive effect on corporate value, accelerated depreciation, as an effective means of initial financing for an enterprise, can significantly enhance the value of the enterprise. In this paper, we use the double differential model (DID) to explore whether the fixed asset accelerated depreciation policy can effectively increase the value of the enterprise, and make up for the gap in the policy effect of the fixed asset accelerated depreciation policy based on the perspective of enterprise value. At the same time, this paper conducted a robust test of the model to ensure the rigor and reliability of the research.

3. INSTITUTIONAL BACKGROUND AND RESEARCH HYPOTHESIS

3.1 Institutional Background

With the improvement of people's living conditions and the improvement of cultural level and knowledge and skills, China has gradually lost the advantage of abundant and cheap labor resources possessed by a populous country, and labor cost has also become an important factor restricting the development of enterprises. Reducing labor costs is not objectively operable, so the key to breaking the bottleneck lies in enterprise transformation and upgrading, improving technical level and increasing added value of products. But at present our country financial system and market system is not perfect, the enterprise generally has the financing difficulty is big, heavy tax burden, shortage of funds, machinery, equipment renewal speed can't keep up with market changes and other difficulties, coupled with the most enterprises in our country as the private, the private enterprises, the internal capital insufficiency, including external factors together, under the influence of the transformation of enterprise is struggling. At this time, the government is bound to increase policy support to alleviate the pressure of enterprises. Based on this, the government issued a policy on accelerated depreciation of fixed assets in six industries on January 1, 2014, and issued two follow-up policies in September of the same year and the second year in succession to ensure the smooth implementation of the policy. The policy of accelerated depreciation of fixed assets postpones the payment of tax and reduces the cash expenditure of enterprises in tax payment. This policy effectively increases the daily cash flow of enterprises, alleviates the tax pressure before the implementation of projects, and promotes the innovation and development of enterprises. It can be seen that the accelerated depreciation policy of fixed assets is an important measure to promote enterprise

transformation and upgrading under the background of "new normal" and high-quality economic development.

3.2 Research Hypothesis

This paper draws on the studies of Tang Heng-shu [9], Li Jian [10] and others to get the expression (1) of the enterprise value. At this time, the enterprise value is the sum of the net cash flow.

$$V = \sum_{t=0}^{\infty} e^{-rt} NCF_t \quad (1)$$

According to the expression (2) of the net cash flow according to the Douglas production function:

$$NCF_t = [AL_t^\alpha (K_{t-1} + \Delta I_t)^\beta - (\phi L_t + rK_{t-1} + r\Delta I_t + K_{t-1}\sigma)](1-T) + K_{t-1}\sigma \quad (2)$$

Suppose the enterprise's technological progress factor $A=2$, labor input is $L=10$ million yuan, capital input (original value of fixed assets) is $K=40$ million yuan, labor share $\alpha=0.3$, capital share $\beta=0.7$, When the operating cost is 30 million yuan, the discount factor is 0.96.

(1) When depreciation is carried out by the ordinary straight line method, the depreciation period is 10 years, the depreciation rate is 10%, and the remaining conditions remain unchanged.

$$V_1 = [(2 \times 1000^{0.3} \times 5000^{0.7} - 3000) \times 0.75 + 4000 \times 10\%] \times 0.96 = 2666.64$$

(2) Shorten the depreciation period to accelerate depreciation, the depreciation period is 5 years, the depreciation rate is 20%, and the remaining conditions remain unchanged.

$$V_2 = [(2 \times 1000^{0.3} \times 5000^{0.7} - 3400) \times 0.75 + 4000 \times 20\%] \times 0.96 = 2762.64$$

It can be clearly seen that V_1 is less than V_2 . When the accelerated depreciation method is adopted, the enterprise value increases significantly. Based on the above theory and example analysis, hypothesis H1 can be proposed.

H1: The accelerated depreciation policy for fixed assets increases the value of the enterprise.

4. RESEARCH DESIGN AND DATA ANALYSIS

4.1 Data Source and Sample Selection

The data in this paper are derived from the annual financial reports of enterprises in CSMAR database, and the collected data are processed: missing values, outliers and extreme values in the data are deleted, and data that do not conform to accounting standards whose asset-liability ratio is greater than 1 is deleted.

The Caishui [2014] no.75 of the policy shows that: the biological medicine manufacturing industry, special equipment manufacturing industry, railway, shipbuilding, aerospace and other transport equipment manufacturing, computer, communications, and other electronic equipment manufacturing industry, instrument manufacturing, information transmission, software and information technology services such as six companies, January 1, 2014 new purchases of fixed assets in the future, can shorten the useful life or adopting accelerated depreciation method. Therefore, this paper sets the research time interval as 2012-2018,

and selects 10,467 samples from 1662 companies listed in A-shares.

4.2 Variable Definition and Model Setting

4.2.1 Model setting

The double difference model (DID) is a popular policy effect evaluation model. Its basic principle is to set up an experimental group and a control group to evaluate the policy effect. This paper sets the pilot companies in the six major industries as the

$$TobinQ_{i,t} = \alpha + \beta_1 Policy_t + \beta_2 Treat_i + \beta_3 Policy_t \times Treat_i + \beta_4 Size_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Lev_{i,t} + \beta_7 Age_{i,t} + \sum Industry + \sum Year + \varepsilon$$

It can be seen from the above model that $\beta_2 + \beta_3$ is the change in the enterprise value of the accelerated depreciation policy for fixed assets in the experimental group, but it includes the common interference of the policy and other factors. β_2 is the change in the enterprise value of the control group before and after the policy, and the change is only The role of other factors. The net effect of fixed asset accelerated depreciation policy on the enterprise value of the experimental group is β_3 , so the main concern is the coefficient of the interaction term between Policy and Treat. If the coefficient is positive, it indicates that the fixed asset accelerated depreciation policy increases the value of the enterprise, which is consistent with assumption H1 Settings.

4.2.2 Variable description

Table 1 shows the indicators and definitions of model measures. The reasons for choosing these indicators and how are described in detail below.

(1) Enterprise value. This article uses the Tobin Q value commonly adopted by scholars at home and abroad to measure enterprise value. The indicators of enterprise value include financial indicators and enterprise market value. The financial indicators are affected by factors such as accounting packaging and the immaturity of the stock market, which may cause

experimental group (Treat=1), and sets 2014 as the policy implementation year as the event year, and assigns Policy=1 in 2014 and subsequent years, otherwise, the value is Policy=0.

In order to study the impact of preferential policies for accelerated depreciation of fixed assets on corporate value, this paper builds a double differential model (DID) to study the relationship between the two.

more serious data distortions, so they should be carefully selected [11]. Cao Ping and Wang Gui-jun (2019) [12] pointed out that the TobinQ value can reflect the value of the enterprise from both market value and profitability, and can effectively predict the future cash flow of the enterprise. Therefore, the TobinQ value is selected based on the practice of most scholars. Measure corporate value as an agent variable.

(2) Control variables. Drawing on the practice of Liu Wei-jiang and Lu Biao (2018) [13], this paper mainly selects three types of control variables. The first type is the internal factors of the enterprise, including enterprise size (Size) and enterprise age (Age). The logarithm of the company's age is measured by the logarithm of the company's establishment time. The second type is the expression of the degree of corporate financial constraints, including ROA and Lev, ROA is the ratio of net profit to owner's equity, and Lev is total liabilities and total assets Ratio. The third type of variables are external influencing factors. This article controls the industry and the year. The industry dummy variables come from the security code in the financial report. The year includes 2012-2018.

Table 1 Variable definition and description

Variable type	Proxy variables	Definition
Explained variable	TobinQ	Company market value/total assets
Explanatory variables	Post	If the year of the observation is in 2014 or later, the dummy variable takes the value "1", otherwise it takes the value "0".
	Treat	If the observed value is within the range of preferential policies for accelerated depreciation of fixed assets, the virtual variable takes the value "1", otherwise it takes the value "0".
	Post×Treat	The value of the interaction item is "1", then Post=1 and Treat=1, otherwise the value is "0".
Control variable	ROA	Net profit/owner's equity
	Lev	Total liabilities/total assets
	Size	Ln (Company's total assets at the end of the period)
	Age	Ln (Time of establishment)

5. EMPIRICAL TEST AND RESULT ANALYSIS

5.1 Descriptive Statistics

Table 2 shows descriptive statistical results. It can be seen from the table that the mean value of TobinQ is 2.2417, the standard deviation is 3.2131, the minimum

value is 0.0826, and the maximum value is 192.8998. It can be seen that there is a large difference in the enterprise value of the sample enterprises. The standard deviation of ROA and Size in the sample indexes is greater than 1, indicating that the difference

is also large, and the overall difference in other indexes is not large.

Table 2 Descriptive statistics

Variable	Observations	Average value	Standard deviation	Minimum value	Maximum
TobinQ	10,467	2.2417	3.2131	0.0826	192.8998
Post×Treat	10,467	0.7450	0.4359	0	1
ROA	10,467	0.0816	2.3837	-66.5353	204.6896
Lev	10,467	0.4169	0.2409	-0.1947	11.5097
Size	10,467	22.1871	1.2127	16.1613	27.3861
Age	10,467	7.6000	0.0026	7.5843	7.6083

5.2 Time Trend of Corporate Value

Figure 1 compares and analyzes the time change trend of the TobinQ value of the experimental group and the control group. The abscissa is the time year, and the ordinate is the agent value TobinQ value of the enterprise value. The realization group is represented by the solid line, and the control group is the dotted line indicates. From Figure 1 it can be seen that the change trend of the TobinQ value of the experimental group and the control group is basically the same. The double differential model requires that the experimental group and the control group have a

larger common value range. It can be seen that the samples meet the requirements of the double differential model. 2014 is the year of implementation of the accelerated depreciation policy for fixed assets, but the implementation effect of the policy is lagging. It can be seen that the TobinQ value has shown a downward trend since the end of 2015, and the difference between the two groups gradually decreased, but whether the result is fixed the impact of accelerated asset depreciation policy needs further verification.

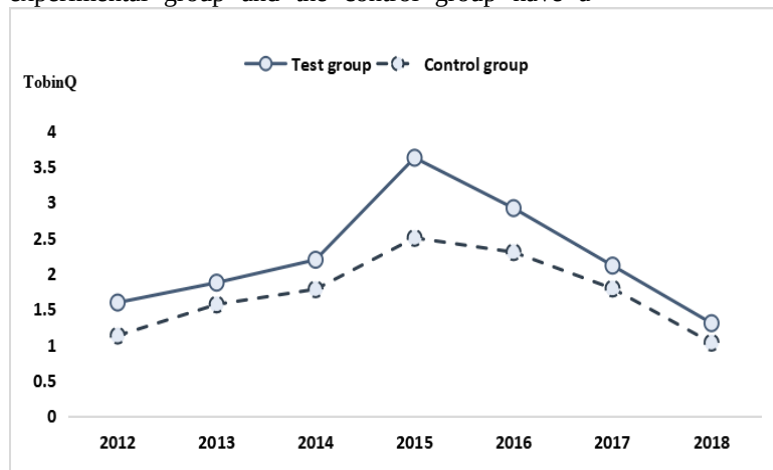


Figure 1 TobinQ value time trend

5.3 Effectiveness Measurement

The measurement of the effectiveness of the accelerated depreciation policy for fixed assets is shown in Table 3. Model 1 is only the effect of accelerated depreciation of fixed assets alone on the value of the enterprise. Model 2 adds the control variables expressed by the degree of financing constraints, Model 3 adds the control variables of internal factors, and Model 4 controls the industry and year. From Table 3, we can find the following: (1) In the four models, the coefficients of the interaction terms are all positive and not large, and all are significant at the level of 1%, indicating that the accelerated depreciation policy of fixed assets improves the value of the enterprise, But the effect is not obvious. (2) After adding the size and age of the enterprise, the interaction coefficient of Model 3

increases significantly, from 0.6740 to 1.0510, which proves that the introduction of this variable significantly affects the policy effect. This is because enterprises of different sizes have different needs for fixed assets, and enterprises of different sizes have different capital scales, financing capabilities, and demands for fixed assets. Therefore, their sensitivity to accelerated depreciation policies for fixed assets varies. (3) The coefficients of the interaction terms of each model are relatively robust, indicating that the model is constructed rationally and is weakly affected by the impact of the missing variables. (4) The control variables expressed by the degree of financing constraints and the control of industry and year have a certain effect on the policy effect, but the effect is not large.

Table 3 Effectiveness measurement of accelerated depreciation policy for fixed assets

Model	Interaction term coefficient	t value	Coefficient of determination R2
Model 1: Interaction terms	0.6830*** (0.0717)	9.5200	0.0090
Model 2: Interactive items + financing constraints	0.6740*** (0.0688)	9.7900	0.0900
Model 3: Interactive terms + degree of financing constraints + internal factors	1.0510*** (0.0644)	16.3200	0.2200
Model 4: Interactive items + degree of financing constraints + internal factors + external factors (industry and year)	1.0540*** (0.0644)	16.3800	0.2210

5.4 Regression Analysis

The double difference model of the policy effect of accelerated depreciation of fixed assets is shown in Table 4. In turn after adding control variables of the model, R² value increased gradually, model 4 R² value maximum, so the model 4 for the final model, and analyzes the results, get the following conclusions: (1) When the enterprise after the policy of accelerated depreciation of fixed assets, the enterprise value of proxies tobinQ value increased 1.054 units, and the results are significant at 1% level, it illustrates the

policy of accelerated depreciation of fixed assets to improve the enterprise value, which conforms to the H1 hypothesis. (2) ROA is significantly positive at 1%, indicating that the higher the return on total assets is under the post-policy effect, the higher the enterprise value will be. (3) Lev, Size and Age are significantly negative at 1%, indicating that under the policy effect, the lower the asset-liability ratio, the smaller the enterprise Size and the younger the enterprise, the higher the enterprise value.

Table 4 Regression result of double difference model of policy effect

Explanatory variables	Tobin Q			
	Model 1	Model 2	Model 3	Model 4
Post×Treat	0.683*** (0.0717)	0.674*** (0.0688)	1.051*** (0.0644)	1.054*** (0.0644)
ROA	—	0.321*** (0.0126)	0.305*** (0.0116)	0.305*** (0.0116)
Lev	—	-2.085*** (0.124)	-0.405*** (0.122)	-0.443*** (0.123)
Size	—	—	-1.021*** (0.0244)	-1.020*** (0.0244)
Age	—	—	-24.17** (10.60)	-24.19** (10.60)
Time fixed effect	NO	NO	NO	YES
Industry fixed effect	NO	NO	NO	YES
Constant term	1.733*** (0.0619)	2.583*** (0.0803)	24.25*** (0.524)	208.1*** (80.60)
Number of samples	10,467	10,467	10,467	10,467
R ²	0.009	0.090	0.220	0.221

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5.5 Robustness Test

In this paper, the data using the unbalanced panel data for 2012-2018, in order to avoid the policy for individual company results caused by different factors are part of the deviation, this paper rebuilds the balance panel data from 2012 to 2018, the running results show that the interaction of coefficient in the 1% significance level is positive, that accelerated depreciation of fixed assets policy can improve the enterprise value. In addition, the policy of accelerated depreciation of fixed assets was officially put into effect on January 1, 2014. The actual implementation of the policy is lagging behind time. Therefore, the

analysis is carried out again in 2014 after excluding the transition year of the policy

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

Taking a-share listed companies from 2012 to 2018 as samples, this paper constructed A double-difference model to study the policy effect of accelerated depreciation of fixed assets. The research conclusions are as follows: Accelerated depreciation of fixed assets increases the value of enterprises; the policy of accelerated depreciation of fixed assets has a greater effect on small and medium-sized enterprises than on large enterprises. The accelerated depreciation policy

of fixed assets effectively alleviates the financing pressure of enterprises with high degree of financing constraint. The conclusion of this paper is conducive to better improve the policy of accelerated depreciation of fixed assets. Based on the above analysis, this paper puts forward the following Suggestions:

First, expand the scope of accelerated depreciation of fixed assets. The policy of accelerated depreciation of fixed assets will be extended to all manufacturing industries, and the policy of accelerated depreciation of fixed assets will be implemented for energy-saving and environmental protection equipment of similar high-polluting enterprises to realize energy conservation and emission reduction, thus promoting sustainable and high-quality economic development. Second, enterprises should adapt policies according to their own conditions. For enterprises with large scale and high value of fixed assets, they can timely update their fixed assets to take advantage of preferential policies and enjoy welfare. For small and medium-sized enterprises can use the new policy of fixed assets to increase the purchase of fixed assets to ease the financial pressure, promote the expansion of enterprise scale. Third, strengthen the deduction means, the process of information degree. There are many kinds of fixed assets, and most of the depreciation year tax and accounting treatment is not consistent, there are long-term differences, if in the declaration, deduction process error, will cause a series of problems, tax risk is evident. Therefore, tax authorities can set up a separate subsystem of accelerated depreciation of fixed assets in the tax filing system to reduce tax workload and enhance the operability of the policy.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No. 19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

REFERENCES

[1]Wu Hong, Zheng Jia-xing, Wang Qiao, "Accelerated depreciation of fixed assets, manufacturer characteristics and enterprise innovation investment: an empirical study based on high-end manufacturing A-share listed companies," *Tax Research*, 2019(11): 34-40.

[2]Li Hao-yang, Cheng Xiao-ke, Gao Sheng-hao, "Do tax incentives affect the R&D investment of enterprises?—Test based on the accelerated depreciation policy of fixed assets," *Scientific Research*, 2017, 35(11): 1680-1690.

[3]Han Ren-yue, Ma Hai-tao, "Preferential taxation methods and enterprise R&D investment: an empirical test based on the double difference model" *Journal of Central University of Finance and Economics*, 2019(03): 3-10.

[4]Cao Yue, Chen Wen-rui, "The policy effect of accelerated depreciation of fixed assets: empirical evidence from Caishui No. 75," *Journal of Central University of Finance and Economics*, 2017(11): 58-74.

[5]Liu Qi-ren, Zhao Can, Huang Jian-zhong, "Preferential taxation, supply-side reform and enterprise investment," *Management World*, 2019, 35(01): 78-96+114.

[6]Liu Xing, Ye Kang-tao, Lu Zheng-fei, "Accelerated depreciation policy and enterprise investment: empirical evidence based on 'quasi-natural experiment'," *Economics (Quarterly)*, 2019, 18(01): 213-234.

[7]Cen Wen-jing, Wang Zhi-yu, "The Impact of Accelerated Depreciation Policy on Fixed Assets on Corporate Income Taxes—Taking Xi'an Aerodynamics Co., Ltd. as an Example," *Finance and Accounting Monthly*, 2015(16): 74-78.

[8]Wan Ya-ping, "Discussion on the impact of accelerated depreciation policy on corporate income tax," *China Collective Economy*, 2019(11): 128-129.

[9]Tang Heng-shu, Liu Jun-xiu, Cheng Yu etc. "Research on fixed asset depreciation model and enterprise value," *Friends of Accounting*, 2018(20): 112-114.

[10]Li Jian, "Research on fixed asset depreciation model and enterprise value," *Chinese and foreign entrepreneurs*, 2018(20): 149.

[11]Zhang Li-min, Li Yan, "Auditing Opinion, Corporate Governance and Enterprise Value of Continuous Operations—Empirical Evidence Based on Companies in Financial Distress," *Audit and Economic Research*, 2017, 32(02): 13-23.

[12]Cao Ping, Wang Gui-jun, "Has 'camp reform' increased the value of enterprises?—Empirical evidence from Chinese listed companies," *Economics and Finance*, 2019(03): 20-30.

[13]Liu Wei-jiang, Lu Bang, "The Impact of the New Deal on Accelerated Depreciation of Fixed Assets on Total Factor Productivity of Manufacturing Enterprises—An Empirical Study Based on Double Difference Model," *Journal of Central South University (Social Science Edition)*, 2018, 24(03): 78-87.

The Fitting of National Debt Term Structure Based on the Changes of NS and NSS Models

Hang Zhang¹, Jia-Ming Zhu^{1,*}, Chun-Li Wang²

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

² Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: The term structure of interest rate refers to a kind of yield curve formed by the relationship between the interest rate levels of different term, which includes maturity yield curve, spot interest rate term structure, forward interest rate term structure and so on. With the help of the commonly used NS (Nelson-Siegel) and its extended model NSS model, the effect of different parameters on the structure of interest rate is analyzed. And using MATLAB mathematical software to draw the figure after the parameter change, and explain the fitting of the function more intuitively on the basis of the figure. Then take the trading data in the treasury bond market in the second half of 2018 as an example to fit the analysis. Finally, it is found that the relationship between interest rate term structure and economic variables is mutual. Based on the results analysis, corresponding policy recommendations are proposed.

Keywords: Term structure of interest rate; Fitting study; NS model; NSS model; MATLAB

1. INTRODUCTION

The term structure of interest rate refers to the relationship between the interest rate level of different term and the remaining period under the same risk. And it is often expressed in the form of yield curve (yield curve), that is, on a graph with term as the horizontal coordinate and interest rate level as the vertical coordinate, an interest rate term structure is a yield curve. To fit the term structure of treasury bonds, we can use the NS model and the NSS model. Among them, the greatest advantage of NS model is that its model parameters are rich in many economic meanings, but limited to fitting more complex shape curves. Given this, NSS model makes an advantage supplement. Based on the NS model, new curvature factors β_3 , new adjustment parameters m_2 and a medium term are added, so more complex and accurate models can be characterized.

The database should be screened before the term structure fitting of the interest rate of national debt. First, bonds used for the same yield curve must be guaranteed to have the same credit rating and tax treatment conditions to ensure that the only difference between these bonds is the residual period; Second, to eliminate the impact of the precise separation of the options contained on the interest rate; Finally, to remove securities with large liquidity differences and

unreasonable pricing; And to ensure that the remaining period of all selected securities covers as far as possible the intervals to be estimated in length of time. In this paper, the method of indirect fitting is used to fit the whole term structure of interest rate by function, so the accuracy will be improved and more convenient.

This paper analyzes the specific influence of the whole term structure of interest rate by fixing one of the parameters of NS and NSS model from the perspective of substitution. Then, with the help of the example analysis, the spot interest rate yield data of the national debt from June 2018 to December 2018 are selected. And the recession rate of the index τ is set to 0.8, so that the parameter fitting estimation is carried out. Different confidence levels were set to evaluate the prediction accuracy of the model. The results show that with the improvement of confidence level, the fitting accuracy of the model becomes more and more stable, and the prediction ability of the parameters becomes stronger and stronger.

2. LITERATURE REVIEW

There are many researches on NS model and NSS model, and the main research focus is different. For example, Guo Jimin and others have fitted the validity of the spot yield curve based on Nelson-Siegel model and analyzed the economic significance of the model parameters [1]. Zhu Wenting's research shows that VAR model is more accurate in predicting Nelson-Siegel model parameters [2]. A vector autoregressive model of four parameter factors affecting the term structure of interest rate in the NSS model was developed by Zhang Qikun and the out-of-sample prediction was carried out [3]. Chen Fangfei and others found that the prediction effect of NS model is better than that of random walk model [4].

This paper, combining with previous studies, further explains and compares the NS and NSS models, and the main difference is to analyze the effect of the spot interest rate on the national debt from the perspective of fundamental parameter change. At the same time with the help of MATLAB mathematical software visual display, can help readers more intuitive understanding of its action process. Finally, the paper adopts the data of the treasury bonds of Shanghai Stock Exchange and carries out the fitting research with the help of the more reliable NSS model.

3. MODEL PREPARATION

This paper mainly discusses the term structure of the spot interest rate in the treasury bond market, then needs to use the spot interest rate function. Therefore, it is necessary to introduce the two models associated with the spot rate function in the NS and NSS models.

3.1 Ns Model (Nelson-Siegel)

On the basis of the term structure model of dynamic interest rate, Nelson and Siegel derived the formula of instantaneous forward interest rate in the form of Table 1. NS Main parameters and specific implications of the model

Symbol parameters	Explanatory note
m	The adjustment parameter of the function, the attenuation velocity determined $\beta_1 \beta_2$
β_0	Determining long-term interest rates, reflecting changes in levels
β_1	Determine short-term interest rates, reflecting changes in slope
β_2	Determine short-term interest rates to reflect changes in curvature
$R(0,s)$	From the present moment until the s moment in the future

3.2 Nss Model (Nelson-Siegel-Svensson)

The NS model can only fit the curve of rising, falling, falling first and then rising, but it cannot generate more abundant curve, so the NS model can be extended to NSS model, and the short and medium term part can be added. Therefore, the spot rate function of NSS model can be established on the

Table 2. NSS Main parameters and specific meanings of the model established outside the NS model

Symbol parameters	Explanatory note
β_0	Level factor reflecting long-term interest rates
β_1	slope factor, reflecting the degree of inclination
β_2	Curvature factor reflecting degree of bending
β_3	Curve adjustment factor, new curvature parameter $\beta_1 \beta_2$
m_1	Function adjustment parameters in NS model
m_2	Adjust parameters for new functions
τ_1, τ_2	Position of the extreme point of the control yield curve
t	Remaining period
$R(0,s)$	New short- and short-term after the spot rate function

4. ANALYSIS OF THE EFFECT OF THE CHANGE BASED ON MODEL PARAMETERS

4.1 Parameter Change Assumptions

To analyze the fitting effect evaluation of each parameter change in the NS model and the NSS model on the interest rate term structure, we first assume the specific original value as well as the change value of the parameter. Then, with the help of MATLAB mathematical software, we use the above model function formula to fit, and analyze the function after adding the new parameter by visual view more intuitively.

Hypothesis one: In the NS model, the most important is $\beta_0, \beta_1, \beta_2$ and m these four influence parameters, in which the initial parameters are assumed to be:

$$\beta_0 = 5\%, \beta_1 = -1.5\%, \beta_2 = 1\%, m = 3.$$

Question one: Assuming that the values of the two

index in 1987:

$$f(0,s) = \beta_0 + \beta_1 e^{-\frac{s}{m}} + \beta_2 e^{-\frac{s}{m}} \frac{s}{m} \quad (1)$$

Based on the relationship between the spot rate and the instantaneous interest rate, the function of the spot interest rate can be deduced:

$$R(0,s) = \frac{1}{s} \int_0^s f(0,\tau) d\tau = \beta_0 + \beta_1 \frac{1 - e^{-\frac{s}{m}}}{\frac{s}{m}} + \beta_2 \left(\frac{1 - e^{-\frac{s}{m}}}{\frac{s}{m}} - e^{-\frac{s}{m}} \right) \quad (2)$$

Parameter interpretation and economic implications of formula (1) and (2), as shown in the Table 1.

basis of NS model:

$$r(t) = R(0,s) = \beta_0 + \beta_1 \frac{1 - e^{-\frac{s}{m_1}}}{\frac{s}{m_1}} + \beta_2 \left(\frac{1 - e^{-\frac{s}{m_1}}}{\frac{s}{m_1}} - e^{-\frac{s}{m_1}} \right) + \beta_3 \left(\frac{1 - e^{-\frac{s}{m_2}}}{\frac{s}{m_2}} - e^{-\frac{s}{m_2}} \right) \quad (3)$$

Formula (3) New parameter interpretation and economic implications, as shown in the Table 2.

parameters β_1 and β_2 are the percentage integer of the change between [-6%, 6%]. The term structure of the interest rate is compared by the change value and the initial value, and the concrete influence of slope parameter β_1 and curvature parameter β_2 are analyzed at the same time.

Hypothesis two: First expand the NS model into a NSS model, and then assume that the six parameter values are respectively: $\beta_0 = 5\%, \beta_1 = -1.5\%, \beta_2 = 1\%, \beta_3 = -1\%, m_1 = 3, m_2 = 0.3$.

Question two: In the same problem one, assuming that the new parameter β_3 is the percentage integer of the change between [-6%, 6%], we further analyze the actual function and the specific influence of the new parameters by comparing the initial parameters in the NSS model and the interest rate term structure under different value parameters.

4.2 Impact Analysis

(1) For question one

NS model, it is assumed that the two parameter values β_1 and β_2 are the percentage integer of the change between $[-6\%, 6\%]$. The term structure of interest rate is compared by the change value and the initial value, and the concrete influence of slope parameter β_1 and curvature parameter β_2 are analyzed at the same time.

$\beta_0 = 5\%$, $\beta_1 = -1.5\%$, $\beta_2 = 1\%$, $m = 3$ First set according to the NS model parameters, when, that is, the long-term factor of setting the term structure of interest rate is 5%, the short-term factor is -1.5%, the medium-term factor is 1%, and the adjustment parameter is 3, its term structure of interest rate is shown in Figure 1.

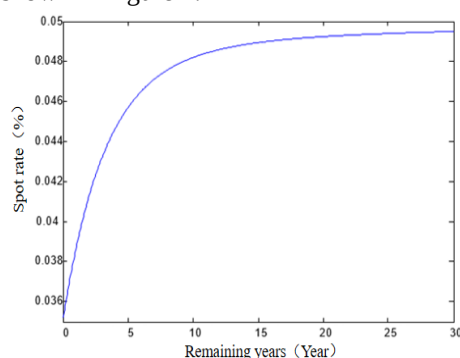


Figure 1 Structure of interest rate term under assumed conditions

With the increase of bond maturity in the market, the yield of bond maturity increases rapidly in the initial period, but when it increases to a certain extent, the increment of yield is not obvious.

When β_1 is rounding the percentage change within $[-6\%, 6\%]$, the interest rate term structure is shown in Figure 2.

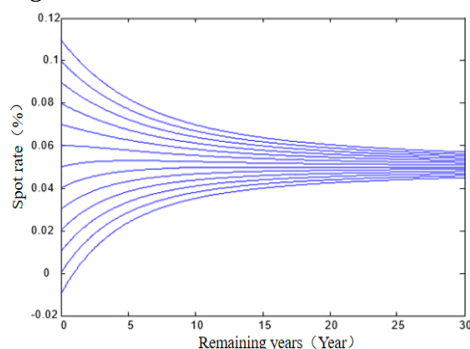


Figure 2 Term structure of interest rates when changing in the $[-6\%, 6\%]$ interval

Among them, the bottom curve of the graph is -6% , and the top curve is 6% . It can be seen that when the slope factor increases gradually from negative number to positive number, the slope degree of the curve decreases gradually first, then changes the direction and gradually becomes larger.

It can be seen that with the increase of the remaining period, the level of interest rate will increase; when the structure of interest rate term is close to the level,

it shows that the difference between short-term and long-term interest rate levels is not large. From Figure 2, when β_1 passing through zero from -6% to $+6\%$, the interest rate yield is almost horizontal, no matter how much the bond price, and maturity, will not fluctuate too much.

When the curvature parameter β_2 is rounded within $[-6\%, 6\%]$ with the change of the percentage, the term structure of interest rate is shown in Figure 3.

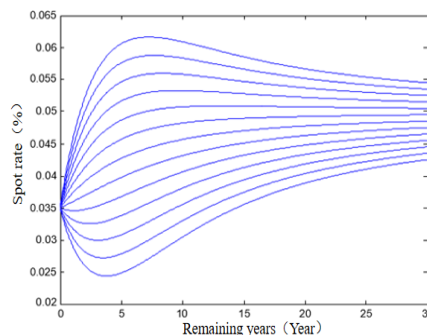


Figure 3 The term structure of interest rate when changing in $[-6\%, 6\%]$ interval

The top curve of the figure is 6% , and the bottom curve is -6% . When it increases gradually from negative to positive, the bending degree of the curve decreases gradually and changes the bending direction gradually.

Moreover, by changing the change of parameter m , if the m value is small, the convergence rate of β_1 and β_2 are faster, and the curve with longer term can be well fitted; Otherwise, the larger the m value, the slower their convergence rate will be, but the better fit the yield curve with shorter term.

(2) For question two

The NS model is extended to the NSS model. on the basis of problem one, assuming that the new parameter β_3 is a percentage integer of variation between $[-6\%, 6\%]$, the actual function and the specific influence of the new parameter are further analyzed by comparing the initial parameters and the interest rate term structure under different value parameters in the NSS model.

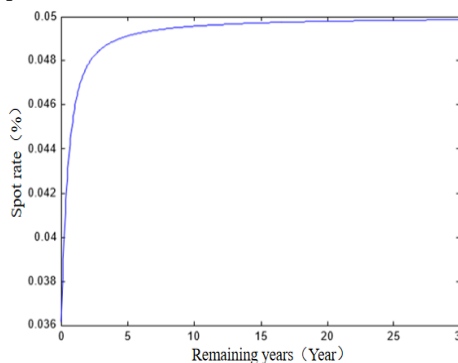


Figure 4. Structure of interest rate term under hypothesis two

$\beta_0 = 5\%$, $\beta_1 = -1.5\%$, $\beta_2 = 1\%$, $\beta_3 = -1\%$, $m_1 = 3$, $m_2 = 0.3$ Firstly, according to the function

formula of the extended NSS model, six parameters are set for a time, and the term structure of interest rate is drawn by using the MATLAB as shown in Figure 4.

By changing the new parameter β_3 so that they are rounded within $[-6\%, 6\%]$, the other parameter values remain the same, so that the term structure of interest rate can be obtained as shown in Figure 5

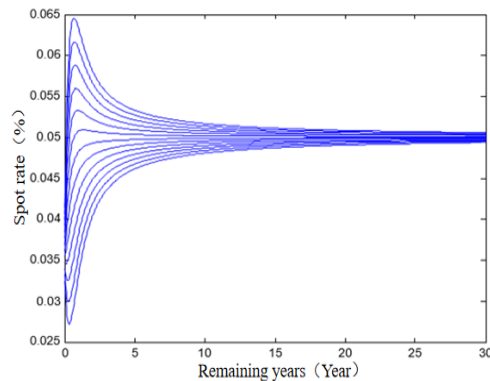


Figure 5 Term Structure of Interest Rate when Curve Parameters Change

The bottom curve of the figure is -6% , and the top curve is 6% . It can be seen that when the curve β_3 gradually increases from negative to positive. The

Table 3 NSS Changes in indicator values due to changes in parameters

Parameters	Mean	Standard deviation	Sequence correlation	β_0	β_1	β_2
β_0	2.87	0.58	0.77	1	-0.42	0.23
β_1	-1.36	0.82	0.56	-0.42	1	0.01
β_2	-1.30	2.00	0.80	0.23	0.01	1

And then compare the yield of the adjusted eight-term treasury bonds, using NSS model to fit. In addition, the model's fitting prediction effect is estimated, and the parameter estimation of mean square error in mathematical statistics is used to calculate. The formula is as follows:

Table 4 Comparison of Prediction Accuracy with Different Gradients of Confidence Level

Confidence level (%)	0	10	20	30	40	50	60	70
Number of days projected	148	136	108	96	88	68	50	30
Fit accuracy	52%	58.8%	60%	68.2%	70.3%	83.2%	93.7%	98.5%

The prediction results show that with the increasing of confidence level, the fitting accuracy of the model becomes more and more stable, and the change of parameters becomes more and more powerful to the prediction ability in the future.

6. CONCLUSIONS

1. By comparing the changes of NS and NSS parameters to analyze the fitting degree under the structure of interest rate term in different cases, we can see that the size of the parameter m will determine the speed of convergence, and the length of the fitting curve term. If the m is large and the convergence rate β_1 and β_2 are slow, the bonds with short fitting period are more suitable, whereas those with longer fitting period are more suitable. In addition, β_1 , β_2 and β_3 may also decide which kind of maturities the bond uses to fit. When their

short-term bending degree of the curve gradually decreases and changes the bending direction gradually becomes larger, and the mid-term tilt degree first changes from large to small, and then changes the direction from small to large. As can be seen, the change of yield is more sensitive to the change of new curvature parameters, which is also obviously different from NS model.

5. EXAMPLES

5.1 Data Sources

Data from the Shanghai Stock Exchange, From June 2018 to December 2018, and then, according to the distribution of the duration of the Treasury bonds, They can be adjusted to the following nine periods: 0.5, 2, 3, 4, 5, 7, 9 and 12. In cases where the expiration date is inconsistent, we can adjust them to the range of these eight expiration periods using the MATLAB Lagrange interpolation method.

5.2 Fitting Effect Estimates

First, the decline rate of the index τ is set to 0.8, and then with the help of the NSS model, the three different parameters β_0 , β_1 , β_2 in the NSS model are correlated with the mean, standard deviation, and sequence. The statistics are detailed in Table 3.

$$MSE_t = \frac{\sum_{i=1}^N (R_{i,t} - \hat{R}_{i,t})^2}{N} \quad (4)$$

In addition, it is necessary to set the confidence levels at all levels, and it is concluded that the model fitting accuracy under different confidence level gradients is shown in Table 4.

convergence rate is slower, can be used to fit the longer term bond maturity; vice versa can be used to fit the shorter term, and the effect is obvious. All of these can be used as the discriminant method for selecting the term fitting structure model of national debt.

2. Through the example analysis of this paper, we can see that using the function to fit the whole interest rate term structure, the smoothness of the obtained curve is also good. The smoothness of the NSS model is better than that of the NS, and perhaps that's why many European banks and the Bank of England use the model to estimate the maturity structure of interest rates. At the same time, it is found that the accuracy of NSS model prediction increases with the increase of confidence level.

7. RECOMMENDATION

When fitting and predicting the interest rate structure of national bonds, corporate bonds and local bonds, it is necessary to ensure the sufficient amount of sample data and prevent the credibility of the model from decreasing on the predictability. It is suggested that the research department choose the comprehensive effect of several models in the model fitting prediction, so as to avoid the unpredictability caused by a single model, and the combination type is more accurate. According to the national conditions can be appropriate to establish the yield curve of national debt, or according to the national debt data to establish the corresponding matching model. Which should not only take into account theoretical factors, but also accommodate realistic factors.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No. 19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

[1]Guo Jimin, Zhang Jiwei, "Prediction of yield curve of bond based on Nelson-Siegel model Bonds," 2016, (7): 66-72.
 [2]Zhu Wenting, "The Application of Nelson-Siegel Model in the Term Structure of Chinese National Bond Interest Rate," Fudan University, 2013.
 [3]Zhang Qikun, "Time series analysis of influencing factors of interest rate term structure based on NSS model," Journal of Chifeng University (Natural Science Edition), 2014, 30(11): 109-113.
 [4]Chen Fangfei, Shen Changzheng, "Prediction of Nelson-Siegel Model and Bond Yield Curve," Statistics and Decision Making, 2006, (4): 133-135.
 [5]A. Ang, G. Bekaert, M. Wei, "The term structure of real rates and expected inflation," Journal of Finance, 2008, 63(2): 797-849.
 [6]A. Ang, J. Boivin, S. Dong, R. Loo-Kung, "Monetary Policy Shifts and the Term Structure," Review of Economic Studies. 2011, 78(2): 429-57.
 [7]J. Annaert, A.G.P. Claes, M.J.K. De Ceuster, H. Zhang, "Estimating the spot rate curve using the Nelson-Siegel model A ridge regression approach," International Review of Economics & Finance, 2013, 27: 482-96.
 [8]C. Cakmakli, "Modeling the density of US yield curve using Bayesian semiparametric dynamic Nelson-Siegel model," Econometric Reviews, 2019.
 [9]J.H.E. Christensen, F.X. Diebold, G.D. Rudebusch,

"The affine arbitrage-free class of Nelson-Siegel term structure models," Journal of Econometrics, 2011, 164(1): 4-20.

[10]P. Christoffersen, S. Heston, K. Jacobs, The Shape and Term Structure of the Index Option Smirk: Why Multifactor Stochastic Volatility Models Work So Well," Management Science, 2009, 55(12): 1914-32.

[11]F.X. Diebold, C. Li, V.Z. Yue, Global yield curve dynamics and interactions: A dynamic Nelson-Siegel approach," Journal of Econometrics, 2008, 146(2): 351-63.

[12]M. Fernandes, F.Vieira, A dynamic Nelson-Siegel model with forward-looking macroeconomic factors for the yield curve in the US," Journal of Economic Dynamics & Control, 2019, 106.

[13]G. Gauthier, J.G. Simonato, "Linearized Nelson-Siegel and Svensson models for the estimation of spot interest rates," European Journal of Operational Research, 2012, 219(2): 442-51.

[14]N.S. Gronborg, A. Lunde, "ANALYZING OIL FUTURES WITH A DYNAMIC NELSON-SIEGEL MODEL," Journal of Futures Markets, 2016, 36(2): 153-73.

[15]M. Guidolin, M. Pedio, "Forecasting and trading monetary policy effects on the riskless yield curve with regime switching Nelson-Siegel models," Journal of Economic Dynamics & Control, 2019, 107.

[16]S. Joslin, M. Pribsch, K.J. Singleton, "Risk Premiums in Dynamic Term Structure Models with Unspanned Macro Risks," Journal of Finance, 2014, 69(3): 1197-233.

[17]K.H. Kang, "Forecasting the Term Structure of Korean Government Bond Yields Using the Dynamic Nelson-Siegel Class Models," Asia-Pacific Journal of Financial Studies, 2012, 41(6): 765-87.

[18]S.J. Koopman, M.I.P. Mallee, M. Van der Wel, "Analyzing the Term Structure of Interest Rates Using the Dynamic Nelson-Siegel Model With Time-Varying Parameters," Journal of Business & Economic Statistics, 2010, 28(3): 329-43.

[19]L. Krippner, "A THEORETICAL FOUNDATION FOR THE NELSON-SIEGEL CLASS OF YIELD CURVE MODELS," Journal of Applied Econometrics, 2015, 30(1): 97-118.

[20]J. Levant, J. Ma, Investigating United Kingdom's monetary policy with Macro-Factor Augmented Dynamic Nelson-Siegel models. Journal of Empirical Finance, 2016, 37: 117-27.

[21]V. Virmani, "On estimability of parsimonious term structure models: an experiment with the Nelson-Siegel specification," Applied Economics Letters, 2012, 19(17): 1703-6.

[22]J.H. Wright, "Term Premia and Inflation Uncertainty: Empirical Evidence from an International Panel Dataset," American Economic Review, 2011, 101(4):1514-34.

[23]X. Zhu, S. Rahman, "A regime-switching

Nelson-Siegel term structure model of the 44: 1-17.
macroeconomy,” Journal of Macroeconomics, 2015,

The Impact of Foreign Direct Investment on the Upgrading of China's Industrial Structure Based on the VAR Model

Yi-Hui Wang¹, Jia-Ming Zhu^{2,*}, Yue Jin¹, Chun-Li Wang³

¹ Finance College, Anhui University of Finance and Economics, Bengbu, 233030, China

² School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

³ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: Based on the annual data of OFDI and industrial structure from 2003 to 2018, it can be seen that China's OFDI is mainly concentrated in developing countries, and the main body of the market is becoming more and more rational, the industrial structure turns to the "three two one" type, and the new industrial vitality is gradually released. To explore the impact of OFDI on the upgrading of China's industrial structure, this paper uses the Tyr index to measure the rationalization of industrial structure, and uses the VAR model to carry out model. According to the research, OFDI has a positive effect in influencing the upgrading of industrial structure, and the later positive effect begins to weaken. The inhibition effect gradually increases year by year by year.

Keywords: OFDI; Upgrading of industrial structure; VAR model; Measured analysis

1. INTRODUCTION

With the introduction of China's "Belt and Road" strategy in 2013, domestic enterprises began to "go out" on a large scale, actively explore new markets, seek resources, improve their own efficiency level, foreign direct investment (hereinafter referred to as OFDI) gradually increased the breadth and depth of the development, to achieve a qualitative growth trend. In the era of economic integration and development, No country or region can be separated from the international market, only rely on their own conditions to develop the economy. Making full use of the advantages of international resources, technology and capital, and strengthening cooperation and contact with various countries are the only way to develop and progress in our time. The rapid development of foreign direct investment has promoted the process of China's foreign trade and brought remarkable economic benefits to China. However, under the background of the new normal, China has also exposed the pressure from international competition, resource allocation, environmental constraints and so on, in order to make steady progress in the new situation, we must give full play to our own advantages, actively promote reform and innovation, speed up the process of structural transformation, and promote the upgrading of industrial structure. The upgrading of industrial

structure has played a role in promoting economic development and economic restructuring, while the development of foreign direct investment is the strategic demand to promote industrial structure adjustment and supply-side reform. In order to further promote the implementation of the "going out" strategy and promote the development of economic globalization, China must raise the level of foreign direct investment and speed up the upgrading of industrial structure. This paper is mainly based on the VAR model for empirical analysis, in order to obtain the impact of OFDI on the transformation and upgrading of industrial structure.

Related literature mainly studied the relationship between OFDI and industrial structure development based on the data of provinces, cities, and industries, and the methods of demonstration mainly adopted grey correlation analysis and VAR model. Using the panel data of Zhejiang province from 2002 to 2012, Yu Jiagen [1] analyzed the differences between OFDI and various urban industrial structures based on the fixed effect. Guo Huaizhao and Zhou Rongrong [2] used the grey correlation analysis method to research the industrial upgrading of Jiangsu Province. Regionally, Asia is the most correlated area, followed by Africa. In terms of industry, the manufacturing industry has the highest correlation degree, followed by the retail and wholesale industry. Wang Jipeng [3] empirically analyzed that OFDI has a time-lag effect on the upgrading of the domestic manufacturing industry structure, and the promoting effect first rises and then declines. Xie Guangya and Du Junjun [4] adopted the grey correlation analysis method to study 8 industries and 173 countries, indicating that the financial industry has a prominent effect on the optimization and upgrading of industrial structure. In addition, China has the highest correlation degree in developing countries and the lowest correlation degree to newly industrialized countries. Tang Jing and Yu Lixin [5] concluded through correlation analysis that different industries have diverse degrees of influence on the adjustment of industrial structure, and the investment correlation degree of technology acquisition, contract labor, market development, and resource acquisition is highly related. Yang Ying, Liu Caixia [6] study the

relationship between OFDI and the upgrading of China's industrial structure under the background of "Belt and Road", and through empirical studies of 64 countries along the route, it shows that the impact of FOREIGN direct investment in China's industrial upgrading is not significant, and the adjustment of China's industrial structure will promote the development of Outward Foreign direct investment; Li Dongkun, Deng Min [7] using the panel data of China's inter-provincial, based on the space Dubin model from the rationalization of industrial structure and industrial results from the high degree of two convenient to measure the spillover effect of inter-provincial OFDI. The empirical results show that inter-provincial OFDI has obvious promotional effect on the former, and the effect on the latter is not obvious.

2. OVERVIEW OF CHINA'S OUTWARD FOREIGN DIRECT INVESTMENT AND UPGRADING OF INDUSTRIAL STRUCTURE.

2.1 Overview of China's Industrial Structure.

In the face of the complex international situation, China's industrial restructuring has accelerated, with its internal structure has become more reasonable, and economic vitality has been fully unleashed. From 2003 to 2018, the proportion of value added of various

industries in China's GDP can be seen that the primary industry (agriculture) to the national economy, and since 2004, the proportion of industrial value added has been declining trend, tending to about 10%, secondary industry (industry) in the national economy, since 2011, the proportion of industrial value added has been declining year by year, tending to about 40%, and the contribution rate of tertiary industry (service industry) to the national economy is increasing. The proportion of industrial value added is increasing year by year. From Figure 1, the value added of the tertiary industry exceeded the secondary industry for the first time in 2012, occupying the leading position in the industry. This indicates that China's industrial structure in 2012 has undergone an iconic change, from the "231" industrial type to the "three-two-one" industrial type, to achieve the transformation from a lower-level form to a higher form, the industrial structure has been continuously upgraded. So far, although China's industrial structure has made outstanding achievements, but also faced with the problem of high deficiency, at this stage, how to use the existing production conditions to promote the high-quality development of industrial structure is particularly critical.

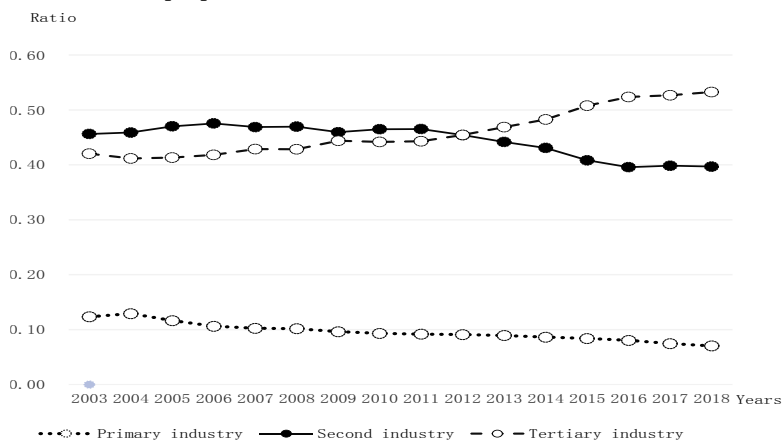


Figure 1 The proportion of industrial increase in GDP from 2003 to 2018. Source: national bureau of statistics

2.2 The Situation of Outward Foreign Direct Investment.

Since the 12th five-year plan period (2011-2015), China's OFDI has made steady progress and moved toward diversified development, playing a prominent role in promoting industrial transformation and upgrading.

In terms of investment scale, China's OFDI has a growing influence on global OFDI and is an important force in the world's economic development. At the end of 2018, OFDI traffic accounted for 14.1% of the global total, ranking the second in the world and ranking the top three in the world for seven consecutive

years. At the end of 2018, OFDI stock accounted for 6.4% of the global total, ranking the third in the world and achieving a huge breakthrough in the world ranking. From Figure 2, China's OFDI stock and flow situation can be seen from 2003 to 2018, China's total foreign direct investment in both stock and flow volume is growing from 2003 to 2016, from 2016 onwards, China's OFDI flow has been declining for three consecutive years, in 2017, the growth rate of OFDI stock began to slow down, which shows that the Chinese market began to attach importance to high-quality investment, foreign investment more mature and rational.

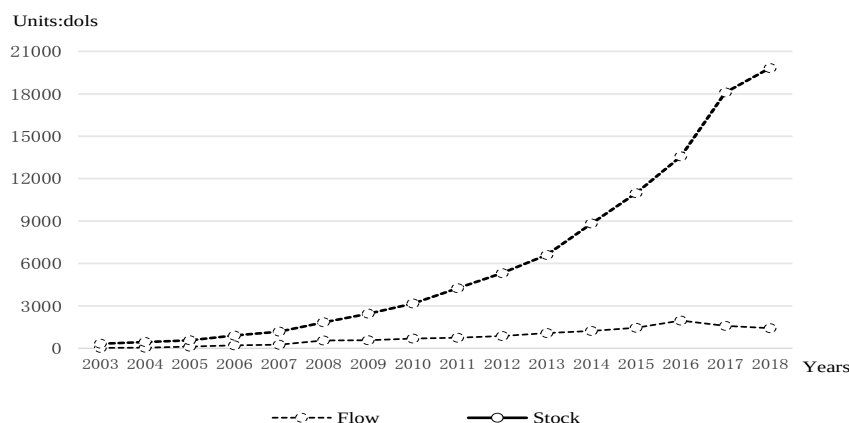


Figure 2 China's OFDI stock and flow trends from 2003 to 2018

Data source: statistical bulletin of China's OFDI in 2018.

From the point of view of investment industry, the distribution of Chinese foreign direct investment in various industries is very different. At the end of 2018, China's OFDI stock was concentrated in the tertiary industry of nearly 80%, followed by the secondary industry reached 21.4%, the stock of primary industry is only 0.6%. In terms of the sector category of the national economy, traditional industries continue to dominate, with leasing and business services accounting for 34.1%, followed by wholesale and retail trade at 11.7%.

From the investment region, mainly to Asia and Latin America, investment flows to the main sectors of wholesale and retail trade, accounting for a total of 84.0%, indicating that China's investment is concentrated in developing countries, Africa and North America, the proportion of investment increased significantly, year-on-year growth of 31.5% and 34.2%, respectively, the proportion of investment in Europe and Oceania decreased year-on-year, down 64.3% and 56.5% year-on-year, respectively. Among Asia, China has the highest proportion of OFDI in Hong Kong, followed by Singapore. In the Americas, the country or region with the highest proportion of China's OFDI is the United States. In addition, with the implementation of the "Belt and Road" strategy, Chinese enterprises are actively investing in countries along the route, making China's of-foreign direct investment in the region towards diversification.

3. ANALYSIS OF THE MECHANISM OF OFDI'S INFLUENCE ON INDUSTRIAL STRUCTURE UPGRADING.

3.1 The Mechanism of the Influence of Resource-Seeking OFDI on Industrial Upgrade

In the course of economic development, a country or region often lacks some important resources, which hinders the process of upgrading industrial structure. OFDI can make full use of the abundant resources of the invested countries, alleviate the plight of domestic or regional resources and meet the needs of domestic development. At the same time, cheap resources can also reduce the production costs of enterprises in the

production process, thereby bringing more economic benefits.

3.2 The Mechanism of the Influence of Market-Seeking OFDI on Industrial Upgrade

Because of the saturation of the domestic market and fierce market competition, investors are shifting their resources to countries with insufficient domestic demand to avoid overcapacity. Through plant production and operation in the host country, we can expand market share, on the one hand, promote the economic development of the host country, promote cooperation and exchanges among trading countries, on the other hand, help the investor countries to break through trade barriers, reduce the cost of trade, coupled with the expansion of the market brought about by the huge economic benefits, the overall development of the domestic industry is very beneficial.

3.3 The Mechanism of the Influence of Technology-Oriented OFDI on Industrial Upgrade

Technological progress is the key factor to improve production efficiency and reduce production costs, and promote the upgrading of industrial structure by affecting the demand and supply of industries. Direct investment by investment countries in countries with technological advantages can, on the one hand, expand the market of the investing country and enhance its competitiveness. On the other hand, we can obtain the advanced technology of the host country, improve the technical level of domestic industry, and promote the optimization of industrial structure.

4. EMPIRICAL ANALYSIS.

4.1 Variable Selection and Processing

To explore the influence of OFDI on industrial structure, this paper selected OFDI index and TL index of industrial structure upgrading to build the VAR model. The ratio of OFDI stock to GDP is selected as the indicator of OFDI. The industrial structure upgrading index is measured according to the Theil index proposed by Gan Chun-hui [8]. The formula is as follows:

$$TL = \sum_{i=1}^n \left(\frac{Y_i}{Y} \right) \ln \left(\frac{Y_i}{L_i} / \frac{Y}{L} \right) \quad (1)$$

Among them, TL stands for Theil index, Y stands for output value, and L stands for industry employees. When the economic structure is in balance, TL=0. When the Theil index is used to measure the reasonable degree of industrial structure, the larger the TL value is, the more unreasonable the industrial structure will be, indicating that the industrial structure is not developing towards the direction of transformation and upgrading.

4.2 Data Sources

The indicators to measure the upgrading of the industrial structure come from the national bureau of Table 1 The result of ADF test

Variable	Inspection (C, T, K)	ADF Statistic	1% Critical Value	5% Critical Value	10% Critical Value	Conclusion
TL	(0, 0, 1)	-2.8686	-2.7406	-1.9684	-1.6044	Stationary
D(TL)	(C, T, 0)	-4.1495	-4.8000	-3.7912	-3.3423	Stationary
D(TL,2)	(C, 0, 0)	-6.9196	-4.0579	-3.1199	-2.7011	Stationary
OFDI	(C, T, 0)	-1.1316	-4.7283	-3.7597	-3.3250	Unstationary
D(OFDI)	(C, 0, 0)	-2.3528	-4.0044	-3.0989	-2.6904	Unstationary
D(OFDI,2)	(C, 0, 0)	-3.0588	-2.7550	-1.9710	-1.6037	Stationary

2) The determination of hysteresis order. The fluctuation of the target variable is not only related to the influence of the current period but also needs to consider the influence of the lag period in order to ensure the accuracy of the analysis. When the order of lag period is too large, in order to avoid the validity and consistency problems above, according to the information criterion, when the lag order is 1, the results in the Table 2 are all the minimum values. After the optimal lag order is determined to be 1, the following regression analysis equation can be obtained.

$$OFDI = 0.880342 * OFDI(-1) - 0.129261 * TL(-1) + 0.041747$$

$$TL = 0.124311 * OFDI(-1) + 0.959038 * TL(-1) - 0.012272$$

Table 2 Optimal hysteresis order results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	51.88779	NA	8.40e-07	-8.314631	-8.233813	-8.344553
1	96.12955	66.36265*	1.05e-09*	-15.02159*	-14.77914*	-15.11136
2	96.95004	0.957237	1.94e-09	-14.49167	-14.08758	-14.64128
3	100.8390	3.240795	2.49e-09	-14.47317	-13.90744	-14.68262
4	107.8516	3.506314	2.62e-09	-14.97527	-14.24791	-15.24457*

Note: * represents the optimal lag order selected under each information criterion.

3) Stability test of the model. Stability is the basis of model establishment, which can be intuitively reflected by the AR root diagram. As shown in Figure 3, the roots of all the characteristic equations are in the circle, indicating that the model can analyze the current and future dynamic processes of endogenous variables

statistics, and the OFDI data are summarized according to the statistical bulletin of China's OFDI in 2018.

4.3 Empirical Analysis

This paper studies the impact of China's OFDI on the upgrading of domestic industrial structure, and conducts an empirical test by building the VAR model, to study the dynamic changing relationship among various variables over time.

1) In order to prevent false regression, ADF unit root is used for testing, and the results are shown in table 1. According to the ADF test in Table 1, only the original sequence of the variable TL was stable. After the difference treatment, all the second-order sequence difference variables passed the stationarity test.

(2) The regression equation with the industrial structure upgrading index as the dependent variable has a determination coefficient of 0.9831. The fitting degree of the model is good which indicates that the index of OFDI has a high degree of explanation to the industrial structure upgrading index. When the number of parameters increases, the degree of freedom decreases. When the lag period is too small, the residual sequence may appear autocorrelation, resulting in parameter error.

through the stability test.

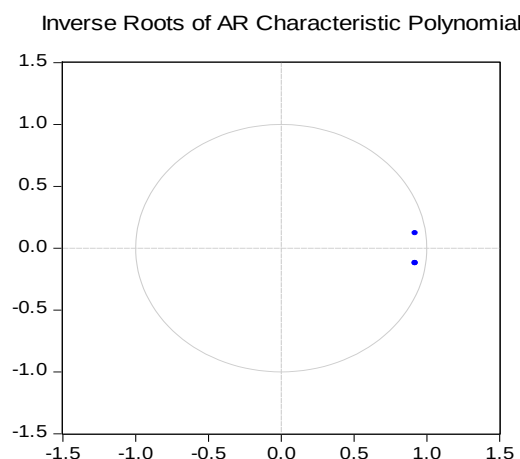


Figure 3 The AR root of the VAR model

4) Impulse function response analysis. In this paper, the impulse function response is used to analyze the dynamic influence process between China's OFDI and industrial structure upgrading in a certain period, and the results are shown in Figure 4. It shows the response of OFDI to the impact of a unit pulse on TL. Starting from phase 1, as time goes on, the positive effect of OFDI begins to appear, and the promoting effect increases, while the promoting effect begins to decrease after the peak of phase 7, indicating that overall OFDI has a positive effect on the upgrading of industrial structure.

Figure 5 shows the information that when TL exerts a one-unit impulse impact on OFDI, TL has a negative influence on OFDI since the first phase, and the negative influence gradually becomes stable after the eighth phase. It can be seen that the upgrading of China's industrial structure will inhibit China's foreign direct investment to a certain extent. As time goes on, the inhibition will gradually increase and eventually stabilize.

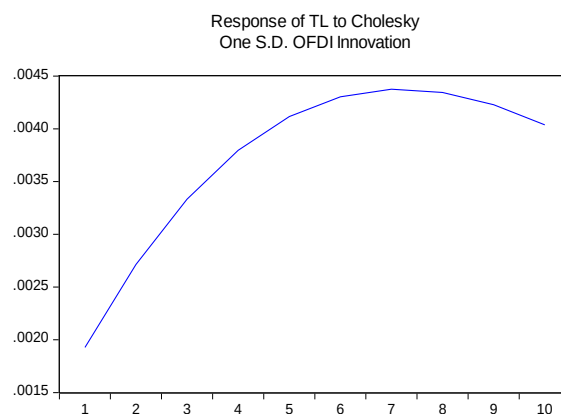


Figure 4 The impulse function response of OFDI to TL

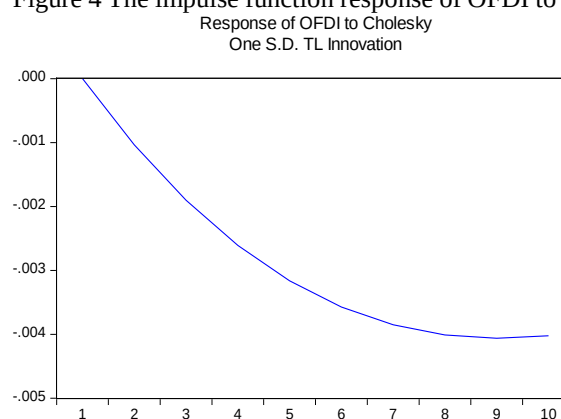


Figure 5 The impulse function response of TL to OFDI

5) Variance decomposition. By analyzing the contribution rate of each impact, variance decomposition can evaluate the influence of different variables. As shown in Table 3 below, columns 3 and 4 respectively represent the proportion of their disturbance degree in the variance of the forecast of industrial structure upgrading and the influence of the disturbance of the OFDI index. In the early stage of China's industrial upgrading, the impact of OFDI on industrial upgrading has been increasing, reaching 29.37% in the 10th phase. The data analysis results show that 29.37% of the prediction variance of TR is caused by the fluctuation of OFDI.

Table 3 Variance decomposable table

Variance Decomposition of TL:			
Period	S.E.	OFDI	TL
1	0.008234	5.480432	94.51957
2	0.011580	8.262934	91.73707
3	0.014055	11.23421	88.76579
4	0.016027	14.25142	85.74858
5	0.017637	17.21461	82.78539
6	0.018957	20.05364	79.94636
7	0.020037	22.71890	77.28110
8	0.020911	25.17516	74.82484
9	0.021611	27.39770	72.60230
10	0.22163	29.37018	70.62982

The variance decomposition between variables is shown in Figure 6. It provides information that in the prediction variance of TL and OFDI, their perturbations become smaller and smaller. The self-

contribution rate of TL in phase 10 drops to 70% and OFDI also has the same pattern, decreasing to 60%, while other variables have an increasing influence on them.

Variance Decomposition

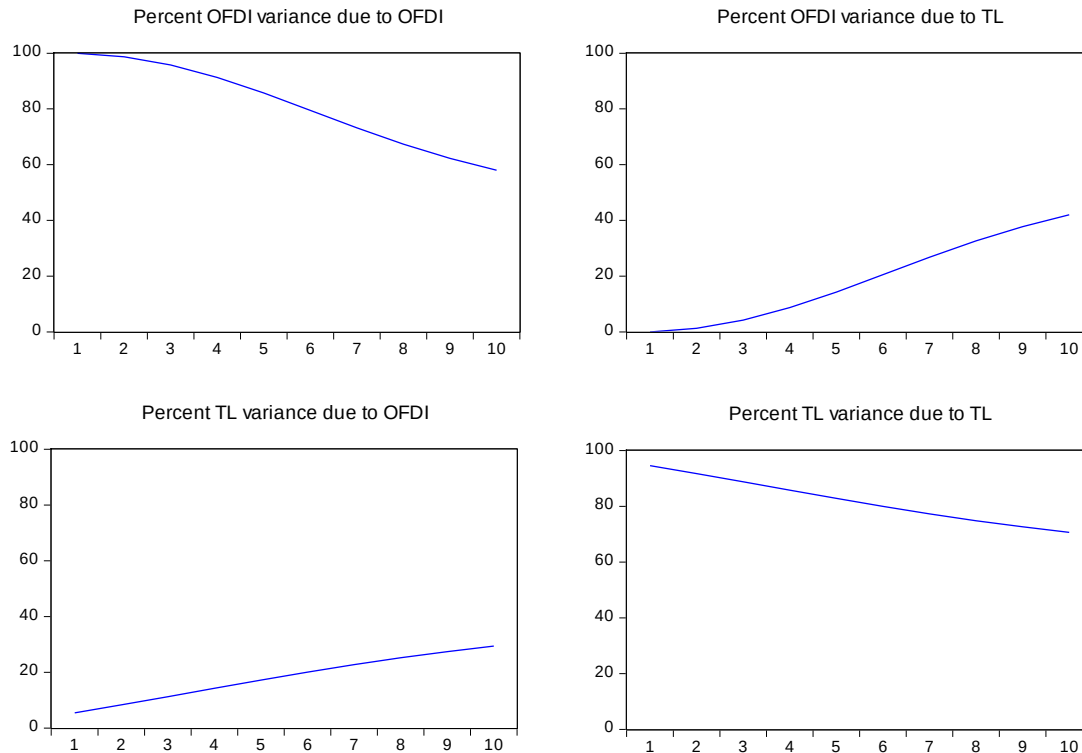


Figure 6 Variance decomposition diagram

5. CONCLUSION AND SUGGESTION.

In this paper, the Theil index is used to measure the rationalization of industrial structure, and the impulse response and differential decomposition are carried out between China's OFDI and the VAR model of industrial structure from 2003 to 2018, analyzing the relationship between them.

First, there is a stable mutual influence between OFDI and the change of industrial structure. According to the AR root diagram, the reciprocal absolute value of all roots of the characteristic equation is less than 1, indicating that the established model of OFDI and industrial structure transformation and upgrading are stable and effective.

Second, according to the results of the impulse function, OFDI has a positive promoting effect on the upgrading of the industrial structure, and the promoting effect begins to weaken after a period of time. The upgrading of industrial structure inhibits China's OFDI to a certain extent. The inhibitory effect gradually increases but eventually becomes stable with the time adds.

Third, when OFDI is increased by 1%, the industrial structure upgrading coefficient will rise by 0.1243%. At the macro-level, the impact of OFDI is mainly manifested through resource acquisition effect, marginal industrial expansion effect, and technological progress effect. At the micro-level, OFDI promotes the

upgrading of domestic industrial structure through resource orientation, market orientation, efficiency orientation, and strategic orientation.

In recent years, China's OFDI has been increasing in scale and its industrial structure has been continuously improved. In the face of the complex international situation, we still need "seek improvement in stability". In order to further enhance the boost of OFDI to the industrial structure, the following suggestions are proposed:

First, no country can develop in isolation from the rest of the world. Economic reform and innovation cannot be achieved without the support of the international market. Primarily, we must continue to strengthen international exchanges and project cooperation, and use technology transfer and spillover effects to promote domestic technological progress and promote the development of productive forces. Next, we need to enhance our international status, take an active part in formulating international investment rules, seize strategic opportunities, and make full use of the advantages of the world's second-largest economy.

Second, we must not only focus on the speed of domestic development and stay ahead of a strong country but also raise the quality of development. The rational layout of the industrial structure and coordinated development to meet market demand. We also need to give full play to regional advantages,

improve the mechanism of mutual assistance and cooperation, and promote the comprehensive development of the regional economy.

REFERENCES

- [1]Yu Jiagen, "Empirical research on OFDI and industrial structure upgrading in Zhejiang province: based on panel data from 2002 to 2012," *Financial and economic studies*, 2014, (08): 10-15.
- [2]Guo Huaizhao, Zhou Rongrong, "Research on the impact of OFDI on industrial upgrading under the new normal: a case study of Jiangsu province," *Modern business and trade industry*, 2016, 37(30): 2-4.
- [3]Wang Jipeng, "Empirical analysis of China's OFDI and the upgrading of manufacturing structure under the background of 'One Belt and One Road'," *Journal of Zhejiang shuren university (humanities and social sciences)*, 2008, 18(06): 47-52.
- [4]Xie Guangya, Du Junjun, "Correlation analysis between China's OFDI and domestic industrial structure optimization and upgrading: grey correlation analysis based on industry selection and country selection," *Journal of Hunan University (social sciences edition)*, 2015, 29 (05): 71-77.
- [5]Tang Jing, Yu Lixin, "Correlation analysis of China's OFDI and industrial restructuring," *International trade issues*, 2012, (11): 42-49.
- [6]Yang ying, Liu caixia, "The relationship between fdi and China & apos; industrial upgrading under the background of 'One Belt And One Road'," *Journal of south China normal university (social sciences edition)*, 2015, (05): 93-101 +191.
- [7]Li Dongkun, Deng Min, "China Inter-Provincial OFDI, Space Spilling and Industrial Structure Upgrade-Empirical Analysis based on the Space Panel Dubin Model," *International Trade Issues*, 2016, (01): 121-133.
- [8]Gan Chunhui, Zheng Ruogu, Yu Dianfan, "Influence of industrial structure change on economic growth and fluctuation in China," *Economic research*, 2011, 46 (05): 4-16+31.

Volatility Analysis of Small and Medium Board Market Based on ARMA-EGRACH Model

Rui-yu Chen¹, Jia-Ming Zhu^{1,*}, Chun-Li Wang²

¹ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

² Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: The financial time series usually has autoregression, but the traditional autoregressive model does not consider the heteroscedasticity, which leads to the model error. Based on the autoregressive conditional heteroscedasticity model, this paper selects the small and medium-sized stock index as the research object, establishes the grach family model, uses the closing price data of the small and medium-sized stock index from January 2006 to June 2019, and makes an empirical analysis on the fluctuation of its daily return, especially uses the arma-egrach model to capture the volatility in the daily return of the small and medium-sized stock index. The results show that the estimation coefficients of ARCH and GARCH are very significant and have the expected characteristics, which verifies the existence of persistent volatility aggregation, and the daily return volatility of the closing price of small and medium-sized stock index is largely affected by the information about volatility and lag volatility in the previous period. This result confirms that the continuous high volatility of small and medium-sized board's daily earnings makes the risk of investors' investment in the stock market increase, and the government and stock regulators should take appropriate measures.

Keywords: ARMA-EGRACH; Small and medium board fingers; GARCH; Volatility

1. INTRODUCTION

As a part of the international financial market, China's stock market has been continuously improved and developed after several ups and downs in the past 30 years since its establishment in 1990. Especially in recent years, with the substantial increase of market scale, the correlation between Shanghai and Shenzhen stock market and national economy has gradually increased. The aggravation of financial environment makes people study the internal law of stock price fluctuation [1,2]. The outbreak of the subprime crisis in the United States has brought an unprecedented financial crisis, which has spread all over the world. All of these let us realize the importance of preventing and responding to risks. Also let us deeply understand: in such a immature stock market as China, we should not only grasp the trend of stock price

qualitatively, but also study its internal law quantitatively, so that we can not be at a loss when the crisis comes.

2. LITERATURE REVIEW

Generalized autoregressive conditional heteroscedasticity (GARCH) model proposed by Engle (1982), Bollerslev (1986) and Taylor (1986) is a very popular model of stock market volatility. Nelson supplemented the conditional distribution, established the index generalized autoregressive conditional heteroscedasticity (EGARCH) model, and based on the EGARCH model, empirically analyzed the volatility of the standard 90 index daily price.

In the study of domestic stock market, Zhang Siqi (2002) used the ARMAARCH-m11 model to make an empirical study on the Shanghai composite index components from January 2, 1992 to June 3, 1998. The results show that the effectiveness of China's stock market has been significantly improved and the market has some weak and effective market characteristics. Through the analysis of A-share index in Shanghai stock market, Ding Hua got ARCH phenomenon in the stock index, and got ARCH (1) and ARCH (2) models.

In modern financial theory, the risk of return and the uncertainty of price in financial market are often described by variance. A large number of research results on price behavior confirm that the variance used to express uncertainty and risk changes with time. In the process of variance change, the larger change will be relatively concentrated in some periods, and the smaller change will also be concentrated in other periods [3]. The autoregressive conditional heteroscedasticity (ARCH) model is widely used in financial time series because it reflects the variation of variance most intensively [4].

Based on the above foundation, this paper establishes GARCH model, and empirically analyzes the volatility of return rate based on the small and medium-sized board index from January 2006 to June 2019. This paper is divided into four parts: background introduction and literature review at home and abroad; introduction of GARCH family model and its modeling process, such as preprocessing of time series, model order determination, model parameter estimation and

significance test, model optimization and other steps; empirical analysis based on EGARCH model of small and medium board index logarithm yield; relevant conclusion analysis.

3. INTRODUCTION TO GRACH FAMILY MODEL

(1) ARCH (P) model

Engle first proposed a time series model with auto-regressive conditional heteroscedasticity (ARCH). The model with order (≥ 1) autoregressive conditional heteroscedasticity (ARCH) is defined as [5]

$$X_t = \sigma_t \varepsilon_t, \quad \sigma_t^2 = c_0 + b_1 X_{t-1}^2 + \dots + b_p X_{t-p}^2 \quad (1)$$

where $c_0 \geq 0, b_j \geq 0, \{\varepsilon_t\} \sim \text{IID}(0,1)$, for all t, ε_t and $\{X_{t-k}, k \geq 1\}$ independent random processes. $\{X_t\}$ defined by the above equation are called ARCH(P) processes.

(2) GARCH (P, q) model

Based on the existing ARCH model, bollerslev and Taylor generalized autoregressive heteroscedasticity (GARCH) model. The generalized autoregressive conditional heteroscedasticity model with order $p (\geq 1)$ and $Q (\geq 0)$ is defined as

$$X_t = \sigma_t \varepsilon_t, \quad \sigma_t^2 = c_0 + \sum_{i=1}^p b_i X_{t-i}^2 + \sum_{j=1}^q a_j \sigma_{t-j}^2 \quad (2)$$

where $c_0 \geq 0, b_j \geq 0$ and $a_j \geq 0, \{\varepsilon_t\} \sim \text{IID}(0,1)$, for all t, ε_t and $\{X_{t-k}, k \geq 1\}$ independent random processes. $\{X_t\}$ defined by the above equation are called ARCH(P) processes.

The relationship between ARCH model and GARCH model lies in that the high-order ARCH model can better describe the heteroscedasticity of the sequence, and the increase of the corresponding parameters to be estimated will make the solution of the model more complex and reduce the efficiency of the estimation model [6-8]. The high-order ARCH model can be fully expressed by the low-order GARCH model, which greatly reduces the number of parameters to be evaluated and greatly improves the efficiency of model estimation.

In many cases, financial time series can be well described by GARCH (1, 1) model. Compared with ARCH model, the advantage of GARCH model is that the low-order GARCH model with less parameters to be estimated can replace the high-order ARCH model with more parameters to be estimated, which makes the process of solving model parameters easier and more efficient.

(3) EGARCH (p, q) model

In the research process of financial yield series, when the range of yield decline and the range of yield rise are the same, the decline process is often accompanied by more violent volatility, which leads to the asymmetry of volatility of financial yield series. In order to study this property, Nelson extended GARCH model and proposed the index generalized autoregressive conditional heteroscedasticity model. The exponential generalized autoregressive

conditional heteroscedasticity model with order $p (\geq 1)$ and $q (\geq 0)$ is defined as:

$$X_t = \sigma_t \varepsilon_t, \quad \ln \sigma_t^2 = \omega + \sum_{i=1}^q \left(\alpha_i \left| \frac{X_{t-i}}{\sigma_{t-i}} \right| + \gamma_i \frac{X_{t-i}}{\sigma_{t-i}} \right) + \sum_{j=1}^p \beta_j \ln \sigma_{t-j}^2 \quad (3)$$

where $c_0 \geq 0, b_j \geq 0$ and $a_j \geq 0, \{\varepsilon_t\} \sim \text{IID}(0,1)$, for all t, ε_t and $\{X_{t-k}, k \geq 1\}$ independent random processes. $\{X_t\}$ defined by the above equation are called ARCH(P) processes.

(4) ARMA (P, q) - EGARCH (m, n) model

By combining the EGARCH model with the ARMA model, a general ARMA-EGARCH model can be constructed in the following form:

$$Y_t = \mu + \sum_{i=1}^p \theta_i Y_{t-i} + \sum_{j=1}^q \theta_j e_{t-j} \quad (4)$$

$$e_t = \sigma_t \varepsilon_t \quad (5)$$

$$\ln \sigma_t^2 = \omega + \sum_{i=1}^m \left(\alpha_i \left| \frac{e_{t-i}}{\sigma_{t-i}} \right| + \gamma_i \frac{e_{t-i}}{\sigma_{t-i}} \right) + \sum_{j=1}^n \beta_j \ln \sigma_{t-j}^2 \quad (6)$$

where Formula(4) is the mean equation, which satisfies the ARMA (P, q) form, and Formula(6) is the conditional variance equation, If $\gamma_i \neq 0$, it indicates that the information effect is asymmetric, when $\gamma_i < 0$, the increase of future conditional variance is larger in negative volatility; otherwise, when $\gamma_i > 0$, the increase of future conditional variance is larger in positive volatility. Formula (5) by default, ε_t is subject to standard normal distribution, and e_t is subject to normal distribution. At this time, the model is normal.

4. DATA SOURCES AND EMPIRICAL RESULTS ANALYSIS

(1) Data source and visual processing

This paper takes the time series data of daily closing price logarithm yield of small and medium-sized board index from January 2006 to June 2019 as an example. (Data source: NetEase Finance)

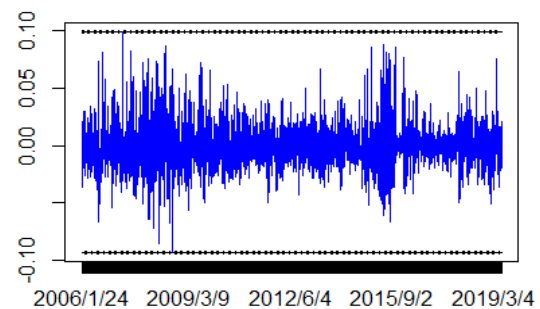


Figure 1 Small and Medium Board Refers to the Time Figure 1 shows the timing chart of the daily logarithmic return of the SME board index. Series Chart of Daily Logarithm Yield, 2005-2019

In recent years, the amplitude is relatively large from August 2015 to May 2016, among which the decline in August 2015 reached the peak. The sharp drop in the stock market in August 2015 is influenced by the US stock market. As we all know, the US is one of the largest financial markets in the world, with a wide

range of influence. From June 2016 to March 2018, the daily logarithmic rate of return fluctuated steadily. However, around April 2018, due to the launch of President Trump's "301 act", Chinese enterprises were once again impacted, so their stock prices fell again.

(2) The normal test of logarithmic yield

Figure 2 shows the distribution diagram of daily logarithmic yield of small and medium-sized board, and figure 3 shows the normal QQ diagram. It can be seen that the financial time series shows peak thick tail [9]. Compared with the standard normal distribution, the kurtosis is higher, the tail of the two sections is thicker, that is, the extreme value is more. Table 1 is a table of descriptive statistics and p-value of normality test of small and medium board index. It can be seen that the mean value of logarithmic yield of small and medium board index is 0, the standard deviation is 1, the skewness coefficient is 0.61, the kurtosis coefficient is 2.64, and the p-value of normality test is close to 0, that is to say, the daily logarithmic yield of small and medium board index is not normal distribution, showing a left skew distribution, and has a sharp peak and thick tail phenomenon [10].

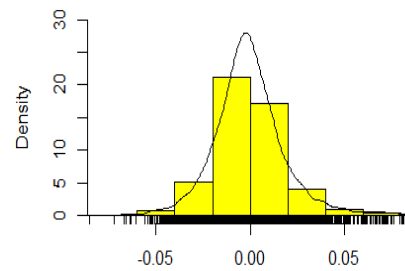


Figure 2 Distribution of Log Yield of Small and Medium Board Index

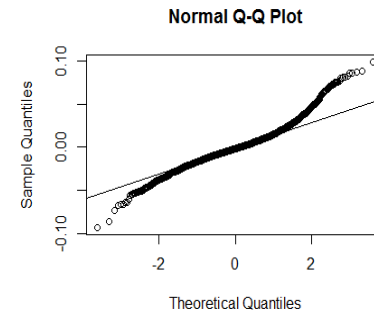


Figure 3 Normal Q-Q Graph

Table 1 Descriptive Statistics of Small and Medium-Sized Index Returns

	Variance	n	Mean value	Skewness coefficient	Kurtosis coefficient	P value of normality test
Rate	1	3258	0	0.61	2.64	<2.2e-16

(3) Test of the stationarity of logarithmic rate of return

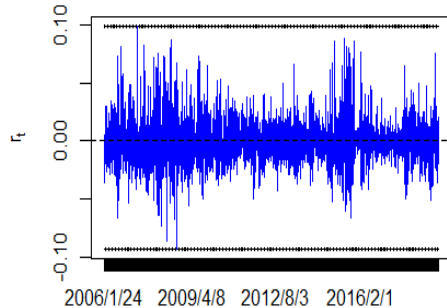


Figure 4 Return Volatility Series

Figure 4 shows the return volatility series. It can be seen that the daily logarithm return series of small and medium-sized board shows certain volatility and aggregation in the sample range, especially in 2015-2016. The normal test and stability test show that the sequence is normal and the sequence is stationary.

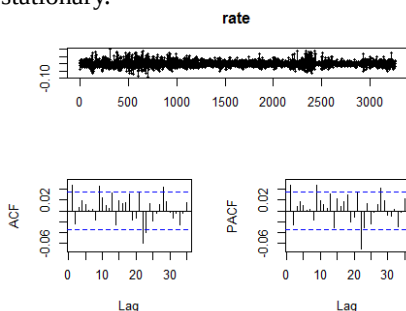


Figure 5 Auto Correlation Function and Partial Auto

Correlation Function

Figure 5 shows the autocorrelation function and partial autocorrelation function of daily logarithm rate of return of small and medium-sized board. From the ACF diagram and PACF diagram of the rate of return series, it can be concluded that most of the function values of the two graphs jump up and down in the confidence interval (blue dotted line area in the figure), so the autocorrelation of the rate of return series is very low [11-14], or it has a very weak autocorrelation, so it is not necessary to introduce autocorrelation into the conditional expectation model. In the correlation part, the average equation of GARCH model is satisfied, and the yield is composed of a constant term plus a random disturbance term. The extended autocorrelation method (eacf) shows that the model is in good agreement with ARMA (1, 0).

(4) The test of ARCH effect

The timing chart of the yield shows that there may be ARCH effect in the daily yield data. If there is ARCH effect, the GARCH model can be combined. On the contrary, GARCH model cannot be used to fit the equation.

Table 2 ARCH effect test results

Chi-square statistic	P value
271.78	< 2.2e-16

Table 2 shows the inspection results of ARCH. The original hypothesis of the test is that there is no ARCH effect. The result of the test is that the value of chi square statistic is 271.78, and the corresponding p

value is almost 0, that is to say, the original hypothesis is rejected at the significance level of 1%, so the hypothesis that there is no ARCH effect is rejected, and the return series has ARCH effect, so the GARCH model can be fitted.

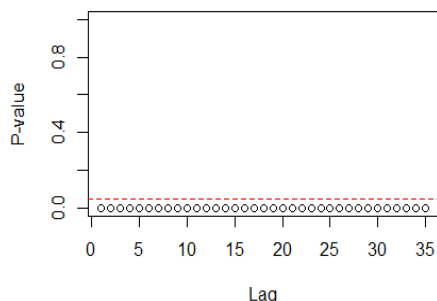


Figure 6 P-value Chart of ARCH Effect Test

Figure 6 shows the p-value chart of ARCH effect test of the financial time series. After the residual sequence lags 35 orders, the coefficient of the residual autoregressive function is significant, and the sequence still has autocorrelation. Therefore, the original hypothesis is rejected, indicating that there is a significant ARCH effect in the sample sequence. The logarithm return series has volatility aggregation, stable sequence, significant ARCH effect, and can be modeled by EGARCH model due to the asymmetry of volatility.

(5) Estimation of optimal parameters

Table 3 Optimal parameter estimation

	Estimate	Std. Error	T value	Pr(> t)
ar1	0.032039	0.017582	1.82224	0.016814
omega	-0.129128	0.010961	-11.78059	0.000000
alpha1	0.001408	0.008108	0.17364	0.000086
beta1	0.983189	0.001319	745.31408	0.000000
gamma1	0.146155	0.015044	9.71522	0.000000

Table 3 shows the optimal parameter estimation of the modified model. It can be seen that the estimated values of each coefficient of the model are all $p < 0.05$, it can be considered that the model is fitted successfully, the final fitting model is ARMA (1, 0) - EGARCH (1, 1).

(6) Standardized residual analysis of ARMA (1, 0) - EGARCH (1, 1) model

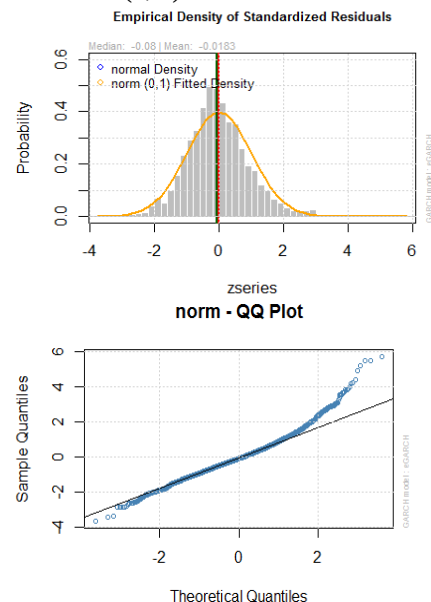


Figure 7 Empirical density diagram and normal QQ diagram of standardized residuals

The empirical density map and the normal QQ map of the standardized residuals of the fitting model show that the standardized residuals are similar to the standard normal distribution, and through the normal test, the p value is close to 1, that is to say, the standardized residuals of the fitting model are similar to the normal distribution [15].

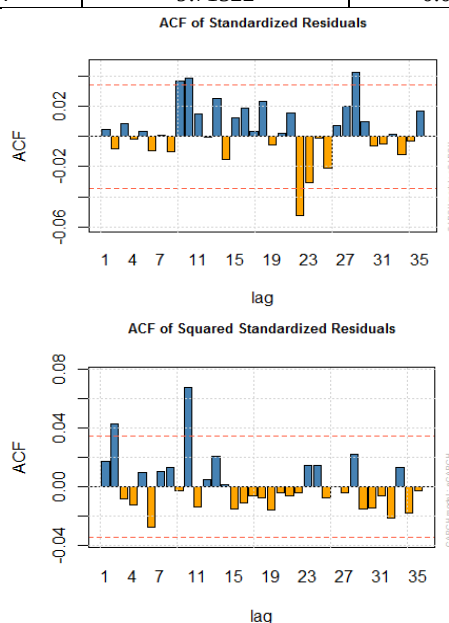


Figure 8 ACF graphs of normalized residuals and ACF graphs of residuals squared

From the Figure 7 and Figure 8, we can see that most of the function values of the ACF graph of the residual sequence jump up and down in the confidence interval (the dotted orange area in the graph), so the standardized residual sequence does not have autocorrelation, or has a certain weak correlation [16]. The ACF of the square sequence of residuals has no obvious tailing or truncation, and all the function values are in the confidence interval, so it has no sequence correlation [17]. The results show that ARMA (1, 0) - EGARCH (1, 1) model can effectively explain the yield series.

5. CONCLUSION

Heteroscedasticity is often reflected in financial time series, and the fitting effect of ARMA model is often

unsatisfactory, and the error is large. In this paper, we consider the heteroscedasticity of time series, and use EGARCH model to get the ideal fitting effect. The model is consistent with the actual situation, and has strong applicability in the field of economy and finance. The conclusions are as follows: (1) the return series of China's small and medium-sized board market has the characteristics of peak and thick tail; (2) the logarithmic price volatility of small and medium-sized board index has the phenomenon of aggregation. It can be concluded that the stronger the stronger, the weaker the weak the phenomenon appears in China's stock market. With the development of theoretical research, ARCH-M model, TARCH model, IGRACH model and other commonly used models have been developed on the basis of ARCH model, so it is necessary to further study the GARCH model.

6. CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

This work is supported by the project of Innovation training program of Anhui University of Finance and economics provincial innovation and entrepreneurship training program (NO. S201910378493). Besides, This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No. 19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research Fund Project (acxkjsjy201803zd and acjyyb2018006).

REFERENCES

[1]R.S. Tsay, Financial time series analysis. 2nd Edition. People's post and Telecommunications Press. 2010.
 [2]Shi Daimin, "Research on volatility and efficiency of China's stock market," Southwest University of Finance and Economics Press, 2002.
 [3]Cheng Cheng, "Analysis of volatility characteristics of Shanghai stock index based on GARCH model: Master's thesis," Shandong: School of mathematics, Shandong University, 2014.

[4]Liu Zhiping, "Research on the volatility and correlation between the real estate market and the stock market based on ARCH model: Master's thesis," Hunan: School of finance, Central South University, 2012.
 [5]Deng Chuanjun, Liu Jiayue, Li Xuan, "ARCH model analysis of Shanghai stock return," Contemporary economy, 2007 (11).
 [6]Tang Qiming, Chen Jian, ARCH effect analysis of Chinese stock market. World economy, 2001, (3).
 [7]Qin Xiaoyu, Wang Xiaoping, Zhang Xiaohong, "Research on volatility of Shenzhen stock index yield based on GARCH model," Modern property, 2012 (3).
 [8]Weng Liwei, Huang Wei, "ARCH effect analysis of Chinese stock market based on A-share empirical analysis of Shanghai stock market," Financial sector, 2010 (2).
 [9]Jonathan D. Cryer, Kung Sik Chan, "Time series analysis and application. The second edition of the original book," Beijing: Mechanical Industry Press, 2011.
 [10]Xia Lu, "Research and application of GDP prediction in county economy based on ARIMA Model -- Taking Huoqiu County as an example. Economic Perspective (2), 2011 (07): 71-72.
 [11]Li Zinai, Pan Wenqing, Econometrics. Third edition. Beijing: Higher Education Press, 2015.
 [12]Wang Yan, "Applied time series analysis. Third edition," Beijing: China Renmin University Press, 2012.
 [13]Lu Mei, "Analysis and prediction of economic growth in Qianxinan Prefecture based on time series analysis," Guizhou University for nationalities, 2012.
 [14]Pang Hao, "Econometrics. Third edition. Beijing: Science Press, 2015.
 [15]Song Haijiao, "The application of ARIMA model in Shanghai GDP forecast," Science and education literature collection (last ten issues), 2008 (08): 208-209.
 [16]Zhao Lei, Chen Meiyang, "Application of ARIMA model in GDP prediction of Fujian Province," Science and technology and industry, 2007 (01): 45-48.
 [17]Yu Nisha, Wang Shanshan, "Time series analysis of economic growth," Value engineering, 2007 (07): 13-16.

Metrological Analysis of Factors Affecting Allergic Diseases Based on Logistic Regression

Xiang Xu¹, Juan Jiang², Hang Zhang³, Jiaming Zhu^{3,*}, Chunli Wang⁴

¹ Fourth People's Hospital, Bengbu, Anhui Province, 233010, China

² Lanzhou University, Lanzhou, Gansu Province, 730000, China

³ School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China

⁴ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: Influence factors for allergic disease, use in combination with qualitative and quantitative method, classified according to the department, will first allergic disease of allergic diseases, age and season influence factors such as image matching and multiple Logistic regression analysis, classification and use of SPSS software, such as the relationship between environmental protection index and allergens, and gives a reasonable environmental protection initiative.

Keywords: Allergic division; Multiplex classification Logic review; Fisher discovery; Correlation coefficient method; SPSS; MATLAB

1. INTRODUCTION

The 19th CPC National Congress report says "to treat the ecological environment like life, to protect the ecological environment is to protect the future.". The continuous deterioration of the ecological environment will lead to a series of air pollution and other phenomena. For example, increased PM2.5 concentration can lead to the occurrence of various allergic diseases, such as skin allergies, respiratory allergies, digestive tract allergies. Allergic diseases are a kind of immunoreactive diseases, including allergic rhinitis, bronchial asthma, urticaria, allergic conjunctivitis and so on [1]. And may occur at all ages from the newborn to the elderly, often with a distinct genetic predisposition. In anaphylactic diseases, rapid allergic reactions are more common, the main types are skin allergic reactions, respiratory allergic reactions, digestive tract allergic reactions and anaphylactic shock. It provides a reliable basis for the prevention of allergic reactions and the treatment of allergic diseases through the analysis of the relevant influencing factors of allergic diseases, thus effectively reducing the incidence of allergic diseases. At the same time, combined with the relevant ecological environmental indicators, the impact of ecological environment on the incidence of allergic diseases is analyzed, and the ecological protection proposal for the relevant government departments and friends of the general public is written and provided with reasonable suggestions.

2. MODEL HYPOTHESIS AND LITERATURE REVIEW

2.1 Data Sources and Assumptions

The data are from Chinese medical clinical cases. For ease of problem solving, the following assumptions are made: (1) Suppose that the patients in the attachment in pediatrics, otolaryngology, respiratory department and dermatology are all tested for allergens due to their own allergic diseases; (2) Assume that the degree of allergy given in the attachment can be approximately rounded: if the degree of allergy "5(4+)" can be approximately equal to "5".

2.2 Literature Review

Yanyan Liu [2] Hurdle model was used to analyze the influencing factors of the number of positive allergens with zero swelling data, and to provide the basis for preventing allergic reactions and allergic diseases. Yuyang Luo [3] The clinical characteristics and related factors of allergic diseases in infants ~ 0 to 24 months in Nanning were studied by Logistic regression analysis. Yifan Cui [4] A single factor analysis and Logistic regression analysis were used to analyze the risk factors of allergic rhinitis in children. By using different methods, the related factors of allergic diseases were obtained and the basis for the prevention of allergic reactions was provided. G Melioli etc. [5] The cross-sectional study of children with allergic diseases of different ages showed that Ig E (food allergen specificity) can be detected from serum in early childhood (within 2 years of age), which is mainly milk and eggs, while the specific IgE of inhaled allergen in later stage gradually appears and is stable. SP Nissen etc. [6] Early food allergens in infants were found to have the highest sensitization rate, while late inhalation was dominant [7]. All the above studies have found that allergens vary with age and are IgE in serum specificity [8]. Changes occur on markers of this I type of rapid allergic reaction.

2.3 Data Processing

(1) Classification of departments: by consulting relevant medical literature, the original data sheets were reclassified into: pediatrics, respiratory,

otolaryngology, dermatology, other departments [9].

(2)Set up other allergens: For patients who come to visit but have no known pathogenic allergens, set up other allergens.

(3)Classification of allergic diseases: First of all, according to the hospital allergen test data according to the department of this index to classify the types of allergic diseases, according to the weight of each department of the small allergic diseases into five categories: pediatrics, otolaryngology, respiratory department, dermatology and other departments, from the formula $p_i = n_i / \sum n_i$ can be calculated that the frequency of visits to each department is: pediatrics 0.074, otolaryngology 0.076, respiratory department

0.275, dermatology department 0.375, other departments 0.2.

(4)Gender treatment: since gender is only male and female, gender is set as a dummy variable, with 0-1, male to 1 and female to 0.

(5)Treatment of seasons: four seasons of the year are introduced into the three virtual variables, spring, summer and autumn, and set to have this property of 1, or 0.

(6)Treatment of allergen detection results: the IgE concentration of the test results is based on the lack of a clear explanation of the findings in the question [10], can convert 0~6 grade allergens into specific fractions, see Table 1.

Table 1. Specific concentration levels

Specific IgE concentration	0-0.35	0.35-0.7	0.7-3.5	3.5-17.5	17.5-50	50-100	≥100
Level	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6

(7) Age treatment: 2284 allergic patients were divided into 20 groups according to their age group of 5 years.

3. QUALITATIVE ANALYSIS OF THE RELATIONSHIP BETWEEN ALLERGIC DISEASES AND TIME, SEASON, SEX, AND AGE

3.1 Research Ideas

Data on visits for a total of four years are measured by 365, and date data are converted into days corresponding to the year as relevant data on the factors affecting allergic diseases in time;(2)The departments are divided into five categories, counting the number of visits per department on a quarterly basis, respectively, as the basis of data on the seasonal impact;(3)Data on visits by men and women in each department are counted as the basis of data on the factors affecting gender;(4)The number of visits by different departments is counted as relevant data on the factors affecting age by 20 groups of age data. By using Excel、Matlab and other software to draw the scattered plot and histogram between different types of allergic diseases and various influencing factors, descriptive analysis was carried out according to the results obtained.

3.2 Methods of Study and Analysis of Results Between Allergic Diseases and Variables

3.2.1 Relationship between allergic disease and time

The first use of MATLAB to the data collected for preliminary processing, the date and time through 365 days / year scale unit as the x axis, the age of the patient as the y axis to draw the number of visits to five categories of departments scattered plot, as shown in Figure 1.

From the analysis of Figure 1, we can see that the frequency of visits between 0-50 days and 250-365 days in otolaryngology and respiratory department is higher, and between 100-250 days is lower. Generally speaking, the frequency of allergic diseases decreased significantly in summer compared with autumn and winter.

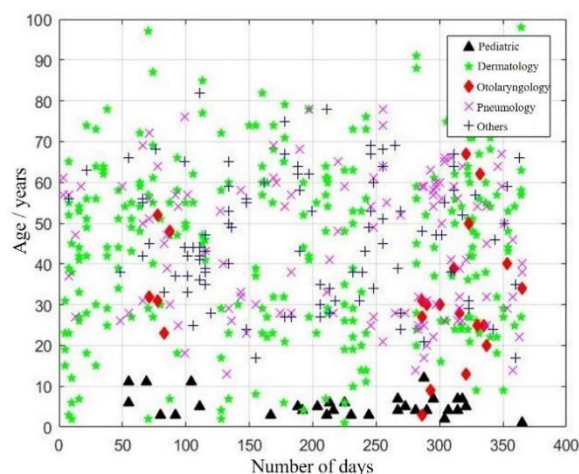


Figure 1. Scatter plot of frequency distribution in each department

3.2.2 Relationship between allergic diseases and seasons

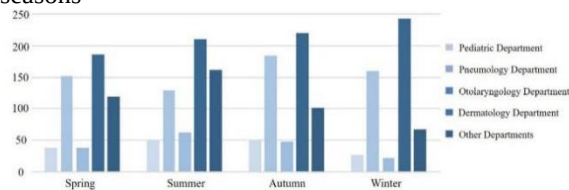


Figure 2. Number of visits by departments in different seasons

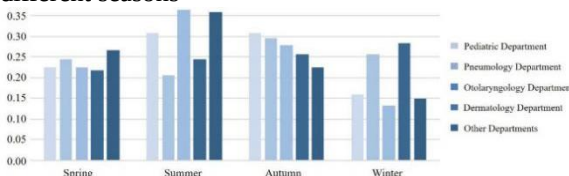


Figure 3. Frequency of visits by departments in different seasons

Figure 2 shows that the number of dermatologists is the most and the number of otolaryngology is the least in the whole year compared with other departments. The number of patients in the remaining

departments did not fluctuate significantly throughout the year. Figure 3 shows that the incidence of allergic diseases in summer is significantly higher than that in winter, and there is no obvious difference in spring and autumn. It is concluded that the proportion of dermatologists is the highest among the five departments and there is no obvious fluctuation in the four seasons.

3.2.3 Relationship between allergic diseases and sex

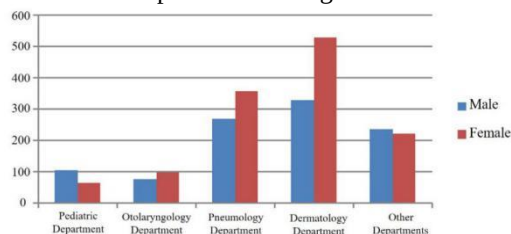


Figure 4. Figures of male and female visits in departments

Figure 4 shows that the incidence of allergic diseases in the dermatology of men and women is significantly different, women are more prone to skin allergies. It can be seen that the number of visits of the other four departments has no obvious fluctuation, which indicates that there is no obvious correlation with gender.

3.2.4 Relationship between allergic diseases and age

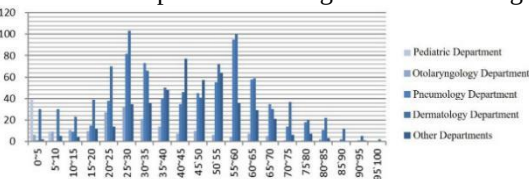


Figure 5. Chart of the number of visits by department and age group

As can be seen from Figure 5, the incidence of allergic diseases is higher in infancy and lower in adolescence, but the incidence of ear, nose and throat allergic diseases is increasing (e.g. rhinitis). At the same time between 25~30, 55~60 years of age is more likely to suffer from skin allergic diseases, horizontal comparison, the incidence of skin allergic diseases is the highest, followed by respiratory allergic diseases, so the size of age and allergic diseases have a certain relationship.

4. QUANTITATIVE ANALYSIS OF THE RELATIONSHIP BETWEEN ALLERGIC DISEASES AND TIME, SEASON, SEX, AND AGE

4.1 Research Ideas

We eliminate the data that the result of the department visit is empty, classify the different departments, and establish the functional relationship between the time, season, sex of the explanatory variable and the department before the explained variable. By setting dermatology as reference category, sex and season as factors and age as covariates, we establish Logistic regression model with multiple classifications and find out the model. the relationship between pediatric related variables was tested by binary Logit regression, and solved by

SPSS and EvIEWS software. through the analysis of the running results, the logical regression equations between allergic diseases and time, season, sex and so on were obtained and reasonable explanation and mutual argument were made.

4.2 Research Methodology

Multiple classification Logistic regression model: for K possible classification results, we run K-1 independent binary logical regression model, in which one of the categories is regarded as the main category during the run, and then the other categories and the main category we choose are regressed separately. In this way, if we choose the result as the main category, we can get the following formula:

$$\ln \frac{\Pr(Y_i=1)}{\Pr(Y_i=K)} = \beta_1 x_i, \ln \frac{\Pr(Y_i=2)}{\Pr(Y_i=K)} = \beta_2 x_i, \dots, \ln \frac{\Pr(Y_i=K-1)}{\Pr(Y_i=K)} = \beta_{K-1} x_i \quad (1)$$

The following formulas are obtained by exponentializing the left and right formulas:

$$\Pr(Y_i=1) = \Pr(Y_i=K) e^{\beta_1 x_i}, \Pr(Y_i=2) = \Pr(Y_i=K) e^{\beta_2 x_i}, \dots, \Pr(Y_i=K-1) = \Pr(Y_i=K) e^{\beta_{K-1} x_i} \quad (2)$$

If we have a coefficient $\beta_i (0 < \beta_i < 1)$ for each variable, we have to add up to 1, and based on this fact we can get

$$\Pr(Y_i=K) = 1 - \frac{\sum_{k=1}^{K-1} \Pr(Y_i=K) e^{\beta_k x_i}}{1 + \sum_{k=1}^{K-1} e^{\beta_k x_i}} \rightarrow \Pr(Y_i=K) = \frac{1}{1 + \sum_{k=1}^{K-1} e^{\beta_k x_i}} \quad (3)$$

The final result can be obtained by bringing formula (3) into formula (2). See formula (4):

$$\Pr(Y_i=1) = \frac{e^{\beta_1 x_i}}{1 + \sum_{k=1}^{K-1} e^{\beta_k x_i}}, \Pr(Y_i=2) = \frac{e^{\beta_2 x_i}}{1 + \sum_{k=1}^{K-1} e^{\beta_k x_i}}, \dots, \Pr(Y_i=K-1) = \frac{e^{\beta_{K-1} x_i}}{1 + \sum_{k=1}^{K-1} e^{\beta_k x_i}} \quad (4)$$

We introduced 0-1 variables to season, sex, age, And the output categories are: Pediatrics: 1, Respiratory: 2, ENT: 3, Dermatology: 4, Other: 5. To ensure a one-to-one correspondence x_i with the output $\Pr(Y_i)$, we multiply Y_i on the right side of formula (4) x_i , The model is shown in formula (5):

$$\Pr(\sum_{i=1}^5 Y_i) = \frac{e^{\beta_k x_i (\sum_{i=1}^5 Y_i)}}{1 + \sum_{k=1}^{K-1} e^{\beta_k x_i (\sum_{i=1}^5 Y_i)}} \Pr(\sum_{i=1}^5 Y_i) \quad (5)$$

4.3 Results Analysis

According to the above analysis, we used SPSS software to replace each type of allergic disease with each frequency of onset, respectively, and used it as dependent variable, the reference category was dermatology; sex and three virtual variables of spring, summer and autumn were used as factors; because the patient's age as an independent variable is not artificially controlled, but its value still affects the outcome of the disease, we used age as a covariate for multivariate Logistic regression, and the results are shown in Table 2.

Table 2. Proposed Optimum Table

Indicators	CARDS	Degree of freedom	Significant
Pearson	2281.544	2464	.996
Deviation	2184.790	2464	1.000

From Table 2 above, we can see that the original hypothesis model can fit the original data well, and the last column Pearson chi-square significant value is 0.874, the probability is large, and the original hypothesis holds, which shows that the model's fitting of the original data passes the test. According to the maximum likelihood ratio test table, we can see that the effects of the final entry into the model include intercept, age, sex, season, and the last column significant values are less than 0.05, indicating that the independent variables contribute significantly to the model composition, so according to the parameter estimate table, the model is shown as follows:

$$W_1 = \log \left[p \left(\frac{\text{Pediatrics department}}{\text{Dermatology department}} \right) \right]$$

$$= 4.32 - 0.428x_1 - 0.177x_2 - 0.455x_3 - 0.326x_4 - 0.354x_5$$

$$W_2 = \log \left[p \left(\frac{\text{Otolaryngology department}}{\text{Dermatology department}} \right) \right]$$

$$= 1.749 - 0.186x_1 - 0.837x_2 - 0.077x_3 - 0.827x_4 - 0.033x_5$$

$$W_3 = \log \left[p \left(\frac{\text{Other department}}{\text{Dermatology department}} \right) \right]$$

$$= 0.963 - 0.496x_1 - 0.79x_2 - 0.940x_3 - 0.459x_4 - 0.007x_5$$

$$W_2 = \log \left[p \left(\frac{\text{Pneumology department}}{\text{Dermatology department}} \right) \right]$$

$$= -0.354 - 0.2x_1 - 0.185x_2 + 0.075x_3 - 0.234x_4 - 0.009x_5$$

5. QUANTITATIVE ANALYSIS OF THE CHANGE OF THE CHANGE TREND OF ALLERGEN DETECTION RESULTS IN 2013-2017

5.1 Research Ideas

The number of all kinds of people in 2013-2017 by the Excel through the preliminary processing of data through the Excel to carry on the preliminary processing through the preliminary processing of R, and then make each kind2Inspection. By consulting a large number of literatures, 17 allergens were classified into soil pathogenic allergens, airborne allergens and water pathogenic allergens according to the ecological environment factors. Finally, the gray-scale prediction model is used to predict the incidence and environmental factors of various allergens in recent years.

5.2 Research Methodology

Allergen test results change trend: we use the Excel for statistical analysis, considering the degree of allergy, we use the method of summation, statistical summary of the number of all kinds of allergen in 2013-2017 patients (see appendix 6), and thus the number of all kinds of allergen over time multiple regression model and give the test coefficient, the specific results are shown in Table 3.

Table 3. Allergen trend fit equation table

Allergens	Regression equation (actual value)	R^2
Dust mites combination	$y_1 = 88.79 \ln(t) + 122.38$	$R^2 = 0.5133$
Tree combinations	$y_2 e = 42.279^{-0.208 t}$	$R^2 = 0.3947$
Peanuts, milk, grass	Periodic variation of trigonometric functions	None
House Dust	$y_6 = -13.89 \ln(t) + 69.297$	$R^2 = 0.3274$
Common ragweed	$y_7 t = 7.75^3 t \quad 87.25^2 + 286t - 202.6$	$R^2 = 0.5305$
Dog skin	$y_8 = 32.142 \ln(t) + 25.624$	$R^2 = 0.2753$
Cockroaches	$y_9 t = 4.0833^3 - 45.536 t^2 + 142.38t - 67.2$	$R^2 = 0.3913$
Seafish combination	$y_{10} = t \quad 2.6667^3 t \quad 28.571^2 + 93.762t - 32.8$	$R^2 = 0.4572$
Crab crab	$y_{11} e = 103.09^{-0.291 t}$	$R^2 = 0.5875$
Cat hair	$y_{12} = 26.806 \ln(t) + 30.133$	$R^2 = 0.537$
Chicken protein	$y_{13} = 23 t - 16$	$R^2 = 0.5352$
Artemisia argyi	$y_{14} t = 42.651^{-0.545}$	$R^2 = 0.4655$
Shrimp	$y_{15} = t \quad 79.753^{-1.292}$	$R^2 = 0.9463$
Mold combination	$y_{16} t = 32.96^{-0.457}$	$R^2 = 0.633$
Soybean	$y_{17} = t \quad 21.467^{-0.126}$	$R^2 = 0.5637$

Selection of Environmental Protection Indicators: We then considered 17 allergens scientifically according to the of ecological environment[11]. It is divided into three categories: soil pathogenic allergens,

airborne pathogenic allergens and water pathogenic allergens. The specific classification results are shown in Figure 6.

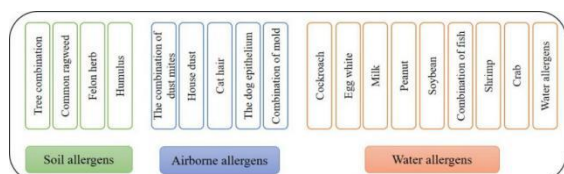


Figure 6. Results of classification of pathogenic allergens

By consulting the environmental protection literature,

we selected two soil environmental protection indicators: total sewage discharge, precipitation; two air environmental protection indicators: total smoke dust discharge, PM2.5; 1 water resources environmental protection indicators: waste water main pollutant discharge; the results of the related data are shown in Table 4 below.

Table 4. Environmental Indicators Data Sheet

Time	Main pollutant discharge from wastewater /10,000 tons	Precipitation/ mm	Smoke dust emissions/ t	Pm2.5/ ug/ m ³	Total sewage discharge /10,000 tons
2013	2352.7	653.5	12781410.76	72	634800
2014	2294.6	636.2	17407507.58	62	631100
2015	2223.5	648.4	15380132.7	50	624500
2016	1046.53	728.5	10106627	47	657430
2017	867.32	641.3	8432589.5	43	636042

The total amount of sewage discharge is related to most allergen detection results (see Appendix X), so we select the total amount of sewage discharge as the environmental protection index to carry on the correlation analysis.

Step3 correlation analysis: the allergen index and environmental protection index were standardized, and the correlation between the two was obtained by using the correlation number method as shown in Table 5.

Table 5. Table of correlation Numbers

Indicators	Tree combinations	Common ragweed	Artemisia argyi	Dust mites combination	House Dust	Cat hair	Dog skin	Cockroaches	Mold combination
Total sewage discharge	0.611	0.698	0.579	0.811	0.688	0.306	0.088	0.802	0.899
Indicators	Lawgrass	Chicken protein	Milk	Peanuts	Soybean	Seafish combination	Shrimp	Crab crab	—
Total sewage discharge	0.518	0.194	0.667	0.597	0.5447	0.588	0.15	0.775	—

Besides cat hair, dog epithelium, chicken protein and shrimp, there was a strong positive correlation between total sewage discharge and other 13 allergen indexes.

According to the relevant data of 2013-2017, the grey prediction method was used to predict the allergen indexes and 5 environmental protection indicators for 2018, as shown in Table 6 below.

5.3 Testing of Models

Table 6. Projected data for 2018

Categor y	Tree combinations	Common ragweed	Artemisia argyi	Dust mites combination	House Dust	Cat hair	Dog skin	Cockroaches
Forecast	8.581	25.2759	20.0987	292.758	35.4381	62.9134	56.2133	21.7201
Categor y	Mold combination	Lawgrass	Chicken protein	Milk	Peanut s	Soybea n	Seafish combinati on	Shrimp
Forecast	13.1887	64.1517	124.9957	103.334	39.5637	24.8818	55.2548	4.9379
Categor y	Crab crab	Pm2.5	Average annual precipitation	Main pollutants discharged from wastewater	Sewage discharge	Smoke dust emission		
Forecast	21.6939	36.79572668	687.0639	670.058	649237.3	66231462.89		

According to the data forecast table of 2018, we use

the data of total six years from 2013 to 2018 to do

regression analysis and the solution of correlation matrix. The results obtained can be seen that the prediction results are consistent with the original results.

6. RECOMMENDATIONS AND CONCLUDING REMARKS

In recent years, due to the continuous deterioration of the air environment, waste gas, waste water, solid waste and other continuous pollution of the environment, our living environment due to the spread of bacterial mites, the increase of inhalable particles and solid dust in the air, drinking water sources, soil pollution, directly or indirectly affected our daily life. It is therefore urgent to protect the environment, and we should take immediate action to protect the environment on which we live and to defend our health. First of all, we should prevent the generation of sewage from the source, at the same time strengthen the recycling of sewage; improve soil environmental protection vegetation; reduce carbon emissions to improve air quality; at the same time, we should strengthen our own physical exercise, maintain a sunny attitude, positive and happy every day.

For the analysis of the influence of allergenic factors, this paper uses the method of quantitative and qualitative combination, and uses the multi-classification logistics regression model commonly used in the field of medicine to analyze, which improves the accuracy of the correlation between the variables obtained[12]. According to the allergy rating criteria, we converted the allergy grade (1-6) into the test score (1-100), which made the original variable into a continuous variable, effectively distinguish the differences between different allergies, and make the results more accurate and reasonable. A variety of mathematical software, such as SPSS, Eviews, MATLAB, are used to calculate and learn from each other to make the results more accurate[13]. The model does not take too much account of practical factors, the number of samples of the model is too small, the amount of data is small. no more effective regression methods were used. Based on the extension of the multi-factor analysis model of allergen, the quantitative correlation between time, season, age, sex and pathogenic category of allergen was obtained[14-17]. At the same time, multi-classification of Logistic regression in the medical field has its important position and influence.

ACKNOWLEDGMENT

This study was supported by Humanities and Social Sciences Research Project of the Ministry of Education "Research on the Development of Chinese Family Policies at Low Fertility Levels" (No.19YJCZH069) and Anhui Education Department Teaching and Research Fund Project (No. 2018jyxm1305); Anhui University of Finance and Economics School-Level Teaching and Research

Fund Project (acxkjsjy201803zd and acjyyb2018006). Anhui university of finance and economics 2018 undergraduate research and innovation fund project(XSKY1834ZD)

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

REFERENCES

- [1]<https://baike.baidu.com/item/%E8%BF%87%E6%95%87%E6%95%8F%E6%80%A7%E7%BE%E7%97%85/7904762>, Allergic Diseases, Baidu Encyclopedia.
- [2]Liu Y. Y., Li M., Yu L., et al, "The influence factor analysis based on logit-NB Hurdle model positive allergen number." *China Hospital Statistics*, 2015, 22(06):415-418.
- [3] Luo Yuyang, Wu Weilan, Wu Baoning, et al, "Clinical characteristics and related influencing factors of allergic diseases in infants ~0 to 24 months in Nanning." *China Maternal and Child Health Care*, 2018, 33(01):132-135.
- [4]Cui Yifan, Xiao Xuwu, "Advances in research on risk factors associated with allergic diseases in infants." *Chinese Journal of Child Health*, 2016, 24(05):489-492.
- [5]Giovanni Melioli, Laura Marcomini, Alessia Agazzi, Gyada Bazurro, Mariangela Tosca, Giovanni A.Rossi, Paola Minale, Renato Rossi, Giorgio Reggiardo, Giorgio W.Canonica, Giovanni Passalacqua, "The IgE repertoire in children and adolescents resolved at component l level: A cross - sectional study." *Pediatric Allergy and Immunology*, 2012, 23(5).
- [6]Susanne P.Nissen, Henrik F.Kjær, Arne Høst, et al, "The natural course of sensitization and allergic diseases from childhood to adulthood." *Pediatric Allergy and Immunology*, 2013, 24(6).
- [7] Duan Mengxi, Zhang Xiaoyu, Zhu Hong, et al, "Analysis of the results of detection of common allergens in 490 children aged 0~14 with allergic diseases in Dalian." *Primary Medical Forum*, 2017, 21(17):2168-2170.
- [8]<https://baike.baidu.com/item/%E8%A1%80%E6%B8%85%8D%E7%96%AB%E7%90%83%E8%9B%8B%E7%99%BDE%28Ig.E%29/16305019?fr=aladdin>, IgE, Baidu Encyclopedia.
- [9]Zhang Yingjun, "Category and detection of common allergens." *Chinese Journal of Clinicians*, 2008, 36(12):15-17
- [10]Wang Ruiqi, Zhang Hongyu, "Test results of 200,000 allergen-specific IgE." *Chinese Journal of Clinical Immunology and Allergy*, 2012, 6(1):18-23.
- [11]Zhou Daoping, He Xiaodan, Lei Chengye, et al, "Analysis of Allergen Spectrum and Risk Factors Associated with Common Allergic Diseases in Adolescents." *Chinese Journal of Hemorheology*, 2016, 26(4):458-461.
- [12]Zhu Jianping, "Application of Multivariate

Statistical Analysis (Third Edition).” Beijing: Science Press, 2016

[13]Yang Guiyuan, Zhu Jiaming, “Analysis of Excellent Papers in Mathematical Modeling Competition.” Hefei: China University of Science and Technology Press, 2013

[14]Zhu Jiaming, Liu Jiapo, “Essays in Science and Technology Competition.” Hefei: China University of Science and Technology Press, 2017

[15]Zhu Jiaming, “A Metrological Analysis of Influencing Factors of Shanxi Tourism Economic

Development Based on Grey Correlation Method.” Journal of Shanxi Datong University (Natural Science Edition), 2019, 35(03):32-36.

[16]Gang Jianwei, Gao Tianhui, Zhu Jiaming, “Prediction of Bus Mobile Payment Users Based on Logistic Regression.” Journal of Jiaozuo University, 2019, 33(02):84-87.

[17]Zhu Jiaming, Ren Xiaoxing, “Smart Growth Metrological Analysis Based on AHP- Entropy Method.” Journal of Anhui University (Natural Science Edition), 2017, 41(06):61-67

Research on the Relationship between Physical Exercise and Academic Performance based on Regression Model

Su Zhang¹, Yang Gui², Jiaming Zhu², Chunmi Wang³*

¹ Department of Physical Education, Anhui University of Finance and Economics, Bengbu 233030, China.

² School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu 233030, China.

³ Institute of Information Technology of GUET, Guilin, Guangxi, 540004, China

Abstract: Through the software tools such as SPSS and EXCEL to process and analyze collected data, this article aims at the relationship between physical exercise and academic performance. It presents the result of positive influence of the former on the latter, which is laid out by quantitative researches between students' physical being and academic record and efficiency using both multi factor linear regression model and multi Logistic regression model. Lastly, the article offers suggestions on advancing physical education contents to decision makers.

Keywords: Academic Performance; Physical Exercise; multi factor linear regression; Logistic regression; SPSS

1. BACKGROUND

Sports, in a broad sense, refers to a conscious, organized social life with physical exercises as the basic means to enhance physical fitness which can promote the all-round development of people, enrich social and cultural life and promote spiritual civilization. In a narrow sense, sports refers to a purposeful and planned educational process that enhances physical fitness through physical activity, imparts knowledge, skills, techniques, and develops moral and conscious qualities. Appropriate sports activities can help people improve the needs of social interaction, realize the need for aesthetics, ensure good physical health, further temper the will power, and mobilize the motivation for learning. At certain times, negative emotions can be vented to meet the needs of the senses, so that students can get a certain sense of accomplishment[1].

Modern research has found that the longer students participate in sports, the better their understanding of classroom content and assignments. Sports at that time can improve the blood circulation of the brain and increase brain-derived neurotrophic factors, thereby improving the brain's agility and intelligence, such as thinking, learning, memory, decision-making and processing information. Academic performance has a very important impact. When children exercise, some of the neurotransmitters in the brain, such as dopamine, increase significantly, and these substances can improve behavior such as inattention[2].

Students who receive cultural education in schools face life and learning pressure. Many students lack physical exercise, and they are in sub-health statuses such as declining physical condition and lack of energy. Therefore, recognizing the relationship between physical exercise and academic achievement and properly handling the relationship between the two is a corrective and fundamental basis for improving physical education and improving students' academic performance and physical quality. Through questionnaire research, by the software tools such as SPSS and EXCEL to process and analyze collected data, we use quantitative analysis to explore the impact of physical activity on college students' academic performance.

With the rapid development of social economy and the influence of media propaganda, the people's living standards have improved, material needs have been met accordingly, health and fitness issues have become more and more concerned, and college students' awareness of sports has also improved. Although the frequency and intensity of college sports have been greatly improved, college students generally lack the awareness of lifelong exercise in sports because of motivation, personality, sports injuries, employment pressure, heavy learning tasks, and physical differences.

As the pillar of the country, it's important to enhance the physical fitness of students which holds a practical significance for the improvement of the physical quality of the society. In this context, we must be highly aware of the role of physical exercise in promoting students' academic performance and change the traditional concept of Chinese people's sports. Schools must also attach great importance to sports and design scientific and rational physical exercise programs.

2. METHODS

2.1 Participants and Setting

Before the investigation, PE teachers were trained by a technician to get prepared for finding and recruiting students in their university during their college semesters. After that, students were recruited to participate in the research while having a basic understanding of the study purpose, voluntary

participation, assurance of confidentiality and anonymity and no penalty for choosing not completion of the questionnaires. Then students who had returned the signed consent forms could finally become the participants of the research project. Participants of different college grades would receive questionnaires during their studying, exercising and breaking time. After removing the students who did not complete the questionnaire, there were 200 students participating in the research project. The male to female ratio was roughly 1:5, with 17.4% being male and 82.4% being female because this research project was carried out in a college of finance and economics which had a higher proportion of female students. The participating students were between 17-22 years old and the average age was about 19 years old. There is a need of emphasizing that all students live in the dorms on campus.

2.2 Data Collection

Participants received the questionnaires during the middle and end of their college term. The questionnaires consist of physical activity habits, physical quality, and academic performance. The International physical activity questionnaire (IPAQ) was used to measure the intensity of physical activity, including vigorous, moderate, and walking, as well as sitting time performed on a daily basis. The IPAQ consists of seven self-reporting questions, requiring recall of physical activity in the past week. Results are used to estimate total physical activity measured in MET- min/week and time spent sitting. The IPAQ is reliable and has internal consistency with a Cronbach's alpha coefficient of 0.758 in our study and $\alpha > 0.80$ in previous studies[9]. The academic performances were collected with the help of the teachers and participators. The grade ranking, failing subjects, acceptance level of the course content, reasons for learning difficulties and participators' initiative preview, review and study state were analysed. The relationships between physical activities and academic performances were studied based on the survey results.

2.3 Data Analysis

The questionnaire data has high reliability and validity, and the data is representative except for

missing and wrong parts. The amount of exercise per week is relatively uniform and there are no special circumstances. In the analysis model, X1 means the position of exercise activities, X2 means the mastery of the exercise skills, X3 means the number of mastered exercise skills, X4 means the exercise time per week, X5 means the exercise intensity per time, X6 means the physical quality, Y1 means the score of six sports indicators on component 1, Y2 means the score of six sports indicators on component 2.

There are some students with irregular exercise time. When calculating, the uniform default student exercise time is more regular. Excluded many external influences, and only considered the relationship between learning and sports, but no other influencing factors. The reliability coefficient is 0.882 which shows the set of data holds the better results and higher reliability.

When the dependent variable has multiple values, multiple logistic regression analysis is used to perform the fitting, which can better solve the model. Based on the above analysis, the movement positioning, the mastery of motor skills, the number of mastery of motor skills, There are six factors including the number of weekly exercises, the intensity of each exercise, and the physical fitness. The data were summarized, and regression analysis and linear regression analysis are performed on various learning situation indicators and sports conditions using SPSS software. Based on the academic performance and the efficiency of class attendance, the correlation between academic performance and sports grouping data is explored and conclusions are drawn.

3. RESULTS

3.1 Descriptive Statistics

The subjects of this questionnaire survey are mainly freshmen, sophomores, and juniors, accounting for 99.2% of the total sample, while fewer are seniors, accounting for only 0.8% of the sample. And the proportion of girls in this survey is relatively large, reaching 82%. Table 1 shows the distribution of sample data[8] and the understanding and interpretation of sports survey data and learning survey data.

Table 1. the demographic information of the participants

Variable	Category	%
Gender	male	17.4
	female	82.6
Grade	1	32.6
	2	30.3
	3	36.4
	4	0.8
	Lazy	22.7
exercise attitude	Avid sports maniac	24.7
	On both sides	53.0
Number of daily movements	One time	27.3
	Two times	27.3

	Three times	18.9
	Four or more times	26.5
exercise intensity	Sweating profusely and feeling very tired	23.5
	Little sweating and feeling very tired	53.8
	tired	19.7
	Don't feel tired	3.0
cognitive attitude of college students towards their physical quality	Very strong	2.3
	Relatively strong	26.5
	General	52.3
	Relatively weak	15.2
	Very weak	3.8
cognitive attitude of college students towards the contemporary college students' physical quality	Satisfaction, High physical fitness	8.3
	General physical fitness	29.5
	Poor Physical fitness needs strengthened	56.8
	Unknown	5.3
Exercise purpose	physical exercise	55.3
	Weight loss and fitness	56.1
	kill time	14.4
	Relax and relieve stress	47.7
Grade Ranking	Excellent	6.1
	good	34.8
	medium	43.9
	low	15.2
initiatively preview and review	Never	16.7
	occasionally	64.4
	frequently	17.4
	Every time	1.5
study state	Initiatively learning	45.5
	Passive learning	45.5
	Don't want to learn	9.0
exercise schedules when busy in studying	Find time	18.2
	Depend on mood	51.5
	Reduce exercising	34.8
	Other	6.1

Through the analysis of the sports attitudes of the survey respondents, we can see that 77.7% of the students have certain exercise habits in their daily life. Among them, 24.7% students love sports very much, and 22.7% students say they have no sports Habits and interests. It can be seen from this that most students have the habit and tendency to participate in sports activities in their daily learning life.

Through the analysis of the survey data, it can be found that more than 70% of the students will maintain two or more times of exercise per week, and 26.5% of them will achieve high-frequency exercise four times or more per week. It is easy to see from the analysis of exercise intensity that nearly 80% of them will reach fatigued intensity, and only 20% of their classmates will not feel tired after exercise. However, more than half of the students believe that the number of exercises and the intensity of the college level have decreased compared to the high school period. 30% of the students think that the current exercise situation is basically the same as in high school, and less than 20% of the students think that their exercise intensity has increased in high school; this shows that after entering college, most students' sports enthusiasm will

be lower than before happening.

3.2 Association of Physical Activity, Physical Quality and Academic Performance

The results show that physical activity has some effect on the physical quality and academic performance. Although there are differences between the participators, a getting-enough exercise can help improve physical quality and academic performance.

According to the data, we analyzed the relationship between sports and academic performance (results, major parts) of the sample data. It can be concluded that 81.1% of the students think that their physical fitness is above the general level, and 28.8% of them think that they have Strong physical fitness, but only 8.3% of the respondents believe that the physical fitness of contemporary college students has reached a satisfactory level, and nearly 60% of the respondents believe that the physical fitness of contemporary college students is poor, and physical education needs to be strengthened work out. It can be clearly seen that there is a certain degree of deviation between the respondents' perceptions of themselves and the physical fitness of contemporary college students. In addition, in the analysis of the sports'

purpose of the respondents, we can see that more than half of the respondents' sports are highly targeted, such as physical exercise, weight loss, and stress relief, and less than 15% Respondents used sports as an activity to pass the time.

By analyzing the grade ranking data of the survey respondents, we can see that the data as a whole is olive-shaped and belongs to a relatively healthy situation. Among them, 6.1% of the students are at an excellent level, 15.2% of the students are under-ranked, and 78.7% of the students are at a good and medium average state.

Through the analysis of the subject's application status, we can see that 72.7% of the students said that they have never applied for the subject, and nearly 30% of the students said that they had a record of their application, of which 8.3% of the students had applied for the subject twice. Among the science subjects, ideological and professional core courses are the subjects with the least number of subjects, while more subjects such as English, mathematics, computer, and professional basic courses are more subject-oriented. Such a data form reflects that contemporary college students do not pay enough attention to basic subjects and only pay attention to the so-called core courses, which need to be vigilant.

By analyzing the data of the survey participants' acceptance of the course content, most of the students can trim and understand the content of the class in a timely manner, and the main problems of students with learning difficulties are from their own grasp of the learning methods and Inadequate self-learning ability.

Through the intuitive understanding of the questionnaire situation, we can see that more than 90% of the students spend at least one hour to study in the daily spare time, and nearly 80% of the students said that they have never skipped classes. This shows that most students attach great importance to learning, and will use their spare time to deepen and consolidate their learning of classroom knowledge. Those who do not study outside of class and frequently skip class every week are a very small part. And more than 80% of the students said that they would take the initiative to review and review the content of the study, but only 1.5% of students can do the review and review work before and after each class; combined with the class status table of the students, we can see More than half of the students are in a state of passive learning, which is consistent with the previous data. This shows that the vast majority of students are not enthusiastic about learning and are in a state of passive learning.

According to the survey participants' exercise schedule when they are busy studying, we can see that 34.8% of students will choose to reduce exercise to focus more on learning, 18.2% of students said that they will squeeze out time in between learning Physical exercise, the remaining students will make more judgments from subjective mood.

4. DISCUSSION

The SPSS was used to make a linear regression analysis on the academic performance and the listening situation. The analysis results are as Table 2 and 3.

Table 1. Regression coefficient table of academic performance

model	Unstandardized Coefficients		Standardized Coefficients	t	significance
	B	standard error	Beta		
(constant)	2.369	0.059	—	40.473	0.000
REGR factor score 1 for analysis 1	0.046	0.059	0.057	0.782	0.435
REGR factor score 2 for analysis 1	0.173	0.058	0.218	2.971	0.003

a. Dependent variable: academic performance
From the analysis results, the significant coefficient is

only FAC2, that is, the main body 2 students' physical fitness has a greater impact on student performance.

Table 3. Regression coefficient of lecture attending efficiency

Model		Unstandardized Coefficients		Standardized Coefficients	t	significance
		B	standard error	Beta		
(constant)		1.961	0.038	—	52.187	0.000
1 REGR factor score	1 for analysis 1	-0.012	0.038	-0.023	-0.310	0.007
REGR factor score	2 for analysis 1	0.036	0.037	0.073	0.977	0.051

a. Dependent variable : lecture attending situation
From the analysis results, the only significant coefficient is FAC1, that is, the main component 1 student's exercise situation has a significant effect on

student class efficiency[5-6].

Then, use SPSS to summarize the above data, see table 4 and 5.

Table 4. parameter value of academic record

academic record	B	standard error	wald	DOF	Significance	Exp(B)	95% confidence Interval of Exp(B)	
							lower limit	upper limit
intercept	2.807	2.309	1.478	1	0.224	—	—	—
The mastery of the exercise skills	-1.627	0.539	9.118	1	0.003	0.196	0.068	0.565
Number of mastered exercise skills	0.471	0.342	1.895	1	0.169	1.601	0.819	3.130
Number of exercises per week	0.195	0.381	0.263	1	0.608	1.216	0.577	2.564
[Position of exercise activities=1]	0.292	1.312	0.050	1	0.824	1.340	0.102	17.532
[Position of exercise activities=2]	0.166	1.027	0.026	1	0.871	1.181	0.158	8.830
[Position of exercise activities=3]	0	—	—	0	—	—	—	—
intercept	2.029	2.076	0.955	1	0.328	—	—	—
The mastery of the exercise skills	-1.350	0.475	8.077	1	0.004	0.259	0.102	0.658
Number of mastered exercise skills	0.780	0.303	6.630	1	0.010	2.181	1.205	3.948
Number of exercises per week	0.346	0.335	1.068	1	0.301	1.413	0.733	2.725
[Position of exercise activities=1]	0.336	1.139	0.087	1	0.768	1.400	0.150	13.058
[Position of exercise activities=2]	0.627	0.860	0.531	1	0.466	1.872	0.347	10.112
[Position of exercise activities=3]	0b	—	—	0	—	—	—	—
intercept	0.862	2.094	0.169	1	0.681	—	—	—
The mastery of the exercise skills	-0.929	0.473	3.859	1	0.049	0.395	0.156	0.998
Number of mastered exercise skills	0.701	0.303	5.359	1	0.021	2.015	1.113	3.646
Number of exercises per week	0.356	0.336	1.126	1	0.289	1.428	0.739	2.758
[Position of exercise activities=1]	0.711	1.138	0.390	1	0.532	2.036	0.219	18.945
[Position of exercise activities=2]	0.746	0.862	0.747	1	0.387	2.108	0.389	11.426
[Position of exercise activities=3]	0	—	—	0	—	—	—	—

Table 5. Lecture attending efficiency parameter value

Lecture attending efficiency	B	standard error	wald	DOF	significance	Exp(B)	95% confidence interval of Exp(B)	
							lower limit	upper limit
intercept	-1.475	1.196	1.519	1	0.218	—	—	—
Intensity per movement	0.611	0.483	1.600	1	0.206	1.842	0.715	4.749
[physical quality=1]	1.660	1.040	2.551	1	0.110	5.260	0.686	40.349
[physical quality=2]	0.198	0.845	0.055	1	0.814	1.219	0.233	6.390
[physical quality=3]	0b	—	—	0	—	—	—	—
intercept	-0.097	1.025	0.009	1	0.925	—	—	—
Intensity per movement	0.051	0.423	0.014	1	0.905	1.052	0.459	2.410
[physical quality=1]	2.600	0.968	7.208	1	0.007	13.460	2.018	89.795
[physical quality=2]	1.702	0.740	5.285	1	0.022	5.486	1.285	23.414
[physical quality=3]	0	—	—	0	—	—	—	—
intercept	-1.550	1.194	1.686	1	0.194	—	—	—
Intensity per movement	0.321	0.432	0.550	1	0.459	1.378	0.590	3.216
[physical quality=1]	3.142	1.121	7.851	1	0.005	23.143	2.570	208.366

[physical quality=2]	2.511	0.924	7.38 8	1	0.007	12.323	2.015	75.372
[physical quality=3]	0	—	—	0	—	—	—	—

The above results show that learning performance is significantly related to self-exercise positioning, motor skills mastery, number of motor skills mastery, and number of exercises per week, and is positively correlated; class efficiency is significantly related to each exercise intensity and physical fitness[7], and negatively related to exercise intensity. Positively related to physical fitness.

It can be seen that the four indicators of self-exercise positioning, skill mastery, skill mastery, and the number of exercises per week have a significant impact on academic performance. Among them, the intensity of each exercise is negatively related to the efficiency of class attendance, and the others are positively related; the number of subjects linked to these subjects has no significant relationship. Aiming at the above results, a plan to promote college students' academic performance through physical exercise is given.

In physical education, we must continuously improve the teaching methods of physical education[3], enrich the content of the classroom, and give students more time to practice. At the same time, we must avoid sports teaching passing the field or focusing on student technology, regardless of the actual exercise of the students. Physical education should be based on the actual situation of students, follow the teaching principles of teaching students according to their aptitude, step by step, and comprehensive development of the body, increase the sports knowledge and skills of college students, correctly guide students to carry out scientific physical exercises, and enable students to develop their physical fitness in a comprehensive manner. Some suggestions are provided as follows:

4.1 Carry Out Sports Competitions to Stimulate College Students' Participation In Sports

Various types of sports competitions at all levels such as schools and departments should be actively carried out. In addition, the school grants certain funds or sports equipment every year. The school organizes more than two group competitions every semester, prompting each department to further strengthen students' extracurricular sports activities. Attach importance to competitions to promote the development of sports activities, encourage accompanying sports, provide regular sports exchange opportunities for college students, stimulate students' enthusiasm for participating in sports, and continuously enhance their confidence and perseverance in regular sports, so that college students can participate in physical exercise. Continuous improvement or maintenance, effectively and effectively improve the health of college students. And from freshmen to juniors, students' enthusiasm for sports is gradually diminishing. Schools should

take physical education as an important aspect of year-end performance assessment and urge senior students to participate in sports.

4.2 Schools Carry Out Publicity Activities to Stimulate College Students' Interest in Sports

Stimulating students' strong intrinsic motivation and interest in physical exercise is the prerequisite for cultivating their participation in sports. Colleges and universities should actively carry out various forms of propaganda activities, deepen college students' understanding of physical exercise, and strengthen their awareness of participating in physical exercise. Besides, offering physical education options is also an effective way to increase students' interest in learning and actively participating in physical exercise.

4.3 Improve the Construction of Sports Facilities to Meet The Needs of College Students for Sports Activities

It is important to gradually improve the construction of sports facilities. Under the situation of continuous expansion of enrollment in universities, schools should work out strong measures to allocate stadiums, facilities, and equipment in strict accordance with the standards set by the State Council's education administrative department to improve the environment of stadiums and provide better exercise conditions, make more use of the open space of the school to build simple ball courts, strengthen the opening of stadiums, increase the utilization rate of stadiums, and ensure the normal development of college students' sports activities.

College students having a healthy physique is a reflection of a nation's vigorous vitality, a good mental outlook, and a strong guarantee and prerequisite for serving the country and the people. Improving the contemporary college students' correct understanding of the importance of physical health, and improving the physical fitness of college students is an urgent task. Therefore, we must attach great importance to the role of physical exercise in promoting students' academic performance and change the traditional view of Chinese people on sports. Schools should also attach great importance to physical education and design scientific and reasonable physical exercise programs. College students should deeply understand the importance of physical exercise from their own. While working hard at school, each of our students should correct their thinking, cultivate fitness consciousness, and actively participate in physical exercise to improve their physical fitness.

5. CONCLUSION

This paper analyses and visualizes the survey questionnaire data, and analyses the situation data of the respondents. It also uses multiple classifications and regression analysis methods to obtain sample data

and analyse the correlation between sports and academic performance. In the model, the global optimal correlation status is obtained in the theoretical situation, which has practical significance and convenient features and is conducive to the application of data in the form of questionnaire surveys in a wider range. The paper found that physical education teaching methods and physical fitness of college students should be improved. It is an important way to implement quality education, mold perfect personality, and cultivate qualified personnel for comprehensive development. In the teaching of physical education curriculum, how to improve students' desire and enthusiasm for sports training participation will have a direct impact on the interest and effect of curriculum content practice [4]. Reasonable plans for improving the academic performance of college students using physical exercise was suggested, which can be used to guide the physical arrangement of college students and is realistic and operable.

CONFLICT OF INTEREST

All the authors have no conflict of interest to declare.

ACKNOWLEDGEMENTS

This study was supported by the Humanities and Social Sciences Research Major Project of the Education Department of Anhui Province (SK2017A0452) and Anhui Philosophy Social Sciences Planning Project (AHSKY2017D11).

REFERENCES

[1]Li. W. L., Wang. X. H., "On some experiences in physical education teaching." *Young Science*, 2013, (01):171-172.

[2]Yang. H, Zhou. F, "Research on the Relationship Between College Students' Physical Fitness and Academic Performance from the Perspective of Health Education." *Journal of Liaoning University(Philosophy and Social Sciences Edition)*, 2018, (1): 170-176.

[3]He. Z. Y, Yong. X. Y, et al, "Study on the Relationship between physical exercise and learning efficiency." *Research on the Development of Teachers' teaching ability*, 2018: 843-846.

[4]Chang. S. D., "Master scientific methods to improve learning efficiency." *Selected papers on basic Education theory research*, 2005: 400-401.

[5]Zhang. T, Yang, W. Z., "SPSS statistical analysis and detailed explanation of industry application cases." *Tsinghua University Press*, 2011:169-172.

[6]Duncan. P. Van. Dusen , Steven. H. Kelder, et al, "Associations of physical fitness and academic performance among schoolchildren." *The Journal of school health*, 2011, 81(12): 733-773.

[7]Ronald. W. Bass; Dale. D. Brown, et al, "Physical fitness and academic performance in middle school students." *Acta paediatrica (Oslo, Norway : 1992)*, 2013, 102(8): 832-839.

[8]Hsieh. Shu-Shih, Tsai. Jia-Ren, et al, "The relations between 3-year changes in physical fitness and academic performance in nationally representative sample of junior high school students." *Scientific Reports*, October 2018.

[9]Chung. Bing. Yang, Te. Hung. Tsao, et al, "Cardiorespiratory Fitness, Health-Related Physical Fitness and Academic Performance in College Students." *Advances in Physical Education*, January 2020, 10(01):42-53.

Application of Intelligent Technology in Mechanical Engineering Automation

Tianran Gao

Henan Institute of Architecture, Zhengzhou, 45000, China

Abstract: In the new era, with the vigorous development of China's society and economy, science and technology are constantly updated, various new technologies are constantly emerging, and have been widely and deeply applied in various industries and fields. As a new technology, intelligent technology applied in mechanical engineering automation can improve the intelligent degree of mechanical engineering, and ensure the orderly development of production activities. It has positive significance and important value to promote the technological innovation of China's manufacturing industry. This paper mainly analyzes and explores the application of intelligent technology in mechanical engineering automation, hoping to give some reference and reference to related fields in China.

Keywords: Intelligent technology; mechanical engineering automation; application; analysis

1. OVERVIEW OF INTELLIGENT TECHNOLOGY

With the vigorous development of China's society and economy, a large number of high-tech constantly emerge, which has played a key role and important value in improving residents' lives and promoting social production. As a new technology, intelligent technology, supported by information technology and Internet technology, has a wide range of application prospects, and has been widely and deeply applied in many industries and fields. The application of intelligent technology in mechanical engineering automation can improve the degree of intelligent production and meet the needs of various production activities, which is of great significance to promote the stability and sustainable development of manufacturing enterprises.

Intelligent technology is supported by network technology, big data technology, Internet of things technology and artificial intelligence technology. It is a kind of high-tech product, which integrates computer technology, sensor technology and GPS technology, and has a wide application prospect and high application value. Intelligent technology in the specific application, through the intelligent system to complete the analysis, collation and collection of data and information, under the reflection and judgment of artificial intelligence, puts forward the most direct and effective solution, which can help people solve many problems in work and life. With the development of intelligent technology, it has been applied in many fields of society, and has significant application effect.

2. APPLICATION ADVANTAGES OF INTELLIGENT TECHNOLOGY

2.1 Convenient Operation

Intelligent technology has strong control ability and decision-making ability. Under the support of information technology and network technology, intelligent equipment is easier to operate. At the same time, its operating system is not independent. The cross cooperation of various systems can make up for the loopholes and defects in operation, and improve the intelligent and automation level of mechanical equipment.

2.2 Higher Efficiency and Accuracy

The application of intelligent technology in mechanical engineering automation is mainly reflected in the CPU and RISC chips, which can significantly improve the system operation speed and operation efficiency. In general, the CPU chip is often combined with intelligent technology, which can improve the control accuracy and operation efficiency of the system, and ensure the orderly production activities.

2.3 Convert to Data Results

The most significant difference between intelligent technology and other technologies is that the processing results can be directly transformed into data, which has strong data analysis and processing ability. In data processing, it does not need to consume a lot of time, and has high reliability and accuracy. At the same time, the intelligent technology can also display the data results in the form of text. If the staff have clear requirements for the data, they can also display the data through animation or images, so as to make the data more visualized and specific, and help the staff to make decisions.

3. APPLICATION OF INTELLIGENT TECHNOLOGY IN MECHANICAL ENGINEERING AUTOMATION

3.1 Intelligent Management

After the emergence and application of a large number of intelligent equipment, mechanical automation equipment has been on the edge of elimination. Although the former automation equipment has certain management efficiency, it is difficult to provide decision support for technical personnel due to its low degree of intelligence. The introduction of intelligent technology can realize the intelligent management of the production process. The intelligent system can replace the artificial decision-making. The staff can complete the dynamic management of the production system and production process by using intelligent

equipment, and ensure the management efficiency and quality. At the same time, with the support and assistance of intelligent technology, the staff can find the deficiencies and problems in the production in time, formulate the coping strategies in time, and ensure the production is in a safe and stable state [1].

3.2 Intelligent Diagnosis

In the production and operation of mechanical engineering automation equipment, affected by human operation, operating environment and load operation and other factors, it is easy to have faults and problems. At the same time, due to the complex structure of automation equipment, if the fault occurs, it will increase the diagnostic difficulty for maintenance personnel. The application of intelligent technology can dynamically monitor the running state of the equipment, find out the faults existing in the operation of the equipment in time, judge the fault type, assist the maintenance personnel to judge the location and cause of the fault in time, and then formulate a scientific maintenance plan to ensure that the equipment is in a stable and safe production state.

3.3 Intelligent Production

Although there is a big difference between the automatic production and the previous production mode, it is easy to induce various quality and safety problems, and it is difficult to dynamically monitor the product quality. The application of intelligent technology can carry out intelligent management and supervision on the production process, improve the reaction speed of equipment, and timely analyze the causes of product quality problems, help technical personnel to formulate optimization plans, and then improve product quality [2].

4. THE FUTURE DEVELOPMENT TREND OF INTELLIGENT MECHANICAL ENGINEERING

4.1 Higher Level of Intelligence

With the development of intelligent technology, the structure of mechanical engineering equipment will be more complex and the function will be more perfect. Equipment operation will be replaced by machinery, and the degree of intelligence will be effectively improved. The equipment with intelligent characteristics will cover the mechanical production field and system [3].

4.2 Higher Level of Flexibility

Under the market economy system, if the manufacturing industry wants to achieve better development, it needs to deal with the competition from domestic and foreign enterprises. Flexible management can improve the production efficiency and management level of enterprises. With the development and application of intelligent mechanical engineering, it can provide decision support for enterprises to carry out technological innovation, product innovation and process innovation, and

promote production personnel and production equipment. Stop and start at any time, improve the freedom of production activities, and reasonably adjust production tasks, production capacity and production time [4].

4.3 Better Visualization

Visualization is the most significant feature of intelligent technology, which can display data to users in the form of images or charts. With the development of intelligent technology, CAD drawing function will be more perfect, which can provide rich and effective information for enterprise decision-making.

4.4 Higher Level of Network

Through network technology, various computer systems and electronic devices can be effectively connected, and the dynamic interaction and real-time sharing of information can be realized through network protocol, and the sharing degree and interaction level of resource information can be improved. With the development of intelligent technology, the interactive ability of mechanical engineering will be improved [5].

5. CONCLUSION

In a word, under the new situation of China; economic development, the manufacturing industry has ushered in new opportunities and new challenges. The application of intelligent technology in mechanical engineering automation plays a key role in promoting industry development and technological innovation. Therefore, relevant enterprises and technical personnel should establish innovation awareness and reform spirit, actively explore the application of intelligent technology, and contribute to China; economic construction. Make greater contributions.

REFERENCE

- [1]J. Li, application and development trend of intelligent technology promoting mechanical engineering automation. *China Metal Bulletin*, 2019, (11): 5-6.
- [2]W. S. Gu, Discussion on the application of intelligent technology in mechanical engineering automation from the economic perspective. *China Equipment Engineering*, 2019, (22): 201-203.
- [3]M. Wang, Analysis of intelligent technology based on electrical engineering automation. *Internal combustion engine and accessories*, 2019, (23): 240-241.
- [4]Y. L. Yang, Discussion on the practice of mechanical engineering and its automation in manufacturing. *Information recording materials*, 2019, 20 (12): 95-96.
- [5]F. B. Qin, Exploring the application value of intelligent technology in mechanical engineering automation. *Agricultural development and equipment*, 2019, (11): 149-150.

Analysis of the Current Situation of Fault Pattern Recognition for Rolling Bearing

Lingyan Kong

Shanghai University of Engineering Science, Advanced Vocational Technical College, shanghai, 20000, China

Abstract: as a common rotating part in all kinds of mechanical equipment, rolling bearing not only has a direct impact on the technical state of equipment operation, but also has a high risk of failure. The application of failure mode identification method is an effective way to solve the problem of rolling bearing failure. Based on this, this paper briefly introduces the fault diagnosis of rolling bearing, and discusses several methods of fault pattern recognition of rolling bearing, such as artificial neural network, support vector machine, fuzzy c-means clustering, etc., hoping to provide some reference for the fault maintenance of rolling bearing of related mechanical equipment.

Keywords: Rolling bearing; Fault pattern recognition; Fault diagnosis

1. INTRODUCTION

In the fault diagnosis of rolling bearing of mechanical equipment, the fault feature information is usually needed, and then the fault pattern recognition is carried out according to the fault feature information to clarify the type, point and cause of equipment fault, so as to provide important reference for subsequent fault maintenance. Therefore, as the key link of fault diagnosis, fault pattern recognition of rolling bearing has a direct impact on the safe and stable operation of mechanical equipment rolling bearing, and the research on fault pattern recognition method of rolling bearing is naturally very necessary.

2. OVERVIEW OF ROLLING BEARING FAULT DIAGNOSIS

The fault types of rolling bearing are relatively many, and the impact of the fault is relatively large, such as cage fracture, bearing inner and outer ring fracture and other common faults, which are very sudden and harmful. Once they happen, they often lead to rotor shaft holding and other problems, so that the mechanical equipment cannot continue to run, and even lead to mechanical equipment scrap. For all kinds of faults of rolling bearing, there are many diagnosis methods, such as vibration analysis method, temperature analysis method, oil sample analysis method, etc. Although there are some differences in the specific fault diagnosis ideas, but in the process of fault diagnosis, fault mode identification is basically needed. Taking the most widely used vibration analysis method as an example, this method can be generally divided into several parts, such as collecting vibration signals, determining fault features according to signals, bearing fault identification, fault in-depth analysis, and fault

processing decision-making. Bearing fault identification is the fault pattern recognition based on fault feature information [1].

3. FAULT PATTERN RECOGNITION METHOD IN ROLLING BEARING FAULT DIAGNOSIS

3.1 Artificial Neural Network

As a dynamic network system which can simulate human brain neuron system, the application of artificial neural network in the field of fault diagnosis has been widely concerned since last century, and its specific application direction can be generally divided into fault prediction (establishing dynamic prediction model), expert system fault diagnosis (mainly knowledge processing) and pattern recognition (using model). There are three categories. At present, although there are many mechanical fault diagnosis methods based on artificial neural network, most of them belong to the pattern recognition category. It is necessary to use artificial neural network as the pattern classifier for fault analysis and fault pattern recognition, and the fault pattern recognition methods in rolling bearing fault diagnosis are basically based on this.

Taking the BP network model in the feedforward network as an example, based on this artificial neural network to develop the fault diagnosis of rolling bearing, it is usually necessary to select the operating parameters such as kurtosis coefficient, peak value coefficient and root mean square value which can reflect the running state of the bearing, to form the characteristic vector of the bearing state together, and then use a simple three-layer (input layer, hidden layer and output layer) perceptron structure feedforward network. The number of input layer neurons corresponding to the number of eigenvectors and the specified number (depending on the actual situation) of hidden layer neurons, while the number of output layer neurons is usually 5, respectively corresponding to normal operation, comprehensive failure, outer ring failure, roller failure, cage failure and other rolling bearing operation states. After determining the encoding of network structure and operation state, the field operation data of rolling bearings of mechanical equipment should be input. After determining the difference of the running state and characteristic parameters of the bearing, a representative training sample is selected from it. After normalization, it is input into the BP network model for training, and the weights are adjusted in the training process, so that the actual output value of the BP network model can be adjusted. It can gradually approach the expected output.

After the weight of BP network model is adjusted, it can be directly applied to rolling bearing fault diagnosis [2]. In addition, the application of artificial neural network in rolling bearing fault diagnosis also includes RBF neural network, SOM network, wavelet neural network and so on.

3.2 Support Vector Machine

Compared with other mechanical equipment accessories, the rolling bearing can extract less fault feature information after failure, and the number of typical samples is also very limited. If it cannot meet the sample analysis requirements of artificial neural network, then the model classifier based on artificial neural network is difficult to complete the early learning process training, so as to provide the subsequent fault diagnosis and analysis. To trouble, and through the application of support vector machine, it can just solve the problem caused by the lack of fault samples. Support vector machine itself is a kind of generalized linear classifier, which can binary classify the data according to the way of supervised learning, and has strong generalization ability, and also can play an important role in fault pattern recognition. From the point of view of rolling bearing fault pattern recognition, although the traditional support vector machine can only binary classify the data, and solve the problem of two types of classification pattern recognition, and the training time is relatively long, but through the improvement of the algorithm of support vector machine, it can still be applied to the problem of rolling bearing fault with high complexity [3]. For example, Wan Shuting proposed in the rolling bearing fault diagnosis based on the least square support vector machine that the wavelet packet method should be applied first to extract the bearing state eigenvector from the collected rolling bearing fault signal data, and then input it into the multi-class classifier based on the support vector machine to automatically complete the rolling bearing running state recognition, so as to determine the fault. The severity of the fault, the location of the fault and other information, and to distinguish the bearing outer ring fault, inner ring fault and other situations, and then complete the rolling bearing fault diagnosis assistance. However, it should be noted that since SVM itself has no clear criteria for parameter selection, it usually only depends on the user's own experience to determine the parameters, so once the parameters are not selected properly, the accuracy of fault pattern recognition will be easily affected, and in the case of multi class classification, the sparsity of SVM will be destroyed, which are the current support directions. The key research topic of fault pattern recognition method for measuring machine is to be solved.

3.3 Fuzzy C-Means Clustering

The fault pattern recognition of rolling bearing based on support vector machine can solve the problems of few typical samples, local extremum, high-dimensional inner product operation, etc., but it needs

the prior category knowledge of fault samples, and the parameter selection is easily affected by human factors. There are some deficiencies in the speed and accuracy of fault pattern recognition. To solve this problem, we can also choose to use the fuzzy c-means clustering method (FCM) in the fuzzy clustering algorithm to carry out the training of unlabeled data by optimizing the objective function, so as to effectively improve the speed and accuracy of fault pattern recognition [4]. For example, Zhang Lingling and others put forward in "diagnosis of engine crankshaft bearing fault based on EEMD and fuzzy c-means clustering algorithm". In the face of complex rolling bearing fault, it is necessary to combine EEMD and fuzzy c-means clustering algorithm. First, the set empirical mode decomposition method is used to determine the time scale characteristics of data, so as to realize the decomposition of fault signal and extract fault Feature information, and then input the fault feature information as parameters into the fuzzy c-means clustering algorithm to get the corresponding classification matrix and clustering center. Finally, the known fault sample clustering center and the fault sample to be tested are put together for comparison, and the closeness between them is calculated accurately to complete the effective identification of fault mode. In this kind of rolling bearing fault pattern recognition method, because the fuzzy c-means clustering algorithm itself does not need the prior category knowledge of typical samples, only with the help of FCM model, it can complete the training of unlabeled data, so even after the rolling bearing fault, it cannot obtain the training samples with known category labels, it can also continue to complete the training mode, so as to avoid. There are a series of problems such as slow convergence speed, low operation speed and long training time.

4. CONCLUSION

In a word, although the fault diagnosis of rolling bearing has certain difficulty, as long as the fuzzy c-means clustering, support vector machine, artificial neural network and other fault pattern recognition methods can be reasonably cited in the fault diagnosis process, the validity of such fault pattern recognition can be guaranteed and the important work for the fault diagnosis of rolling bearing can be provided support.

REFERENCE

- [1]Hu Deqiang. Summary of rolling bearing fault diagnosis methods. Internal combustion engine and accessories, 2019, (09): 151-153.
- [2]Liu Kunpeng, Su Tao, Zhao Lei, et al. "Analysis on research status of rolling bearing fault pattern recognition method," Internal combustion engine and accessories, 2018, (23): 62-63.
- [3]Xia Junzhong, Su Tao, An Xiangbi, et al. "Analysis of current situation of fault pattern recognition methods for rolling bearing," Noise and vibration control, 2013, 33(04): 185-189.

- [4]Qin Haiqin, Xu Kejun, Sui Yusong, et al. "Fault pattern recognition of rolling bearing based on system information fusion," *Vibration. Test and diagnosis*, 2011, 31(03): 372-376 + 400.

Analysis of the Influence of Digital Signal Processing on Electronic Measurement and Instrument

Risheng Chen

Hangzhou Dianzi University, No.1158, No.2 Avenue, Baiyang Street, Hangzhou Economic Development Zone, Hangzhou, Zhejiang, 310018, China

Abstract: as a technology of data statistics and processing through digital calculation, digital signal processing technology is widely used in communication, measurement, statistics and other technical fields. At present, people have increased the research work of digital information processing in the application of electronic measuring instruments, and found that digital signal processing has a great impact on electronic measurement and instruments. We must pay more attention to digital signal processing technology.

Keywords: Digital signal processing; Electronic measurement; Instrument; Impact analysis

1. INTRODUCTION

The digital signal processing is very important in the current electronic instrument measurement. Measurement is an essential work in the development of human society. Electronic instruments are the most advanced measuring equipment at present. How to strengthen the effect of electronic measuring instruments through the application of digital signal technology has become a problem that the current measuring workers need to think about and solve.

1.1 Significance of Digital Signal Processing Technology

With the continuous development of economy and the continuous improvement of social productivity, no matter what kind of human production activity, it is inseparable from the figure of measurement work. Only by making good use of the application of digital signal processing technology in electronic measuring instruments can we ensure the smooth progress of various social production activities.

1.2 Function of Measurement

Measurement plays a very important role in social production. Its main connotation is to visualize abstract things. In some production and manufacturing fields, if the products want to be mass produced, they cannot do without the support of various parameter information. The main work of measurement is to obtain these information. In addition, measurement can also standardize production activities to a certain extent. When parts are produced, necessary inspection should be carried out. At this time, a series of data should be used to evaluate products to determine whether products meet production standards. Finally, the

measurement can manage all production links as a whole. Before production, measure the parameters of the parts, and the staff can determine the size and shape of the parts, so as to ensure the smooth implementation of each production link.

2. SIGNIFICANCE OF DIGITAL SIGNAL PROCESSING

The main tool of measurement is electronic instrument. With the development of measurement technology, the improvement of measurement requirements requires more and more electronic instruments. Traditional electronic measurement instruments transfer measurement results through electrical signals, so it is difficult for measurement personnel to analyze the measurement results. But the emergence of digital signal processing technology solves this problem. Digital signal technology can transform electrical signals into digital signals, and the staff analyze the information through digital signals, so as to ensure the smooth development of follow-up work. In order to ensure more accurate measurement results, it is necessary to pay attention to whether the electronic measuring instrument uses DC voltage or AC voltage in the measurement work. If it is AC voltage, it is necessary to convert the AC voltage and DC voltage first, and carry out the digital to analog conversion, and the DC voltage can directly carry out the digital to analog conversion work. Practice has proved that digital signal can simplify the measurement process of electronic measuring instruments, so as to effectively improve the efficiency of staff. Ensure the measurement quality.

2.1 Electronic Measuring Instrument

Electronic instruments are needed in electronic measurement. Generally, electronic instruments need to have three functions. First of all, electronic instruments can filter, weaken, amplify and other preprocessing operations. Secondly, in order to ensure the smooth progress of measurement, the electronic instrument should convert the measurement signal into standard electrical signal. Finally, electronic instruments are needed to display the measurement results. Electronic measuring instruments are also divided into many types according to different standards. At present, there are two kinds of common instruments, one is to measure signal characteristics and parameters, such as random measurement

instrument, time-domain measurement instrument and frequency-domain measurement instrument. The other is the instrument for measuring the characteristics and parameters of the system. Many parameter measuring instruments with multiple characteristics and various excitation signal sources are used [1].

3. THE INFLUENCE OF DIGITAL SIGNAL PROCESSING TECHNOLOGY ON ELECTRONIC MEASURING INSTRUMENTS

3.1 Impact on Signal Source

Signal source is a kind of common measuring instrument. Its working principle is to use frequency synthesis method to measure in the production process. Of course, all signal synthesis techniques must use low-pass filtering, which is the most important part of digital signal processing. Signal source technology has a very obvious advantage. It can avoid the problem that crystal oscillator only provides a specific frequency, so as to improve the stability of the signal, which also provides a guarantee for the accuracy of the final result. The value of mathematical signal processing lies in that it can significantly improve the test performance of signal source.

3.2 Application of Voltage Measurement

Voltage measurement is the basis of electronic measurement. Because the electronic equipment with voltage information is widely used, the electronic measurement technology should be evaluated through voltage measurement and analysis. There are some devices whose parameters, such as field strength information and attenuation information, are directly related to the use of the device, such as transmitters, receivers and other electronic devices. For such devices, these measurement contents should be considered as the focus in electronic measurement. In the work of voltage measurement of electronic measuring instruments, because of the popularization of digital signal processing technology, electronic measuring instruments can use a / D conversion to complete the conversion and analysis of AC voltage and DC voltage in time. In the work, digital signal processing technology can convert the AC voltage into DC voltage, and analyze the continuous change of analog quantity, so as to make discrete statistics. Digital signal processing technology can realize voltage measurement and information statistics through sampling, quantization, coding and other processes. Compared with traditional electronic measurement, digital signal processing technology improves the accuracy of voltmeter measurement, and greatly improves the anti-interference performance and resolution of voltage measurement [2].

3.3 Influence on Oscilloscope Performance

Oscilloscope is a kind of electronic instrument for precise quantitative measurement. It can transform the abstract electrical signal which cannot be observed by the naked eye into the visual image, which provides a favorable help for people to study the change process of various electrical phenomena. The measured signal

is displayed in the form of waveform, and the measured signal is printed on the fluorescent screen by electron beam. The measurement personnel can analyze and interpret the displayed image, including current, voltage, frequency, etc., which can be displayed by oscilloscope. In addition, some special signals can also be displayed by the oscilloscope. The display of amplitude and phase difference of image modulation is in the scope of application of the oscilloscope. With the development of intelligent and digital oscilloscopes, the types of oscilloscopes are increasing. Including digital storage oscilloscope, multi-processing digital oscilloscope and digital hybrid oscilloscope and so on. The technology of oscilloscope can define its performance. Different technologies and theories can promote each other's development.

For every digital storage oscilloscope, there is a relevant sampling rate, because the oscilloscope needs to follow the relevant sampling theory when collecting signals. In waveform display, it is necessary to adapt to the display requirements and change the sampling rate by changing the scanning method. There are two problems in the oscillograph's waveform measurement by means of scanning strategy adjustment. One is the redundancy of low-frequency signal sampling points, which wastes the storage cost. Second, the sampling points of high frequency signal are too few, which results in waveform distortion. In the face of these two problems, we need to take extraction and interpolation technology to solve them. The extraction technology is to calibrate and extract the peak value of the object waiting for measurement by using the digital storage method in the digital signal acquisition, while the interpolation technology mainly uses the sine interpolation and linear interpolation to simulate the signal waveform. The scanning sawtooth wave can only be formed after the signal is sent out. Because of this, all the signals detected by the analog oscilloscope are the signal waveforms after the starting point. The digital storage oscilloscope first stores the observed signals in the sampling memory, and then sends the specific signal waveforms in the sampling memory to the display window according to the actual needs, which changes the starting point Location. After the above operations are completed, the waveform at any position can be observed [3].

3.4 Influence on the Performance of Spectrum Analyzer

Spectrum analyzer plays a key role in frequency domain measurement. When we need to analyze the main components of each frequency in the signal, we need spectrum analyzer to work. Because the spectrum analyzer can enhance the measurement frequency and greatly improve the measurement range, the spectrum analyzer is also known as "RF universal meter". The application of spectrum analyzer to digital filtering technology, discrete Fourier algorithm and other signal processing technology can promote the digitalization of signal development. In the analysis and comparison

between the analog spectrum analyzer and the Fourier transform instrument, it can be found that the Fourier transform analyzer is easy to be limited by the factor of a/D conversion. However, the application of digital and analog spectrum analyzer can effectively avoid the restriction of frequency band, which reflects the very high performance. Therefore, it can be seen that the application of digital processing technology also improves the performance of spectrum analyzer.

4. EPILOGUE

At present, digital signal processing technology has become the core technology of electronic instrument measurement. With the help of filtering and other means, modern digital signal processing technology effectively improves the accuracy of measurement data statistics and analysis in the application of electronic measurement technology. In addition to improving the measurement effect, digital signal processing technology has a very important impact on the digital, visual and intelligent upgrading of electronic measurement instruments. Therefore, relevant

personnel should master the concept of electronic measurement and instruments, be familiar with the use of electronic instruments, pay attention to the impact of digital signal technology on electronic measurement and instruments, and promote more electronic measurement instruments to measure with the help of digital signal processing technology, so as to further improve the measurement level in China.

REFERENCE

- [1]Hu Ruijie, "Analysis of the influence of digital signal processing on electronic measurement and instrument," *Digital users*, 2019, 000(011): 241.
- [2]Zhang Wei, "Research on the influence of digital signal processing on electronic measurement and instrument," *Electronic production*, 2018, 000(004): 28-29.
- [3]Lin Jie, Zhang Wenbing, "The influence of digital signal processing on electronic measurement and instrument," *Modern manufacturing technology and equipment*, 2019, 266(01): 39-40.

Application of Artificial Intelligence in Mechanical Design and Manufacture

Mintao Li

Wenzhou Polytechnic, Wenzhou city, 325000, Zhejiang province, China

Abstract: with the continuous development of social economy, the mechanical design and manufacturing industry is also constantly updated. Affected by information technology, artificial intelligence began to be applied in various industries. Therefore, in order to meet the development of the times, the mechanical design and manufacturing industry should apply artificial intelligence to effectively improve the level of its mechanical design and manufacturing technology. In this paper, we first understand the content of artificial intelligence, and then explain the application of artificial intelligence in mechanical design and manufacturing, and finally explain the specific application of artificial intelligence in mechanical design and manufacturing, which provides the corresponding reference for the development of mechanical design and manufacturing industry.

Keywords: Artificial intelligence; Mechanical design and manufacturing; Application

At present, the application of artificial intelligence in mechanical design and manufacturing can provide corresponding help for the development of mechanical design and manufacturing industry. Through the effective combination of electronic function and artificial intelligence, we can save the cost investment and obtain more economic benefits for the mechanical design and manufacturing enterprises. Therefore, the current mechanical design and manufacturing enterprises are trying to apply artificial intelligence to it, and then through such methods to improve their market competitiveness, promote the stable development of mechanical design and manufacturing industry.

1. MEANING OF ARTIFICIAL INTELLIGENCE

As for artificial intelligence, its content is to enable its technology to realize thinking similar to human through further research of human beings. As a new technology, it belongs to a kind of computer science. At the same time, it also combines the corresponding contents of psychology, human science and so on. It can also be said that the emergence of artificial intelligence directly changes people's life. By applying artificial intelligence to the mechanical design and manufacturing, we can make the machinery complete some complex work contents, thus ensuring the safety of the staff, and at the same time, we can better improve the work efficiency and liberate the productivity [1].

2. APPLICATION SIGNIFICANCE OF ARTIFICIAL INTELLIGENCE IN MECHANICAL DESIGN AND

MANUFACTURING

Mechanical design and manufacturing industry has developed for a long time, but it has always been produced by manual operation. In the mechanical design and manufacturing industry, fundamentally speaking, there are many complex links, which need to involve many aspects in the production process, which requires high professional quality of the staff themselves, which has also become an important factor affecting the development of the mechanical design and manufacturing industry [2]. The application of artificial intelligence can effectively control every production link and achieve better production results. The application of the functions of diagnosis, monitoring and so on in artificial intelligence can better improve the efficiency of mechanical design and manufacturing and obtain more ideal economic benefits for the corresponding enterprises. Therefore, the effective application of artificial intelligence will certainly promote the development of mechanical design and manufacturing industry.

3. APPLICATION OF ARTIFICIAL INTELLIGENCE IN MECHANICAL DESIGN AND MANUFACTURE

3.1 Fuzzy Inference System

In artificial intelligence, its fuzzy reasoning system is very important, so the application of fuzzy reasoning system in mechanical design and manufacturing can collect and analyze the data in mechanical design and manufacturing, and then accelerate the speed of data processing, realize automatic production for mechanical design and manufacturing, and effectively improve the quality of mechanical design and manufacturing [3]. For the fuzzy reasoning system, it is mainly based on the human's calculation behavior, through the method of simulation to carry out data conversion for its mechanical design and manufacturing, to ensure the accuracy of its data. In the mechanical design and manufacturing industry, the application of fuzzy inference system can express the data information. Compared with the traditional mechanical design and manufacturing, the application of fuzzy inference system has great advantages. However, there are still some problems in this, such as the connection between the systems is not close enough, which needs the corresponding researchers to study it urgently, so that it can play a better role in the mechanical design and manufacturing industry.

3.2 Neural Network System

Neural network system is designed on the basis of

human neural system. As the core content of artificial intelligence, when it is applied to mechanical design and manufacturing, it can transfer the corresponding information in real time, complete the transmission purpose in a limited time, and promote the stable development of mechanical design and manufacturing industry. In addition, through the neural network system, the dynamic data can also be effectively processed to understand the dynamic data in the mechanical design and manufacturing, and give the corresponding instructions, so that it can complete the design and manufacturing work [4]. The neural network system simulates the human brain with the method of simulation, and applies the information it collects to all aspects of production. Through the reflection characteristics of the neural network system, the data collected can be analyzed in time, and then the data can be effectively protected. Artificial intelligence is mainly reflected in the thermal deformation control, equipment management and other aspects of mechanical design and manufacturing. For the mechanical design and manufacturing of the processing technology can analyze its process data, errors and so on. By applying the neural network system of artificial intelligence to the mechanical design and manufacturing, we can change the low quality of products caused by the unreasonable design in the past, and then let the enterprise realize the automatic production better.

3.3 Fault Diagnosis System

In the process of mechanical design and manufacturing, mechanical and electrical equipment often have problems in the process of operation, resulting in its production is hindered. In order to better solve this problem, we should actively introduce artificial intelligence into the fault diagnosis system. Timely detect the problem and find the location of the problem, so as to reduce the cost investment for the corresponding enterprises and obtain more ideal economic benefits [5]. The fault diagnosis system in artificial intelligence can well complete the work of troubleshooting. This is because the fault diagnosis system has a strong database as the basis. Through the analysis of the data in the database, it can find the location of the fault in advance, and put forward the corresponding processing plan. Through the processing of the data, it can better meet the corresponding production needs. Please. In the process of mechanical design and manufacturing, the fault diagnosis system is mainly divided into several steps. First, the user will enter the corresponding information through the operation page. Secondly, with the support of the system, the information will be analyzed and processed, and the corresponding diagnosis methods will be given based on the database. Third, the system through its diagnosis stage to develop the corresponding maintenance strategy, to ensure the accuracy of its final results, so that the corresponding staff can carry out specific work according to its

prompts, and then to effectively save its production time, better reduce costs.

3.4 Electronic Information System

In the process of mechanical design and manufacturing, the electronic information system is generally used to output and input data, and to define all kinds of information in mechanical design and manufacturing. However, in the process of project operation, it is easy to have various problems, especially for some projects with large amount of data, there are more problems, which seriously affect the safety of mechanical engineering, resulting in the unstable operation of the project. The application of artificial intelligence technology in electronic system can solve this problem well. Through the effective control of its electronic information system, it can better ensure the accuracy of its data processing. Once there is a problem in the electronic information, it will send out an alarm in time, and then it can help the staff to solve the problem, ensure the accuracy of its information output, enable the mechanical design and manufacturing engineering to complete the production, and provide more accurate information assurance [6].

3.5 Automatic Identification System

In the traditional production process, the controller will establish the corresponding model in the working process, and work through the control model. Such a mode makes its control effect not ideal, and it is unable to make clear the design situation in mechanical engineering in time, especially for some complex mechanical design and manufacturing projects, this method cannot really play its role, and cannot effectively complete the corresponding work. Through the application of artificial intelligence technology, we can make the mechanical design and manufacturing engineering run effectively, and then avoid safety accidents. For example, through the use of artificial intelligence, on the basis of automatic identification system, we can know the operation data of corresponding mechanical and electrical equipment in time. If there is a problem in the data, then the sensor will directly alarm. With the help of the sensor alarm, the corresponding staff will take corresponding measures to ensure the safety of the staff. In addition, in the process of mechanical engineering identification, laser scanning, automatic identification technology and so on are mainly used, which can make mechanical design and manufacturing complete the corresponding work accurately and improve its production efficiency better.

4. CONCLUSION

All in all, the content of mechanical design and manufacturing is very complex. If artificial intelligence is applied effectively, intelligent operation can be realized, the best scheme can be selected, and the best effect can be achieved. Therefore, mechanical design and manufacturing enterprises should actively use artificial intelligence, according to the actual situation of their own enterprises, to effectively

improve their production efficiency.

REFERENCES

- [1]Zhang Zhiwu, "Application of artificial intelligence technology in mechanical design and manufacturing," Information recording materials, 2020, 21(02): 92-93.
- [2]Li Shiwen, Zhang Xiangyu, Wang Liqiang, "Mechanical design and manufacturing based on artificial intelligence and its automation practice," Internal combustion engine and accessories, 2020, (02): 231-232.
- [3]Yang Chongying, "Research on artificial intelligence technology in mechanical design and manufacturing in the information age," Hubei agricultural mechanization, 2020, (01): 154
- [4]Fu Yuanshuang, "Analysis of artificial intelligence technology in mechanical design and manufacturing in the information age," Nanfang agricultural machinery, 2019, 50(22): 261.
- [5]Wang Yubo, "Application of artificial intelligence in the field of mechanical design, manufacturing and automation," Information recording materials, 2019, 20(08): 79-80.
- [6]Zhang Jun, "Application and penetration of artificial intelligence in machinery manufacturing," Science and technology innovation guide, 2019, 16(20): 4-5.

On the Structural Design and Construction Framework of Post Cast Strip in Construction Engineering

Zhiyuan Wang

Zhengzhou Institute of business, 450000, Zhengzhou, Henan, China

Abstract: The post cast strip is actually a temporary structural gap designed to prevent and overcome the harmful building settlement and structural deformation caused by the settlement of the main building and the temperature change in the construction of the cast-in-place steel concrete structure. The application of the post cast strip structure in the construction engineering can effectively solve the problems caused by the contraction and settlement of the building structure, with three-dimensional effect. The result is very good and has been widely implemented. This paper expounds and analyzes the structural design and construction framework of post cast strip in construction engineering.

Keywords: Construction engineering; Post cast strip; Structural design; Construction framework

In the economic development, the development of construction industry has also made remarkable achievements. In the field of construction, the problem of structural cracks is increasingly serious, which has a serious negative impact on the overall quality of construction projects. Post cast strip is the preferred way to solve the cracks. It has the advantages of simple application, good control effect and fast construction speed. Based on the above advantages, post cast strip has been widely used in the construction. In order to give full play to the role of post cast strip, it is necessary to do a good job of structural design and construction framework combining with the specific construction situation.

1. TYPE AND FUNCTION OF POST CAST STRIP

From the perspective of type, the post pouring belt includes settlement post pouring belt and expansion post pouring belt. The settlement post pouring belt is set between the podium building and the main building to minimize the adverse impact of settlement on the building structure. After the main structure construction is completed, the construction can be carried out. After the settlement of other parts is stable, the post pouring belt can be supplemented. The expansion and post pouring belt is to solve the problem of cracks and deformation caused by temperature. Generally, it needs to leave a gap along the direction of the foundation. When the concrete shrinks early, it can be poured to fully improve the stress performance of the structure and avoid the influence of shrinkage and temperature difference stress on the whole construction

structure.

Generally speaking, the function of the post cast strip is concentrated in two aspects: first, to solve the problem of settlement difference, which is an important factor affecting the construction quality. When designing the building and the podium structure, if it is a whole, then the two connected parts need to be disconnected. After the main construction is completed, the construction can be carried out to cast it as a whole. Due to the influence of various internal forces and external factors, the problem of settlement difference may be caused, which can be effectively solved by using post cast strip. Secondly, to reduce the cracks caused by temperature shrinkage, under the change of temperature difference, it will lead to thermal stress in the building structure, which will seriously affect the whole construction performance. Setting post cast strip can solve this problem once and for all, reduce the shrinkage stress, so as to reduce the cracks in the building and improve the operation stability of the building.

2. STRUCTURAL DESIGN OF POST CAST STRIP IN CONSTRUCTION ENGINEERING

2.1 Graphic Artist Designer

In the design of post cast strip, it is necessary to fully consider the problems of the plane design part, combine with the construction practice, and put the plane design in the position with less internal force, which can give full play to the role of post cast strip and improve the stability of the building. If the construction is on a long floor, the layout of the post cast strip needs to be optimized through scientific calculation when setting the post cast strip, so as to fully reduce the impact of temperature difference and shrinkage force on the building and reduce the shrinkage stress of the building.

2.2 Width Design

The width of the post cast strip also needs to be comprehensively considered according to the actual situation. Specifically, the width design should follow the principle of "simple construction", on the basis of giving full play to its stability, properly reduce the work amount, and disperse the stress as much as possible during the design to avoid the adverse effect of stress concentration on the building property. The specific value selection needs to be optimized according to the actual situation of the project. Design is the most important part of post cast strip design.

Relevant personnel must conduct detailed analysis on various influencing factors to ensure the design is accurate, scientific and reasonable. From the perspective of professional knowledge, in order to reduce or prevent the influence of temperature difference and force on the building, the width of the post cast strip structure needs to be controlled at about 1cm, but in the actual situation, it is necessary to ensure the feasibility and convenience of the construction first, and the actual application width needs to be designed according to the actual location.

2.3 Pouring Time

The pouring time also has a direct impact on the function of the post pouring belt. Generally, the pouring can be carried out after the settlement of the building structure. This design time is the most reasonable, which can guarantee the quality and performance of the building construction to the maximum extent.

2.4 Coordinate Design Relationship

Post cast strip design and architectural design are a whole, but in the design, it is often the way of independent design. Therefore, in the design, it is necessary to coordinate the relationship between them. Whether it is graphic design, width design, structural design or interior design, it is necessary to follow the overall construction requirements of the building, take into account various factors, and improve the construction quality of the building. Quantity and construction stability.

3. CONSTRUCTION FRAMEWORK OF POST CAST STRIP IN CONSTRUCTION ENGINEERING

3.1 Determine the Position of Post Cast Strip

The determination and selection of the position of the post cast strip has an important influence on the quality of the structure construction. Generally, the post cast strip is set at the position where the structural stress is small, and the middle position of the beam and the plate is taken. The bending moment of this position is small. In the construction process, although the post pouring form is applied, the quality of the reinforcement shall be strictly controlled to avoid the fracture of the reinforcement. If the width of the beam and slab is not large, the reinforcement can be configured in advance. If the width of the beam and slab is large, the reinforcement shall be disconnected in strict accordance with the construction standard. Before the concrete is supplemented, all welding and reinforcement shall be completed according to the difference. Different settlement to calculate the stress scientifically, according to the specific value to design the width, need to consider the convenience of construction, according to the construction structure to choose.

3.2 Grasp the Key of Material Selection

In the construction of post cast strip, the quality control of material selection also needs to be highly valued. The selection of materials should be strictly controlled to avoid shrinkage, cracking and other joint problems

due to material problems. Before pouring, the sundries and dust in the cracks shall be cleaned, the accumulated water shall be completely removed and fully wetted. In the construction process, special interface treatment agent shall be used to treat the construction interface. The strength of the concrete shall be slightly higher than that of the cast-in-place concrete. During the whole pouring process, the problem of stress concentration caused by the contact of the floor, wall and room beam shall be avoided. In the area where the building passes, it shall be disconnected, and then the post pouring belt treatment shall be carried out, and the quality of pouring and maintenance shall be fully guaranteed. The concrete shall be vibrated and compacted sufficiently to ensure the pouring quality [1].

3.3 Scientific Treatment of Construction Joints

In the process of pouring, the concrete is easy to appear initial setting. To solve this problem, high-pressure water can be used to wash away the structural debris and milk slurry. In the aspect of formwork vertical construction joints, high-pressure water can also be used to wash. The concrete needs to be handled according to the situation of the construction site and the requirements of the supervision personnel. If the holes are serious or there are bees Pit condition, then, before pouring, it must be cleaned as required before construction.

3.4 Reasonable Allocation of Concrete Materials

The concrete materials need to be equipped according to the requirements and the actual situation. When mixing, it is necessary to ensure the accuracy of the allocation amount. This process cannot be less than two minutes to ensure that all kinds of materials can be fully mixed and evenly mixed. If the mixing is uneven, many problems will be caused, and the first problem is the quality problem. After full mixing, ensure that the concrete after mixing is put into use within 60 minutes, which can minimize water loss. In the pouring process, it is necessary to ensure the normal operation of vibration, improve the quality of concrete construction, and avoid quality problems caused by different density [2].

3.5 Construction of Waterproof Post Pouring Belt

In the construction of waterproof post cast strip, it needs to be applied to steel plate water stop, which is also an important link in the construction of post cast strip. In the actual construction, in order to avoid settlement problems caused by precipitation of post cast strip, it is necessary to set steel plate and retaining plate in the post cast strip, and set protective layer according to the requirements. During the construction period, it is necessary to ensure that the post cast strip structure can be constructed according to the design position, etc., and that the places that should be kept consistent and aligned should not make mistakes as much as possible. Even a little error will delay the construction period in the future [3].

In the post cast strip project, every step and link needs

to be reasonable, orderly and orderly. After the construction, the post cast strip needs to be maintained and maintained according to the requirements. In many cases, the proportion of post cast strip project is not large. Therefore, many construction units do not provide necessary human and material support in this aspect, and pay attention to the post cast strip construction. Not enough. Under the influence of such factors, the function of the post cast strip structure is not fully played. Therefore, it is necessary to attach great importance to the maintenance work after the construction of the post cast strip. During the maintenance, both sides of the post cast strip should be fully wetted. According to international practice, the maintenance time should be controlled over one week.

4. CONCLUSION

At present, the volume of the building is more and more large, super high-rise and high-rise buildings appear in a large number in the city, and the larger the volume, the higher the floor area, the larger the structural plane, and the higher the incidence of cracks caused by settlement and temperature [4]. Once cracks and settlement occur, it will seriously affect the safety of the building. Scientific setting of post pouring belt can avoid this problem and improve the stability and

safety of the building. In order to give full play to the role of post pouring belt, it is necessary to strictly follow the requirements of design and construction, fully understand the key points of design and construction, optimize and design in combination with the specific situation of construction, and improve the construction of post pouring belt in a step-by-step way.

REFERENCES

- [1]Wu Deming, "On the function and construction technology of post cast strip in construction," Theoretical research on urban construction (Electronic Edition), 2014, (18): 496-496.
- [2]Zhang Min, "On the function and construction technology of post cast strip in construction," Urban construction theory research (Electronic Edition), 2012, (24): 119.
- [3]Zhu Zongzhong, "On the function and construction technology of post cast strip in construction," Jiangxi building materials, 2016, (8): 90-92.
- [4]Liang Yue, "On the function and construction technology of post cast strip in construction," Construction engineering technology and design, 2017, (5): 895.

Analysis of the Virtual Characteristics of Three-dimensional Animation Creation Elements

Leiming Li^{1,2}, Xiao Lin^{1,3}

¹ Cooperative Course Of Performance, Film & Animation, College Of The Arts And Physical Education, Sejong University, Gwangjin-Gu, Seoul, 05006, Korea

² College of Art, South China Agricultural University, Guangzhou, 510642, China

³ South College of Sun Yat-Sen University, Guangzhou, 510970, China

Abstract: As an outstanding representative of virtual art, the fundamental premise for distinguishing animation from other art categories is its virtual nature. This article analyzes the advantages of vitality in the concept, conditions and expression methods of creation based on several major creative elements such as scripts, characters, time and space, cameras and sounds in animation, combined with representative animation works or cases. The virtual characteristics of animation creation elements, and hope to play a good role in promoting animation creation.

Keywords: Virtual animation; Script; Character; Space-time; Camera; Sound

“Virtual” is explained in the “Modern Chinese Dictionary” as: “It does not meet or does not necessarily conform to the assumptions of the facts; fiction.” In the “virtual” of animation, we can understand that animation artists rely on certain technical means to achieve the way and process of picture and sound integration. Based on the creation process of animation works, its virtual characteristics are mainly manifested in virtual scripts, virtual characters, virtual space-time, virtual cameras, virtual sounds and other aspects.

1. VIRTUAL SCRIPT

A virtual script refers to a literary work conceived by a film writer who is not confined to the logical relationship of the real world, based on grasping sufficient materials and using the law of creation of the script. In the real world, all information such as changes in the relationship between the characters and the surrounding environment and the development of the story are unknown, and they are developed in an orderly manner according to objective time. But in the animated script, the time, place, characters, plot and world view of the story are all a virtual re-creation of the screenwriter based on the objective world, and at the same time, the audience can get a unique aesthetic experience that transcends reality. Taking the performance theme of the script as an example, the animation script can express any kind of genre-type theme culture, and even produce traditional cartoons of different countries that have been adapted and

created into new cartoons that are in line with national culture and audience acceptance. For example, in the American film “Prince of Egypt”, although the information about the people, buildings, landforms, customs, songs, etc. appearing in the film are all based on the local humanistic characteristics of ancient Egypt, after the artist refined and processed the art on the basis. Viewers of the world can go through the surface of myths and stories to deepen the deep realm of consciousness and experience the grand feats of Moses leading the tribes to pursue freedom and step out of Egypt in a historical way [1].

2. VIRTUAL CHARACTER

Compared with the roles played by real people in real movies, the characters in the animation are “peers” in another space and are virtual and real art images carefully designed by the artist with his own rich imagination. Although they do not have any life attributes in the real world, they are genuine actors on the screen with no end in life. To some extent, these artistic images even surpassed the live actors in terms of performance space and plasticity in the film. From the perspective of the appearance of the animated character, from the day of the animation, the character image is based on the creative ideas of the animated character designer to change a variety of appearances. With the development of science and technology, especially the popularization of three-dimensional animation technology, the form of expression of animated characters has become more and more abundant. In the film “Nazha Noisy Sea”, the artist draws inspiration from the traditional Chinese New Year paintings, designing Nazha as a naked body, light-colored flesh, smart eyes, hard sword eyebrows, holding Qiankun circle, pedal hot wheels, and tie the image of a little hero with double temples and a red bellyband. In the film “Despicable Me”, using three-dimensional animation technology, Pea has become an indispensable golden supporting role in the film. Not only do they know how to cooperate with the big bad guy Gru to falsify online, they also know how to fly airplanes, make rockets, and even pretend to be humans to go shopping. The screenwriters gave full play to their imagination and turned the little peas into “one-size-fits-all”. It was

bizarre, but they were full of laughter and won the favor of the audience.

From the perspective of animation character shaping process, freehand and exaggeration are often the two key elements in the design process of animation characters. When animators conceive character images, they often do not use the proportions, physical appearance, and language actions of characters in reality as standards, but artificially exaggerate certain parts or links. In the early Disney animation "Snow White", the queen dressed as an old witch with a black robe hijab, skinny, white hair messy, rough eyebrows, exaggerated eyes, unusually long nose, obvious folds, and only one lower incisor, "skull the overall feeling is very obvious. Although such a character is very different from the old man in the real world, such a design reflects the insidious and cunning character of the queen from the side, improving the character's recognizability. The superpower of the housewife Helen in the movie "Superman Story" is extremely flexible. The limbs, torso and neck of the body can be infinitely stretched, and the total ability can turn the tide at an important moment. While her omnipotent body made the audience laugh, she also had to admire the extraordinary imagination of her production team [2].

3. VIRTUAL TIME AND SPACE

Time and space are the basic attributes of things, they are an organic and unified whole. Due to the virtual nature of the space-time relationship of animation, animation creators can exert their subjective initiative, according to the needs of the film plot and rhythm, plan and purposefully flexibly set the time and space of the animation. Virtual time refers to the expression of the artist's subjective initiative, combined with the plot of the film, using montage means, the character's emotions, actions, language and other factors to set the time in a purposeful and planned manner. For example, in the American movie "Pony King", the part of the pony king Spirrett flying over the cliff with Ogawa carrying the action took two or three seconds in the real world, but the film took a total of 24 seconds. To express that shocking leap. The director intends to make this leap stronger, because it not only made Ogawa cheer, but also won the respect of the captain of the company. At the same time, this leap surpassed the race, shaken the soul, and conquered everything. A virtual space refers to a space where an artist exerts subjective initiative based on various elements of the objective world and reorganizes or recreates it in a certain logical relationship. It is these virtual spaces that provide "venues" for character performances that facilitate the advancement of animated plots and the interpretation of one fascinating story after another. The virtual characteristics of space are mainly manifested in the following aspects [3]:

Firstly, the animation scene can be a picture formed by the artist based on the integration of elements in

objective reality, or a purely illusory scene. Regardless of the integration of objective elements or the creation of unknown scenes, as long as it meets the film plot design needs and the logical relationship before and after, it can be virtualized through certain technical means to provide space for characters to perform. In the section of the American film "Kung Fu Panda 1" depicting A Bao's "Daydream", the director showed the audience a spectacle of the rivers and lakes with the blazing sun, dense forests and flying sand. This part of the scene design mainly uses the expression form of Chinese folk paper-cut art, which creates an atmosphere for the film to highlight the characters' behaviors and personality characteristics. The audience is also very easy to radiate association and blend into the beautiful artistic conception of rivers and lakes [4].

Secondly, the characters' body movements, camera movements, and sound synthesis in scene scheduling all have the function of expanding the virtual space of the film. In the movie "Robot Story", the robot climbed the spaceship in order to catch up with Eva, and as the spacecraft rushed into the sky, through the atmosphere and the satellite garbage dump, to the vast space. With the movement of the camera, the conversion process of the entire space is completed in one go, which achieves a clever transition of the film story background from the earth to space.

Thirdly, in order to achieve a breakthrough in visual space, on the basis of the dual structure theory of film and television composed of both visual images and sound symbols, filmmakers have developed 3D holographic imaging technology and based on the composition of vision, hearing and touch "4D" movie. These novel movie technologies have created an omnidirectional, multi-view, realistic virtual space. Such as the movie "Toy Story 3" released in 2010.

4. VIRTUAL CAMERA

The pictures taken by real cameras in real life are objective records of various things or phenomena in the real world. The virtual camera in the animation can freely push, pull, shake, move, etc. to complete the angle or picture that the real camera can't shoot, and visually display the fantasy space; there can be more space for the role of montage; Computer technology completely subverts traditional photography principles and shooting skills. For example, in the animated film "Superman Story", the little superman Dash is chased by a big villain Buddy in the dense forest. Through the movement of the virtual camera, the movement of the characters and the transformation of the scene, the film shows their sense of speed and space in the forest. At the same time, with the help of montage and other shooting techniques, the aesthetic experience of the film's rhythm is proper, the speed is soothing, and the mood is relaxed.

5. VIRTUAL SOUND

Virtual sound refers to the vocals, sounds or music

that animation artists use certain technical means to copy or recreate based on objective reality. Bella Baraz once said: "Our true perception of visual space is closely connected with our experience of sound. A completely silent space will never be very specific and true in our feelings. Yes... Only when the sound exists, we can regard this visible space as a real space." Taking the dialogue between characters as an example, the character dialogue in the movie often adopts the relevant technology or the same time recording technology. Means, use the recorder to objectively record the dialogue between the actors and actors, with a high degree of authenticity. In the animation, because the character itself does not have the life attribute, it cannot speak by itself, so the animation artist only needs to make all the actions that reflect the emotion of the character when speaking, then record the live dialogue through digital recording technology, and digitize it, and finally in the later software Synthesizing the recorded real-life dialogue sound waves with the action images of the virtual characters forms an animated character that can speak. In addition, referring to the character characteristics and emotional actions of the characters, it is possible to simulate the artificially created sound beyond reality. For example, in the movie "Robot Story", the robot Wali and Eva speak with metallic textures. Compared with the traditional film dubbing, the simultaneous recording has too much dependence on objective factors such as character actors, weather conditions, and insufficient adjustment space in the later period. The biggest advantage of the virtual characteristics of the sound lies in the flexibility and flexibility and the optimal control of cost and efficiency. According to the style of the film, referring to the atmosphere and tone of the animation scene, the audio effect elements existing in the real environment can be superimposed or deleted layer by layer through digital audio technology, and finally all levels of the audio effect elements are superimposed, and then digitally output it. The environmental sound effect after artistic treatment is more realistic and shocking. In the assembly of the AIU fighter in the domestic animated film "Super Frog Warrior", there were broadcast speech, laser welding, exhaust, steel

impact, machine operation, electric current, and rock music as the background sound in the assembly process. Sound, they form a group of heavy metal rock music with sci-fi style. The intense environmental atmosphere and the theme of protecting the home and protecting the country are vividly and extremely shocking.

6. CONCLUSION

With the rapid advancement of film and television technology in recent years and the continuous improvement of public aesthetic standards, the relationship between the vitality of animation and the authenticity of movies has also shown some new characteristics: on the one hand, the integration is getting higher and higher, and the vitality of animation and the authenticity of the film are gradually approaching; on the other hand, the competition between animation and film is becoming more and more fierce. The "confrontation" of the film promotes the benign development of animation. In this article, it is mentioned that the virtual characteristics of scripts, characters, space-time, cameras and sounds in the animation creation process are inevitable research areas for animation creators and should also be the cornerstone of animation creation and a magic weapon for winning.

ACKNOWLEDGMENT

Guangzhou philosophy and social science planning 2019 annual topic. Project Number: 2019GZQN22

REFERENCES

- [1]Yang Haojie, Zhang Jianfeng, "Research on the virtual characteristics of film and television animation art," *Popular Literature*, 2017(11): 177-178.
- [2]Wang Junqiong, "Research on the aesthetic characteristics of artificial life animation art," Harbin Institute of Technology, 2009.
- [3]Dictionary Editing Room, Institute of Linguistics, Chinese Academy of Social Sciences. *Modern Chinese Dictionary*. Beijing: Commercial Press, 1999: 1420.
- [4]Kong Lingqiang, "The application of 'hypothesis' principle in animation creation," *Silicon Valley*, 2008 (12): 25.

CNKI-based Visualization Analysis of Research Literature of My Country Industrial College

Yanling Qi, Xiaojuan Chen

Guangdong University of Science & Technology, Guangdong, 523083, China

Abstract: This article uses the bibliographic literature included in the CNKI database as the data foundation, uses bibliometric theory, and uses the visual measurement tools provided by CNKI to quantitatively analyze the research on the Institute of Industry from 2001 to May 2020. The academic paper draws the knowledge map of China's Industrial Institute and reveals the content of the academic leaders, core research institutions and research hotspots of China's Industrial Institute.

Keywords: Institute of industry; Research hot spots; Cluster analysis

1. RESEARCH METHODS

Bibliometrics is a method for quantitative research on literature and literature work, it uses mathematical language for quantitative analysis, and uses mathematical formulas or graphics to express the rules. It uses concise mathematical symbols for the statement and calculation of problems, thereby simplifying and accelerating the thinking process. It has a profound description performance and a high degree of generalization ability [1]. The method adopted by the Institute of Liberal Arts is to use the statistical measurement analysis module provided by CNKI to perform statistical analysis of the literature and generate a visual scale of relevant elements. The clear and intuitive data and charts reflect the publication year, author unit, author area, number of articles published and research hot spots of the research literature's change trend and development status.

2. DATA SOURCE & PROCESSING

CNKI is the world's largest knowledge portal with a full range of documents. It is a knowledge service website integrating periodicals, doctoral dissertations, newspapers, conference papers, year books, multimedia educational and teaching materials [2]. Data in this paper were selected from CNKI for literature search. The search term was "Industrial College", and the search date was June 18, 2020. The time span of the search was from 2001 to 2020. A total of documents were obtained after searching. In view of the small number of research papers on the theme of the Industrial College, the literature search range includes 327 academic journal papers, 4 doctoral thesis papers, 1 international conference paper, and 2 newspaper articles. A total of 334 related documents.

Perform a document search through the CNKI search platform, export the data after selecting the desired documents, and export the documents in Note Expressde format. Basic statistics and sorting of the exported documents through Excel, you can get the basic information such as the annual distribution of documents, the publication of institutions, the status of publication by authors and the citation of documents. Co-occurrence analysis of keywords through Co-Occurrence, drawing co-occurrence map and clustering map.

3. DATA STATISTICS AND ANALYSIS

3.1 Annual Distribution of Literature

According to the survey statistics, the trend of posting is shown in Figure 1:

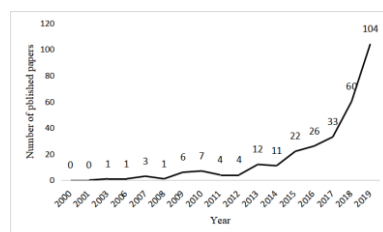


Figure 1 Annual literature analysis in recent years

As can be seen from Figure 1, in the 10 years before 2010, the literature quantity of industrial colleges fluctuated little, indicating that the research of industrial colleges in China was in a relatively stable period of development. Since 2011, the number of relevant literature outputs on the Institute of Industry has continued to increase. Especially after 2017, due to the introduction of policies to support the development of industrial colleges, the research interest in industrial colleges has risen again. In the past 5 years, the research of the Chinese Academy of Industry will be in a period of rapid growth. In the next 2-3 years, the research on the Chinese academy of Industry will still be a hot topic.

3.2 Ranking Analysis of Scientific Research Capability of Institutions Based on Author Unit Statistics

In this paper, statistics and rankings are made according to the authors of the literature, and the top 10 institutions are sorted out to form a graph of the number of articles issued by institutions in Figure 2. As can be seen from Figure 2, the top ten institutions are Zhongshan Vocational and Technical College, Chengdu University, Fujian Jiangxia College,

Dongguan University of Technology, Zhejiang Vocational and Technical College of Economics, Guangzhou City Vocational College, Liaoning Vocational and Technical College of Mechanical and Electrical Engineering, Foshan University of Science and Technology, Putian College and Fujian Normal University. The top-ranked institutions are mainly vocational and technical colleges and local colleges and universities. These colleges and universities pay more attention to training applied talents. The focus of talent training is to serve local and docking industries. Through the analysis of the literature in the research field of industrial colleges, it is found that the research is not carried out at the same time across the country, but it has regional aggregation. According to the author's institution, the migration of the research time of the Industrial College can be roughly analyzed. From 2001 to 2013, the research on the Institute of Industry was concentrated in Zhejiang Province, represented by Zhejiang Economic and Technical College; from 2014 to 2016, the study on the Institute of Industry began to be conducted in Sichuan Province, Fujian Province, and Guangdong Province. The transfer of universities; after 2017, universities in Guangdong became a hot spot for the research of industrial colleges.

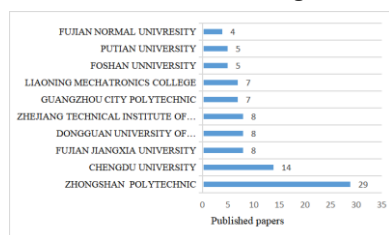


Figure 2 Published papers by the organization

3.3 Analysis of Leading Figures in the Research Field of Industrial Colleges based on Author Statistics

By counting the number of articles published by the authors, they are sorted according to the frequency of the authors. As shown in table 1, the top 10 first authors are Wan Weiping, Zhang Yanfang, Zhao Dongming, Yi Xueling, Zhao Qi, Yin Qin, Huang Bin, Huang Chunping, Zheng Qi, Ge Gaofeng. According to the analysis of the number of articles published by the authors and the number of citations of the articles, it can be seen that the authors of Zhongshan Vocational and Technical College account for a relatively high number of the top 10 in the number of published articles and the number of citations.

The introduction of the top 3 authors is as follows: Wan Weiping, male, associate researcher of Zhongshan Vocational and Technical College, whose research direction is the development and evaluation of vocational education; Zhang Yanfang (1974-), female, associate professor, School of Basic Education, Air Force Aeronautical Maintenance Technical College. Her research interests include vocational education

policies, regulations, and ideological and political education. Zhao Dongming (1978-), male, from Nehe, Heilongjiang, master, associate professor, research direction: vocational education.

Table 1 Published papers produced by high-yield authors

Serial number	Author	Number of posts (pieces)	Serial number	Author	Number of posts (pieces)
1	Wan Weiping	4	6	Yin Qin	3
2	Zhan Yanfang	4	7	Huang Bin	3
3	Zhao Dongming	3	8	Huang Chunping	3
4	Yi Xueling	3	9	Zheng Qi	2
5	Qi Zhao	3	10	Ge Gaofeng	2

3.4 Analysis of Hot Research Fields Based on Single Keywords

Keywords are the main carriers used to express the subject content of a document, and also highly summarize the content of the document. Through the statistical analysis of the keywords in the literature, we can get the research hotspots of my country Institute of Industry.

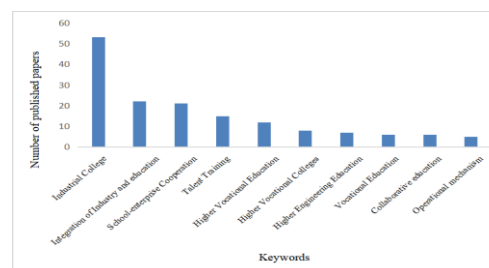


Figure 3 Published papers corresponding to keywords

As can be seen from the figure 3, the hot spots in research institute of industry mainly concentrated in industries institute, the fusion, university-enterprise cooperation, personnel training and education in higher vocational colleges, new technical, vocational education, higher vocational education, cooperative education, mixed ownership, higher education, professional groups, the talent training mode, the higher engineering education, running mechanism and so on. The most frequent occurrence of keywords in the literature is "Institute of Industry", indicating that the research focus is on the construction of the Institute of Industry itself; the keywords "integration of industry and education", "school-enterprise cooperation" and "talent training" appear second only to "Institute of Industry". "Indicating that the talent training model of industry-education integration and school-enterprise cooperation is still the key point and main approach for the research of the construction of industrial colleges. Keywords such as "higher vocational colleges", "new engineering", "vocational

Research on Yoga Correction System Based on DeepPose Pose Attitude Prediction Recognition Algorithms

Qingbo Hao¹, Minmin Du², Yan Xu^{1,*}

¹ Network Information Center of Qufu Normal University, Jining, 273100, China

² College of Physical Education Science, Qufu Normal University, Jining, 273100, China

Abstract: With the increasing popularity of yoga, the lack of standardized motion guidance has caused many yoga enthusiasts to suffer from yoga. In response to this phenomenon, this paper proposes a yoga correction method based on DeepPose posture prediction recognition. The method relies on the mobile terminal to collect the attitude image, and performs the overall and local prediction recognition of the captured image by means of the deep learning method, and finally performs motion feedback through the collecting device to achieve the purpose of correcting the yoga action.

Keywords: Gesture recognition; Image processing; Yoga

1. INTRODUCTION

Yoga is a kind of aerobic exercise that conveys love and health. Regular practice of yoga not only can effectively improve the body's function and enhance people's resistance, but also relieves the mind and makes people achieve physical and mental unity. Therefore, yoga has been highly respected and loved by people (especially young women) in recent years. With the rapid popularity of yoga, some negative problems of yoga practice have gradually emerged. Yoga exercises lack professional guidance. The irregular movements make many yoga practitioners suffer from yoga and bring physical harm to yoga lovers [1,2].

With the rapid development of computer vision technology, the research on the recognition of human body posture has become a hot research topic. How to accurately identify the position of the limb in a complex environment, and predicting the posture of the occluded limb have become the focus of research [3,4]. With the help of DeepPose attitude prediction and recognition algorithm, this paper proposes and constructs a method for posture prediction and recognition of yoga practitioners and correcting the posture.

2. ATTITUDE PREDICTION RECOGNITION ALGORITHM

Predictive recognition of attitude has always been an important concern in the field of computer vision [5]. The key problem of human posture prediction and recognition lies in the location of human joint points, especially in the location of joint points covered in

different posture. The attitude prediction recognition algorithm usually adopts the idea of constructing a local joint model and then uses the local model for gesture recognition. Because this algorithm can only construct local joint models used for detection, which makes the representation ability of such algorithms limited and has strong limitations [5-8].

Deep learning algorithms have powerful classification and positioning capabilities. Deep learning has been widely used in the processing of video, images and language. The deep modeling algorithm is used to model and recognize the human body posture image, which can effectively compensate for the limitations of traditional gesture recognition. DeepPose is a typical global modeling recognition algorithm based on deep learning [6].

2.1 Mathematical Representation of Pose Prediction Recognition

For a person's posture, we assume that it needs to be described by the position of its k key joint points. So we use the vector y to represent a person's pose, as in Equation 1.

$$y = (y_1^T, y_2^T, \dots, y_i^T)^T, i \in \{1, 2, \dots, k\} \quad (1)$$

y_i represents the position coordinates of the i th key joint point. A human gesture image with a label can be represented using (x, y) . Where x is the pose label of the image.

For the key joint parts of different postures, define a detection box b . $b = (b_c, b_w, b_h)$. Where b_c is the position coordinate of the joint. The image is cropped around this point in the subsequent algorithm.

b_w, b_h is the width and height of the image after

cropping. For cropped images, we use Equation 2 to convert each pixel in the image from absolute coordinates to relative coordinates. That is, coordinate standardization.

$$N(y_i, b) = \begin{pmatrix} 1/b_w & 0 \\ 0 & 1/b_h \end{pmatrix} (y_i - b_c) \quad (2)$$

$N(x)$ means to normalize the coordinates of the entire image. $N(x, b)$ means that part of the image

is intercepted using the detection frame $b = (b_c, b_w, b_h)$, and the intercepted image pixel is converted from absolute coordinates to relative coordinates.

$$N(y, b) = (N(y_1, b)^T, N(y_2, b)^T, \dots, N(y_i, b)^T)$$

means to transform the coordinates of each joint y_i . The core idea of the DeepPose attitude prediction recognition algorithm is to transform the attitude prediction into a regression problem. $\psi(x; \theta) \in R^{2k}$ is used to represent the attitude vector of a model that is normalized by means of a convolutional neural network, where θ is the model parameter. The absolute coordinate representation of the pose vector is shown in Equation 3.

$$y^* = N^{-1}(\psi(N(x); \theta)) \quad (3)$$

The training data set is normalized using the formula $D_N = \{f(N(x); N(y)) | (x, y) \in D\}$. If L2 is used as the loss function of the regression prediction, the pose recognition model can be expressed as:

$$\arg \min_{\theta} \sum_{(x, y) \in D_N} \sum_{i=1}^k \|y - \psi(x; \theta)\|^2 \quad (4)$$

2.2 Deeppose Attitude Prediction Recognition Algorithm

In general, the DeepPose attitude prediction recognition algorithm uses the same deep network learning architecture and multiple network model cascaded learning methods for pose prediction and recognition. The algorithm learns the features of the pose model from a large amount of image data by means of the deep learning algorithm, instead of actively establishing the pose recognition model. The DeepPose algorithm is mainly divided into two parts. Firstly, it identifies the key points of the overall picture pose (initial stage); and then identifies the partial image (precise identification stage). The two-part identification process is shown in Figure 1 and Figure 2.

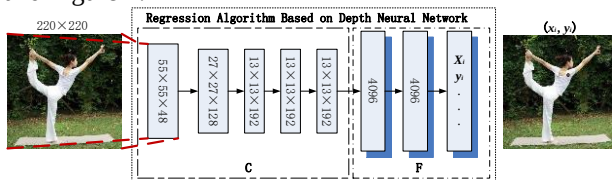


Figure 1 Initial identification stage

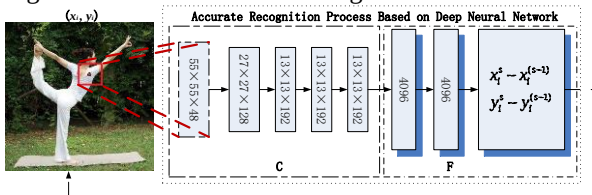


Figure 2 Accurate identification stage

In the initial recognition phase, the DeepPose

algorithm uses the deep neural network regression algorithm to identify the initial joint points of the entire image. In order to effectively control the parameter complexity of the regression algorithm, the size of the processed image is controlled at 220×220 pixels.

In the initial recognition phase and the precise identification phase, C is used to represent the convolution process in predictive recognition, LRN is the local normalization process, P is the merge process, and F is the parameter learning process. In the F process, we use the fully connected neural network structure to learn. Linear and nonlinear transformations are included in the C and F processes. The data of the C process is expressed as width x height x depth. In the initial stage, the deep neural network regression algorithm can roughly identify the key joint points of the human body posture. In order to more accurately identify the joint position of the human body, the DeepPose algorithm cascades a precise identification stage after the initial recognition stage. The identification process is shown in Figure 2. In the precise identification phase, the entire identification structure is identical to the initial identification structure. Only the processing object is converted from the overall image to a highly accurate partial image block. In this recognition process, high resolution image blocks are used to achieve higher prediction recognition accuracy. For this predictive identification process, its model structure can be expressed as: C (55x55x96)-LRN-P-C (27x27x256)-LRN-P-C(13x13x384)-C(13x13x256)-P-F(4096)-F(4096).

3. YOGA CORRECTION SYSTEM BASED ON DEEPOPOSE

With the help of DeepPose attitude prediction and recognition algorithm, this paper designs and develops a yoga correction system based on DeepPose attitude prediction and recognition relying on mobile phones and other mobile collection devices, cloud data processing devices, etc. With the help of mobile devices, the system collects image data, uploads the collected image to the cloud for pose recognition, and feeds back to the user through mobile devices after recognition and calibration to correct the wrong yoga pose. In the cloud of this system, incremental self-learning is used to optimize the model parameters through self-learning, so as to improve the recognition accuracy. The system schematic is shown in Figure 3.

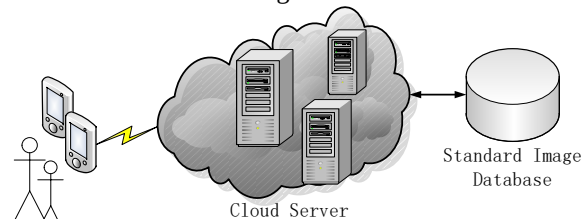


Figure 3 Diagram of yoga correction system

The yoga correction system collects user posture

image data by means of mobile devices such as mobile phones and tablets. The mobile device captures an image every 5 seconds. The collected image is subjected to standardization processing, that is, the image is down-sampled, and the image is normalized to a size of 1024×1024 pixels. Pixel point comparison is performed on the normalized images collected before and after. If the currently acquired image has a similarity of 92% or more to the previous image, the image is discarded, otherwise the image is transmitted to the cloud server.

The server learns by means of a preset standard image database with 108 yoga poses (calibrated according to the Fitness Yoga 108 Position Standard), and each yoga pose has 15 images. The attitude prediction recognition algorithm processes the gesture image transmitted by the mobile terminal using the learned parameters. The image is first down-sampled and processed into 220×220 pixels. The initial pose recognition is then performed on the entire image. The process is shown in Figure 1. The precise image (1024 × 1024 pixels) is cropped according to the initial identified key joint position, and then the cropped image block is accurately identified, as shown in Figure 2. When all the joint positions are recognized, the image human body posture is calibrated according to the weight (where 0 is an abnormal posture, and reference numeral 1-08 is a standard posture). Finally, the judgment result is fed back to the mobile terminal. If the image is standard, then it is stored in a standard image library. After receiving the feedback, the mobile terminal provides feedback to the user through language, image, etc., and guides the user to correct the wrong posture. The server learns based on standard image library timing to optimize model parameters.

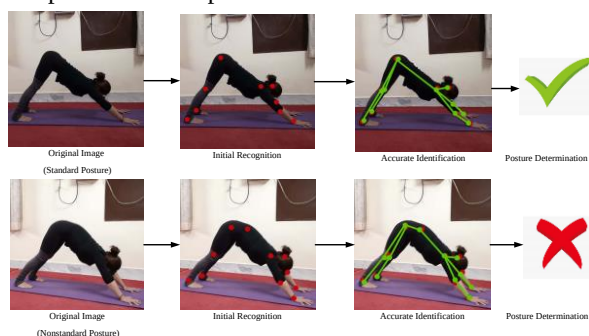


Figure 4 Schematic Diagram of Image Decision Process

From the recognition process in Figure 4, it can be seen that the DeepPose attitude prediction and recognition algorithm can not only recognize the joint position in the attitude image, but also effectively predict the hidden joint position with the help of context information. In the initial recognition stage, DeepPose algorithm only recognizes the rough joint position, while in the precise recognition stage, it further optimizes the joint position recognition by

using the deep neural network learning algorithm. For the non-standard attitude, the number and eigenvector of the “joint” points are different from the standard attitude.

4. SUMMARY AND PROSPECT

This paper proposes and constructs a yoga correction method based on DeepPose attitude prediction and recognition algorithm, and collects human body posture images by means of mobile devices. It uses the cloud server to perform gesture recognition and feedback on the captured images to achieve the purpose of correcting irregular yoga movements. Experimental results show that the method can accurately calibrate the action posture and make corresponding feedback. In view of the fact that the yoga movement also includes subtle movements such as gestures, the method cannot predict the fine posture of the end of the limb in real time, and how to accurately and accurately identify all the yoga postures will be our next research direction.

REFERENCES

- [1]P. Chu, R.A. Gotink, G.Y. Yeh, et al. The effectiveness of yoga in modifying risk factors for cardiovascular disease and metabolic syndrome: A systematic review and meta-analysis of randomized controlled trials. *European journal of preventive cardiology*, 2016, 23(3): 291-307.
- [2]S. Yoo, Evaluation for symmetry ability of one leg standing pose before and after yoga training. *Korean Journal of Sport Biomechanics*, 2014, 24(4): 391-397.
- [3]A. Newell, K. Yang & J. Deng, Stacked hourglass networks for human pose estimation. In *European conference on computer vision*, Springer, Cham, 2016: 483-499.
- [4]B.A. Basques, J.M. Khan, P.K. Louie, et al. Obesity does not impact clinical outcome but affects cervical sagittal alignment and adjacent segment degeneration in short term follow-up after an anterior cervical decompression and fusion. *The Spine Journal*, 2019, 19(7): 1146-1153.
- [5]H. Bilen, B. Fernando, E. Gavves, et al. Dynamic image networks for action recognition, *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2016: 3034-3042.
- [6]A. Toshev, C. Szegedy, Deeppose: Human pose estimation via deep neural networks, *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2014: 1653-1660.
- [7]S.S. Rautaray, A. Agrawal, Vision based hand gesture recognition for human computer interaction: a survey. *Artificial intelligence review*, 2015, 43(1): 1-54.
- [8]N. Harrat, L. Sheynblat, Controlling power consumption of a mobile device based on gesture recognition: U.S. Patent 9, 086, 875. 2015-7-21.

The Full Characterization of the Graphs with a Laplacian Eigenvalue of Multiplicity $n-3$

Daijun Yin¹, Qionxiang Huang^{2,*}

¹ College of Maths, Xinjiang Education College, Urumqi, Xinjiang, 830063, China

² College of Mathematics and Systems Science, Xinjiang University, Urumqi, Xinjiang, 830046, China

Abstract: Let $G(n, k)$ be the set of connected graphs of order n with one of the Laplacian eigenvalue having multiplicity k . It is well known that $G(n, n-1) = \{K_n\}$. The graphs of $G(n, n-2)$ are determined by Das, and the graphs of $G(n, n-3)$ with four distinct Laplacian eigenvalues are determined by Mohammadian et al. In this paper, we determine the graphs of $G(n, n-3)$ with three distinct Laplacian eigenvalues, and then the full characterization of the graphs in $G(n, n-3)$ is completed.

Keywords: Laplacian eigenvalue; Multiplicity; Laplacian spectrum determined; AMS subject classifications; 05C50

1. INTRODUCTION

Let G be a undirected simple graph on n vertices with vertex set $V = \{v_1, v_2, \dots, v_n\}$. The adjacency matrix of G is an $n \times n$ matrix $A(G)$ whose (i, j) -entry is 1 if v_i is adjacent to v_j and is 0 otherwise. The degree of v_i , denoted by d_i , is the number of edges that incident to v_i . The matrix $L(G) = D(G) - A(G)$ is called the Laplacian matrix of G , where $D(G)$ is the $n \times n$ diagonal matrix whose (i, j) -entry is d_i . The eigenvalues of $L(G)$ are called Laplacian eigenvalues of G (short for L-eigenvalues). Since $L(G)$ is a positive semidefinite matrix, the L-eigenvalues of G are non-negative and the smallest eigenvalue equals zero [1-4]. All the L-eigenvalues together with their multiplicities are called the Laplacian spectrum of G (short for L-spectrum), denoted by $\text{Spec}_L(G)$. A graph G is called DLS if $H \cong G$ for any graph H with $\text{Spec}_L(H) = \text{Spec}_L(G)$. Throughout this paper, we denote the multiplicity of L-eigenvalue μ by $m(\mu)$, and the diameter of G by $d(G)$ [5-7].

Since the connected graph with a few of distinct eigenvalues possess nice combinatorial properties, it arouses a lot of interests for several matrices, such as the adjacency matrix [8-11], the Laplacian matrix, the signless Laplacian matrix [12] and normalized Laplacian matrix [13]. We denote by $G(n, k)$ the set of connected graphs of order n with one of the L-

eigenvalue having multiplicity k . It is well known that $G(n, n-1) = \{K_n\}$. Das proved that $G(n, n-2) = \{K_{\frac{n}{2}, \frac{n}{2}}, K_{1, n-1}, K_n - e\}$, and Mohammadian and

Tayfeh-Rezaie gave a partial characterization for the graphs of $G(n, n-3)$. Motivated by their work, we will complete the characterization of the remaining graphs in

$G(n, n-3)$. By the way, we show that all these graphs of $G(n, n-3)$ are DLS.

2. PRELIMINARIES

The following result is given by Godsil.

Theorem 2.1. Let $Q = (I_m | O)^T$ be a $n \times m$ matrix, and let A be a $n \times n$ real symmetric matrix with eigenvalues $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_n$. If the eigenvalues of $M = Q^T A Q$ are $\mu_1 \geq \mu_2 \geq \dots \geq \mu_m$, then $\lambda_i \geq \mu_i \geq \lambda_{n-m+i}$ ($i = 1, \dots, m$). Furthermore, if $\mu_i = \lambda_i$ for some $i \in [1, m]$, then M has a μ_i -eigenvector z such that Qz is a λ_i -eigenvector of A .

There are many pretty properties about Laplacian eigenvalues.

Lemma 2.1. Let G be a graph on n vertices with Laplacian eigenvalues

$\mu_1 \geq \mu_2 \geq \dots \geq \mu_{n-1} \geq \mu_n = 0$. Then we have the following results.

Denote by $m(0)$ the multiplicity of 0 as a Laplacian eigenvalue and $w(G)$ the number of connected components of G . Then $w(G) = m(0)$.

G has exactly two distinct Laplacian eigenvalues if and only if G is a union of some complete graphs of the same order and some isolate vertices.

The Laplacian eigenvalues of $\overline{G}$ are given by $\mu_i(\overline{G}) = n - \mu_{n-i}$ for $i = 1, 2, \dots, n-1$ and

$\mu_n(\overline{G}) = 0$.

Let H be a graph on m vertices with Laplacian eigenvalues $\mu'_1 \geq \mu'_2 \geq \dots \geq \mu'_m = 0$, then the Laplacian spectrum of $G \vee H$ is

$\{n+m, m+\mu_1, m+\mu_2, \dots, m+\mu_{n-1}, n+\mu'_1, n+\mu'_2, \dots, n+\mu'_{m-1}, 0\}$.

It is well-known that

Lemma 2.2. Let G be a connected graph on $n \geq 3$

vertices with s distinct Laplacian eigenvalues. Then $d(G) \leq s-1$.

A graph G is said to be a cograph if it contains no induced P_4 . There's a pretty result about cographs.

Lemma 2.3. Given a graph G , the following statements are equivalent:

G is a cograph.

The complement of any connected subgraph of G with at least two vertices is disconnected.

Every connected induced subgraph of G has diameter less than or equal to 2.

3. CHARACTERIZATION OF $G(n, n-3)$

Recall that $G(n, k)$ is the set of connected graphs

$$\left\{ \begin{array}{l} G_1(n, n-3) = \{G \in G(n, n-3) \mid \text{Spec}_L(G) = [(\alpha)^{n-3}, (\beta)^2, 0]\} \\ G_2(n, n-3) = \{G \in G(n, n-3) \mid \text{Spec}_L(G) = [(\alpha)^2, (\beta)^{n-3}, 0]\} \\ G_3(n, n-3) = \{G \in G(n, n-3) \mid \text{Spec}_L(G) = [(\alpha)^{n-3}, \beta, \gamma, 0]\} \\ G_4(n, n-3) = \{G \in G(n, n-3) \mid \text{Spec}_L(G) = [\alpha, (\beta)^{n-3}, \gamma, 0]\} \\ G_5(n, n-3) = \{G \in G(n, n-3) \mid \text{Spec}_L(G) = [\alpha, \beta, (\gamma)^{n-3}, 0]\} \end{array} \right. \quad (1)$$

Mohammadian and Tayfeh-Rezaie determine the classes of graphs in $G_3(n, n-3)$, $G_4(n, n-3)$ and $G_5(n, n-3)$, all of which we collect in the following theorem.

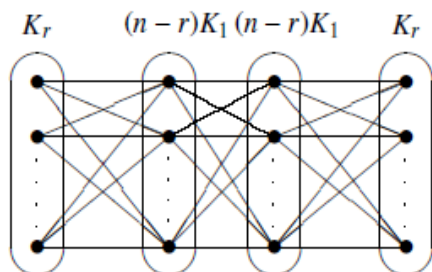


Figure 1 The graph $G_{n,r}$

Theorem 3.1. (Theorem 8, 9, 10). For an integer $n \geq 5$, we have

$$\left\{ \begin{array}{l} \text{Spec}_L(K_1 \nabla 2K_{\frac{n-1}{2}}) = \{[n]^1, [\frac{n+1}{2}]^{n-3}, [1]^1, [0]^1\} \\ \text{Spec}_L(\bar{K}_{\frac{n}{3}} \nabla 2K_{\frac{n}{3}}) = \{[n]^1, [\frac{2n}{3}]^{n-3}, [\frac{n}{3}]^1, [0]^1\} \\ \text{Spec}_L(K_{n-1} + e) = \{[n]^1, [n-1]^{n-3}, [1]^1, [0]^1\} \\ \text{Spec}_L(G_{n,r}) = \{[\frac{1}{2}(3n-2r \pm \sqrt{n^2+4nr-4r^2})]^1, [n]^{2n-3}, [0]^1\} \end{array} \right. \quad (3)$$

$G_5(n, n-3) = \{K_{2,n-2}, K_{\frac{n}{2}, \frac{n}{2}} + e, K_{1,n-1} + e\}$ and the Laplacian spectra of them are given by

$$\left\{ \begin{array}{l} \text{Spec}_L(K_{2,n-2}) = \{[n]^1, [n-2]^1, [2]^{n-3}, [0]^1\} \\ \text{Spec}_L(K_{\frac{n}{2}, \frac{n}{2}} + e) = \{[n]^1, [\frac{n}{2} + 2]^1, [\frac{n}{2}]^{n-3}, [0]^1\} \\ \text{Spec}_L(K_{1,n-1} + e) = \{[n]^1, [3]^1, [1]^{n-3}, [0]^1\} \end{array} \right. \quad \text{For the complete characterization of } G(n, n-3) \quad (4)$$

with $m(\mu) = k$ for some L-eigenvalue μ . If $k = n-1$, then G has exactly two distinct L-eigenvalues, and so $G(n, n-1) = \{K_n\}$ by Lemma 2.1 (ii). If $k = n-2$, then G has exactly three distinct L-eigenvalues, and Das proved that $G(n, n-2) = \{K_{\frac{n}{2}, \frac{n}{2}}, K_{1,n-1}, K_n - e\}$. For a graph $G \in G(n, n-3)$, we see that G has three or four distinct L-eigenvalues. In terms of the number and multiplicity of Laplacian eigenvalues, we can divide $G(n, n-3)$ into five classes:

$G_3(n, n-3) = \{K_{n-3} \nabla \bar{K}_{1,2}\}$ and the Laplacian spectra of it is

$$\text{Spec}_L(K_{n-3} \nabla \bar{K}_{1,2}) = \{[n]^{n-3}, [n-1]^1, [n-3]^1, [0]^1\} \quad (2)$$

$G_4(n, n-3) =$

$$\{K_1 \nabla 2K_{\frac{n-1}{2}}, \bar{K}_{\frac{n}{3}} \nabla 2K_{\frac{n}{3}}, K_{n-1} + e, G_{n,r}\}$$

where $G_{n,r}$ (shown in Fig. 1) is obtained from two copies of $K_r \nabla (n-r)K_1$ by joining the vertices of two independent sets

$(n-r)K_1$. Furthermore, the Laplacian spectra of them are given by

it remains to determine the graphs of $G_1(n, n-3)$ and $G_2(n, n-3)$. At first, we introduce a tool which will be used frequently.

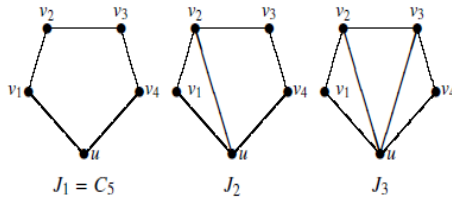


Figure 2 The graphs in Lemma 3.3

Lemma 3.1. Let A be a real symmetric matrix of order $n \geq 6$ having an eigenvalue $\alpha \neq 0$ with $m(\alpha) = n - m$, where $1 \leq m \leq n - 2$. Let M be a principal submatrix of A of order $m + 2$. Then α is also an eigenvalue of M with $m(\alpha) \geq 2$, and there exists eigenvector $z = (z_1, z_2, \dots, z_{m+2})^T$ of M with respect to α such that $z_k = 0$ for $1 \leq k \leq m + 2$.

Furthermore, $\sum_{i=1}^{m+2} z_i = 0$ if $A = L(G)$ for a graph G .

Proof. Let $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_n$ be the eigenvalues of A and $\mu_1 \geq \mu_2 \geq \dots \geq \mu_m$ the eigenvalues of M . By our assumption, there exists some $1 \leq i \leq n$ such that $\lambda_i = \dots = \lambda_{i+n-m-1} = \alpha \neq 0$. By Theorem 2.1, we get that

$$\alpha = \lambda_{i+n-m-2} \leq \mu_i \leq \lambda_i = \alpha \quad \text{and}$$

$$\alpha = \lambda_{i+n-m-1} \leq \mu_{i+1} \leq \lambda_{i+1} = \alpha. \quad \text{Therefore, we}$$

$$\text{have } \mu_i = \mu_{i+1} = \alpha. \quad \text{Suppose that}$$

$$x = (x_1, x_2, \dots, x_{m+2})^T \quad \text{and}$$

$$y = (y_1, y_2, \dots, y_{m+2})^T \quad \text{are two independent}$$

eigenvectors of M with respect to α . For each fixed integer $1 \leq k \leq m + 2$, by linear combination of x and y , we get the eigenvector

$$z = (z_1, z_2, \dots, z_{m+2})^T \quad \text{satisfying } z_k = 0.$$

Furthermore, by Theorem 2.1, we know that $z^* = Qz$ is an eigenvector of A with respect to α ,

$$\text{where } Q = (I_{m+2} | O)^T. \quad \text{Note that the all-ones}$$

vector j is an eigenvector of $L(G)$ with respect to 0 ,

$$\text{then we have } z^* j = \sum_{i=1}^{m+2} z_i = 0.$$

Lemma 3.2. Let G be a connected graph on $n \geq 2m$ vertices with $m(\alpha) = n - m$, where α is a L -eigenvalue of G . Then α is integral.

Proof. Let $f(x)$ be the characteristic polynomial of $L(G)$. As $L(G)$ only contains integral entries, we obtain that $f(x)$ is a monic polynomial with integral coefficients. Let $p(x)$ be the minimal polynomial of α , then $p(x) \in \mathbb{Z}[x]$ is irreducible in $\mathbb{Q}[x]$ and

$(p(x))^{n-m} \mid f(x)$. We assume that $p(x)$ is a polynomial of degree at least 2. Therefore, $p(x)$ has another root $\beta \neq 0$, which is also a Laplacian eigenvalue of G with multiplicity $n - m$. It follows that $2(n - m) \leq n - 1$, which implies $n \leq 2m - 1$, a contradiction. Thus, we have $p(x) = x - \alpha$ and the result follows.

Lemma 3.3. Let $G \in G(n, n-3)$ with $n \geq 6$, then none of $J_1 (= C_5)$, J_2 or J_3 (shown in Fig. 2) can be an induced subgraph of G .

Proof. By way of contradiction. Suppose that G has J_i as an induced subgraph and N_i the principal submatrix of $L(G)$ corresponding to J_i , for $i = 1, 2, 3$. Let α be the Laplacian eigenvalue of G with multiplicity $n - 3$. Then, by Lemma 3.1, α is an eigenvalue of N_i with $m(\alpha) \geq 2$, and there exists an eigenvector z of N_i with respect to α such that

$$z_k = 0 \text{ for } k \in \{1, \dots, 5\}, \text{ and } \sum_{i=1}^5 z_i = 0.$$

First, suppose that $J_1 = C_5$ is an induced subgraph of G and N_1 is given by

$$N_1 = \begin{pmatrix} d_1 & -1 & 0 & 0 & -1 \\ -1 & d_2 & -1 & 0 & 0 \\ 0 & -1 & d_3 & -1 & 0 \\ 0 & 0 & -1 & d_4 & -1 \\ -1 & 0 & 0 & -1 & d_5 \end{pmatrix} \begin{matrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ u \end{matrix} \quad (5)$$

By Lemma 3.1, there exists an eigenvector $x = (0, x_2, x_3, x_4, x_5)^T$ satisfying

$$x_2 + x_3 + x_4 + x_5 = 0 \text{ such that } N_1 x = \alpha x. \quad \text{From}$$

the first entry of $N_1 x = \alpha x$, we have $x_2 + x_5 = 0$.

Therefore, we have $x_3 + x_4 = 0$. If one of

x_2 and x_5 equals zero, then $x_2 = x_5 = 0$. Considering

the second entry of both sides of $N_1 x = \alpha x$, we get

that $x_3 = 0$, and so $x_4 = 0$. It leads to that

$x = 0$, a contradiction. If one of x_3 and x_4 equals

zero, then $x_3 = x_4 = 0$, consider the third entry of

both sides of $N_1 x = \alpha x$ and we get that $x_2 = 0$, and

so $x_5 = 0$. It leads to that $x = 0$, a contradiction.

Thus $x_2, x_3, x_4, x_5 \neq 0$. Without loss of generality,

we may assume that $x = (0, 1, a, -a, -1)^T$. Consider the fourth and the

fifth entries of both sides of $N_1 x = \alpha x$, we have

$$d_5 - a = \alpha = d_4 + 1 - \frac{1}{a}.$$

Since $m(\alpha) = n - 3$ and $n \geq 6$, we get that α is integral by Lemma 3.2. Then a and $\frac{1}{a}$ are both integral. Thus, we have $a = \pm 1$, and so $\alpha = d_5 - 1 = d_4$ when $a = 1$ or $\alpha = d_5 + 1 = d_4 + 2$ when $a = -1$. It follows that $d_4 = d_5 - 1$.

On the other hand, by Lemma 3.1, there also exists an eigenvector $y = (y_1, 0, y_3, y_4, y_5)^T$

satisfying $y_1 + y_3 + y_4 + y_5 = 0$ such that $N_1 y = \alpha y$. From the second entry of $N_1 y = \alpha y$, we have $y_1 + y_3 = 0$. Therefore, we have $y_4 + y_5 = 0$. If one of y_1 and y_3 equals zero, then $y_1 = y_3 = 0$. Consider the first entry of both sides of $N_1 y = \alpha y$, we get that $y_5 = 0$, and then $y_4 = 0$. It leads to that $y = 0$, a contradiction. If one of y_4 and y_5 equals zero, then $y_4 = y_5 = 0$. Consider the fourth entry of both sides of $N_1 y = \alpha y$, we get that $y_3 = 0$, and then $y_1 = 0$. It leads to that $y = 0$, a contradiction. Thus, $y_1, y_3, y_4, y_5 \neq 0$. Without loss of generality, we may assume that $y = (b, 0, -b, 1, -1)^T$. Consider the fourth and the fifth entries of both sides of $N_1 y = \alpha y$, we have $d_4 + b + 1 = \alpha = d_5 + b + 1$.

It follows that $d_4 = d_5$, which contradicts to (4).

Second, assume that J_2 is an induced subgraph of G and N_2 is given by

$$N_2 = \begin{pmatrix} d_1 & -1 & 0 & 0 & -1 \\ -1 & d_2 & -1 & 0 & -1 \\ 0 & -1 & d_3 & -1 & 0 \\ 0 & 0 & -1 & d_4 & -1 \\ -1 & -1 & 0 & -1 & d_5 \end{pmatrix} \begin{matrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ u \end{matrix} \quad (6)$$

By Lemma 3.1, there exists an eigenvector $x = (x_1, x_2, x_3, x_4, 0)^T$ satisfying $x_1 + x_2 + x_3 + x_4 = 0$ such that $N_2 x = \alpha x$. From the fifth entry of $N_2 x = \alpha x$, we have $x_1 + x_2 + x_4 = 0$, which implies that $x_3 = 0$. Then from the third entry of $N_2 x = \alpha x$, we get $x_2 + x_4 = 0$, which implies that $x_1 = 0$, and then from the first entry we have $x_2 = 0$.

Thus, $x_4 = 0$ and hence $x = 0$, a contradiction.

Finally, assume that J_3 is an induced subgraph of G and N_3 is given by

$$N_3 = \begin{pmatrix} d_1 & -1 & 0 & 0 & -1 \\ -1 & d_2 & -1 & 0 & -1 \\ 0 & -1 & d_3 & -1 & -1 \\ 0 & 0 & -1 & d_4 & -1 \\ -1 & -1 & -1 & -1 & d_5 \end{pmatrix} \begin{matrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ u \end{matrix} \quad (7)$$

By Lemma 3.1, there exists an eigenvector $x = (x_1, x_2, 0, x_4, x_5)^T$ satisfying $x_1 + x_2 + x_4 + x_5 = 0$ such that $N_3 x = \alpha x$. Consider the third, the first and the fourth entries of both sides of $N_3 x = \alpha x$ successively, we get that $x = 0$, a contradiction.

Lemma 3.4. Let $G \in G(n, n-3)$ with $n \geq 6$. If $G \neq G_{n,r}$ (shown in Fig. 1), then $\overline{G}$ is disconnected. Proof. By Lemma 2.3, it suffices to show that G contains no induced P_4 . Assume by contradiction that G contains an induced $P_4 = v_1 v_2 v_3 v_4$. If G has three distinct Laplacian eigenvalues, then $d(G) = 2$ by Lemma 2.2. Therefore, there exists a vertex $u \in V(G)$ such that $u \sim v_1, v_4$, since otherwise $d(v_1, v_4) \geq 3$. It follows that at least one of J_1, J_2 and J_3 will be an induced subgraph of G , which contradicts to Lemma 3.3. If G has four distinct Laplacian eigenvalues, then $G \in \{K_1 \nabla 2K_{\frac{n-1}{2}}, \overline{K}_n \nabla 2K_{\frac{n}{3}}, K_{n-1} + e, G_{n,r}\}$ by

Theorem 3.1 (ii), from which we find that all graphs but $G_{n,r}$ have their complements disconnected.

We now give the characterization of the graphs in $G_1(n, n-3)$ and $G_2(n, n-3)$.

Theorem 3.2. For an integer $n \geq 6$, we have

(i) $G_1(n, n-3) = \{3K_1 \nabla K_{n-3}, C_4 \nabla K_{n-4}\}$ and the Laplacian spectra of them are given by

$$\begin{cases} \text{Spec}_L(3K_1 \nabla K_{n-3}) = \{[n]^{n-3}, [n-3]^2, [0]^1\} \\ \text{Spec}_L(C_4 \nabla K_{n-4}) = \{[n]^{n-3}, [n-2]^2, [0]^1\} \end{cases} \quad (8)$$

$G_2(n, n-3) = \{K_2 \nabla (n-2)K_1, K_1 \nabla K_{\frac{n-1}{2}, \frac{n-1}{2}}, K_{\frac{n}{3}, \frac{n}{3}, \frac{n}{3}}\}$ and the Laplacian spectra of them are given by

$$\left\{ \begin{array}{l} \text{Spec}_L(K_2 \nabla (n-2)K_1) = \{[n]^2, [2]^{n-3}, [0]^1\} \\ \text{Spec}_L(K_1 \nabla K_{\frac{n-1}{2}, \frac{n-1}{2}}) = \{[n]^2, [\frac{n+1}{2}]^{n-3}, [0]^1\} \\ \text{Spec}_L(K_{\frac{n}{3}, \frac{n}{3}, \frac{n}{3}}) = \{[n]^2, [\frac{2n}{3}]^{n-3}, [0]^1\} \end{array} \right. \quad (9)$$

Proof. Let $G \in G_1(n, n-3) \cup G_2(n, n-3)$.

Then G has three distinct Laplacian eigenvalues, say $\alpha > \beta > 0$, and so $G \neq G_{n,r}$. By Lemma 3.4, we know that G is disconnected, and so $\alpha = n$ from Lemma 2.1 (i) and (iii).

First suppose that $\alpha = n$ has multiplicity $n-3$, and so G has Laplacian spectrum $\{n^{n-3}, \beta^2, 0\}$. Then, by Lemma 2.1, the L-spectrum of $\bar{G}$ is given by

$$\text{Spec}_L(\bar{G}) = \{[n-\beta]^2, [0]^{n-2}\},$$

which implies that $\bar{G}$ has $n-2$ connected components, say $\bar{G} = G_1 \cup G_2 \cup \dots \cup G_{n-2}$. It is easy to see that $\bar{G} = K_3 \cup (n-3)K_1$ or $2K_2 \cup (n-4)K_1$. Consequently, $G = 3K_1 \nabla K_{n-3}$ or $G = C_4 \nabla K_{n-4}$. Thus, (i) holds.

Next suppose that β has multiplicity $n-3$, and so G has Laplacian spectra $\{n^2, \beta^{n-3}, 0\}$. Similarly, by Lemma 2.1, we have

$$\text{Spec}_L(\bar{G}) = \{[n-\beta]^{n-3}, [0]^3\},$$

which implies that $\bar{G}$ has 3 connected components, say $\bar{G} = G_1 \cup G_2 \cup G_3$. It is routine to verify that

$$\bar{G} = 2K_1 \cup K_{n-2}, \quad K_1 \cup 2K_{\frac{n-1}{2}} \quad \text{or} \quad 3K_{\frac{n}{3}}.$$

Hence $G = K_2 \nabla (n-2)K_1$, $K_1 \nabla K_{\frac{n-1}{2}, \frac{n-1}{2}}$ or $K_{\frac{n}{3}, \frac{n}{3}, \frac{n}{3}}$. Thus (ii) holds.

Note that all of the graphs we find consist of the join of two graphs, by Lemma 2.1 (iv), we obtain their Laplacian spectra, which are shown in (5) and (6).

Remark 1. By using the software SageMath, we get the graphs of $G(n, n-3)$ with $n=4$ and $n=5$. That is,

$$\left\{ \begin{array}{l} G(4,1) = \{P_4, K_{1,3} + e\} \\ G(5,2) = \{C_5, K_1 \nabla C_4, K_2 \nabla 3K_1\} \end{array} \right. \quad (10)$$

Corollary 3.1. Let $G \in G(n, n-3)$ with $n \geq 4$, then G is determined by its Laplacian spectrum.

Proof. Let H be a connected graph on n vertices with $\text{Spec}_L(H) = \text{Spec}_L(G)$. We get that

$H \in G(n, n-3)$. Then the result follows by pairwise comparing the Laplacian spectra of graphs in $G(n, n-3)$.

ACKNOWLEDGMENT

This work is supported by the National Natural Science Foundation of China (Grant Nos. 11671344).

REFERENCES

- [1]C.D. Godsil, G. Royle, Algebraic Graph Theory. Graduate Texts in Mathematics, Springer, New York, 2001: vol. 207.
- [2]D. Cvetković, P. Rowlinson, S. Simić, An Introduction to the Theory of Graph Spectra. Cambridge press, New York, 2013.
- [3]D. Corneil, H. Lerchs, L. Burlingham, Complement reducible graphs. Discrete Applied Mathematics 1981, 3: 163-174.
- [4]K.C. Das, A sharp upper bound for the number of spanning trees of a graph. Graph Comb. 2007, 23: 625-632.
- [5]E.R. Van Dam, W.H. Haemers, Graphs with constant μ and $\bar{\mu}$. Discrete Math. 1998, 182: 293-307.
- [6]A. Mohammadian, B. Tayfeh-Rezaie, Graphs with four distinct Laplacian eigenvalues. J. Algebra Comb. 2011, 34: 671-682.
- [7]Y. Wang, Y. Fan, Y. Tan, On graphs with three distinct Laplacian eigenvalues. Appl. Math. J. Chinese Univ. Ser. B. 2007, 22: 478-484.
- [8]E.R. van Dam, Nonregular graphs with three eigenvalues. J. Combin. Theory Ser. B. 1998, 73: 101-118.
- [9]E.R. van Dam. Regular Graphs with Four Eigenvalues. Linear Algebra Appl. 1995, 226-228: 139-162.
- [10]E.R. Van Dam, Small regular graphs with four eigenvalues. Discrete Mathematics, 1998, 189: 233-257.
- [11]X Huang, Q Huang, On regular graphs with four distinct eigenvalues. Linear Algebra Appl. 2016, 512: 219-233.
- [12]E.R. Van Dam, G.R. Omid, Graphs whose normalized Laplacian has three eigenvalues. Linear Algebra Appl. 2011, 435: 2560-2569.
- [13]F. Ayoobi, G.R. Omid, B. Tayfeh-Rezaie, A note on graphs whose signless Laplacian has three distinct eigenvalues. Linear Multilinear Algebra 2011, 59(6): 701-706.

A Study on the Formative Assessment Reform of Comprehensive English under the Network Learning Space

Shan Cheng

Guangdong University of Science & Technology, Guangdong, 523000, China

Abstract: As a basic compulsory course in the primary stage of English major, the traditional evaluation system of Comprehensive English is a little single, focusing on knowledge and results, and neglecting the effective evaluation of students' learning process, as well as the comprehensive evaluation of students' ability and quality. Based on the principle of the sufficiency of the application of the network learning space, the principle of the deep study of the value of the Comprehensive English course, the principle of the combination of knowledge evaluation with ability and quality evaluation, the principle of process and timeliness, the principle of student-centered, relying on the cloud platform to construct personalized online learning space, and reforming the traditional evaluation methods are conducive to the realization of teaching effect and the achievement of the goal of talent training in application-oriented universities.

Keywords: Network learning space; Comprehensive English; Formative assessment; Reform principles; Reform practice

1. INTRODUCTION

Network learning space is a virtual space that can be used by individuals with real names for life. It is based on the open cloud computing, which is specially designed for learning by enterprises. It focuses on learners. Its features mainly include three functional features, three sharing functions, three social functions and three personal functions. Specifically, the network learning space is not only a teaching platform, a management platform, but also a social platform; it has one button collection, one button subscription, and one button sharing functions; it can praise, leave a message or interact by message board; it has the functions of unlimited storage, unlimited friends, and lifelong companionship.

Comprehensive English is a basic compulsory course in the primary stage of English major. It is a course specially designed to train students' comprehensive English language skills. Its main function is to cultivate students' ability of appreciation, logical analysis and independent thinking of English texts by reading and analyzing English materials with various subjects and rich connotations, deepen students' understanding and perception of life and society, broaden students' horizon and mind, and improve students' comprehensive ability of English language.

The course materials are equipped with corresponding exercises. Through the vocabulary research, reading comprehension, translation practice, stylistic analysis and writing exercises, the students' English level is comprehensively improved. Meanwhile, the students are trained to have more proficient communication ability, more perfect comprehensive quality, more competitive ability and adaptability in the talent market, so as to guide them to develop into professional and forward-looking English talent.

The formative assessment of curriculum refers to the assessment of the performance and effect of students' learning process. Its purpose is to strengthen the guidance and management of students' specific learning process, timely give students' learning information a feedback to better improve students' comprehensive quality and ability [1].

2. DISADVANTAGES OF THE TRADITIONAL COMPREHENSIVE ENGLISH CURRICULUM EVALUATION SYSTEM

The traditional assessment form of Comprehensive English course is a little single, emphasizing the summative assessment rather than the process assessment; the content of the examination is standardized and fixed, emphasizing the objective questions, focusing on the inspection of the basic knowledge of books, such as vocabulary and grammar, less on the comprehensive language ability and quality of students. This kind of static evaluation centered on evaluators with a single form, low validity and reliability. In addition, after the evaluation, the teacher failed to timely give a feedback to the students, which made it difficult for the students to understand their learning effects and deficiencies accurately and timely, and the cohesion between teaching and evaluation needs to be strengthened. However, the realization of curriculum teaching objectives is closely related to the content and form of curriculum assessment, so this assessment method will affect the teaching content and teaching method of the curriculum, which is still the traditional "emphasis on language knowledge assessment, less on ability and quality assessment". In this teaching mode, teachers still pay more attention to "teaching" rather than "learning" of students, to "result" rather than "process", to "knowledge" rather than "quality". This kind of teaching mode and evaluation method is difficult to stimulate students'

spontaneity, initiative and enthusiasm in English learning, which is not conducive to the realization of teaching effect and the achievement of talent training goal in application-oriented universities [2].

In fact, as a professional basic course to improve students' English comprehensive ability, Comprehensive English aims to consolidate the achievements of students' English learning, cultivate students' English logical thinking ability, improve students' reading comprehension and rhetoric appreciation ability of high-level, complex and in-depth articles, and train students' ability of written and oral English expression as well as the ability of translation. In addition, the course also plays an important role in enhancing students' awareness of cultural differences between China and the West and their ability of intercultural communication. In the textbook of comprehensive course, the subjects of the text are widely covered, including marriage and family, ethics and education, network technology and social issues, environmental and political issues, love and family relations, science and technology, war and equality, and many other topics, so that in-depth digging up the connotation of teaching materials is of great benefit for the students "three views" shape. Modern and scientific curriculum design, dynamic and comprehensive evaluation methods are needed to guide students to correctly recognize and think about the above topics, reasonably shape students' three views, and consciously integrate the ideological and political elements of the curriculum in teaching. However, traditional assessment methods are obviously difficult to meet the objectives of curriculum ability and quality, and students' stage performance, independent innovation, communication and cooperation, the ability of language comprehensive application need to be effectively evaluated, besides that, the students' world view, outlook on life and values need to be effectively shaped, so the formative evaluation reform of Comprehensive English course under the network learning space is worthy of researching and applying.

3. THE PRINCIPLE OF FORMATIVE EVALUATION REFORM OF COMPREHENSIVE ENGLISH COURSE UNDER NETWORK LEARNING SPACE

Under the network learning space, the principles of formative evaluation reform of Comprehensive English course mainly include: the principle of sufficiency and scientificity in the use of network learning space; the principle of deep mining the value of Comprehensive English course; the principle of combining knowledge evaluation with ability and quality evaluation; the principle of process and timeliness; and the principle of student-centered.

3.1 The Principle of Sufficiency and Scientificity in the Use of Network Learning Space

In the introduction, the functions and features of the network learning space have been introduced, and

teachers should fully and scientifically use the article/video column, Teacher One platform, questionnaire survey, operation system, examination system, magic cube of course, space micro blog, message board, space MOOC, album and other modules, enrich teaching methods, comprehensively record students' learning process, make full use of the value of online learning space, and comprehensively evaluate students' learning effect.

3.2 The Principle of Deep Mining the Value of Comprehensive English

Comprehensive English is a professional course to improve students' comprehensive ability of English language. The textbook of *Comprehensive Course* involves many topics. The course has a wide range of contents, and there are many in-depth materials worth digging up. It has high requirements for teachers' professional knowledge and cultural literacy. When setting the teaching mode and evaluation index, it should be based on multiple aspects of teaching contents, such as listening, reading, speaking, communicating, cooperating, and stage showing, etc., according to these to develop a hierarchical, comprehensive teaching evaluation standards, so that the results of the course evaluation are more authoritative and accurate. In the process of constructing the curriculum evaluation system, we need to pay attention to the use of Internet information and technology, and make objective and fair evaluation on the teaching objectives, processes and results of the English classes to reflect the self-value of Comprehensive English course [3].

3.3 The Principle of Combining Knowledge Evaluation with Ability and Quality Evaluation

Although the traditional assessment model of Comprehensive English involves students' usual performance, it is not scientific and comprehensive to measure students' ability only by single performance in class and a few after-school assignments. In the evaluation, we should pay attention to the principle of combining the evaluation of language knowledge with the evaluation of ability and quality. In addition to the investigation of students' basic knowledge and skills, we should also pay attention to the investigation of students' practical application ability, logical thinking ability, innovative cooperation ability and critical thinking ability, so as to comprehensively evaluate students' potential of knowledge expansion and practical application in the course. As examining students' knowledge and ability, the attitude, emotion and values of students should be examined as well.

3.4 Principle of Process and Timeliness

Paying attention to the process and timeliness of learning evaluation can effectively optimize the learning process of students and improve the final learning effect. Formative assessment can guide students to reflect on the learning effect, adjust learning strategies and methods in time, and promote students' progress and improvement; formative

assessment can also encourage teachers to reflect on teaching in time, improve teaching methods, so as to promote the development of teachers themselves. Comprehensive English teaching should focus on cultivating students' ability of independent and innovative learning, cooperative and win-win learning, efficient and in-depth learning, attach importance to students' dynamic learning process and effect, guide students to develop a good habit of constantly adjusting their own learning process, so as to promote the teachers' update of teaching methods and the cultivation of students' good learning habits [2].

3.5 Student-centered Principle

The formative evaluation reform of Comprehensive English curriculum under the network learning space should also follow the student-centered principle. That is to say, taking students' development as the center to promote students' all-round development; taking students' learning as the center to cultivate students' ability of active learning and independent learning; taking students' learning effect as the center to take learning effect as the basis for judging the teaching work of Comprehensive English and carry out formative evaluation reform. The development of students, students' autonomous learning and learning effect should be focused on, and effective reform need to be carried out.

4. THE PRACTICE OF FORMATIVE ASSESSMENT REFORM OF COMPREHENSIVE ENGLISH COURSE UNDER NETWORK LEARNING SPACE

This part mainly expounds the practice of formative evaluation reform of Comprehensive English course under the network learning space from two aspects, which are platform construction and evaluation methods, and the specific contents are as follows:

4.1 Platform Construction

This research mainly relies on the article/video column, Teacher One platform, questionnaire, course cube, homework system, examination system, space micro blog, message board, space MOOC and album modules in the cloud to carry out the practice of formative evaluation and reform of Comprehensive English. Teachers need to do a lot of online preparation work before class, and build personalized platform. For example, setting up the article and video column, and uploading the course related resources to the corresponding column, and the video record students' performance in class will also be uploaded to the corresponding column to facilitate teachers' comments and students' mutual comments; in Teacher One platform, Comprehensive English course is established, and relevant documents of the course are uploaded to the platform, which is convenient for students to preview before class; questionnaire survey is issued to enrich teaching methods and stimulate students' enthusiasm for participation, which can be used to test students' preview or study; course cube is used to integrate course resources, and make teaching

more convenient, effective and diverse; the homework system is convenient for teachers to publish and grade students' homework online; the examination system can be built a large question bank in, which will be useful to strengthen students' grasp of knowledge points through "daily practice", and teachers could analyze students' mastery of knowledge points through data; the micro-blog and message board are good helpers for teachers to interact with students, and shorten the distance between them. Students can also give some feedback here, so that teachers can know the teaching effect; and teachers can also release teaching videos through space MOOC, so that students can learn autonomously; through space albums, some wonderful moments in class can be recorded, so as to increase the objectivity and authenticity of the evaluation.

4.2 Evaluation Method

Under the network learning space, the formative evaluation method of Comprehensive English course should pay attention to the diversification of the evaluation subject, the multi-dimension and flexibility of the evaluation standard. According to the characteristics of students' personalized learning, a scientific, reasonable and flexible evaluation system should be established to evaluate the students' comprehensive performance in the course to the greatest extent and in the most comprehensive way, such as attendance and participation enthusiasm, innovation of performance, effectiveness of interaction, confidence and fluency of performance, completion of homework and test, communication, unity and cooperation ability, etc., so as to make a formative evaluation that can better reflect students' personalized learning characteristics and maximize students' learning potential.

5. CONCLUSION

Through practice, it is found that the formative evaluation reform of the Comprehensive English course under the network learning space has a better effect, which can effectively break the shortcomings of traditional evaluation methods, enrich the evaluation forms, enhance the reliability and validity of evaluation, comprehensively evaluate the whole process of students' learning, it can also effectively stimulate students' enthusiasm for learning and conducive to teachers' timely teaching reflection and the improvement of their teaching ability. Besides that the student-centered and curriculum ideological and political teaching ideas need to be integrated into the teaching as well, so as to truly promote the development of students and be helpful to shape their world view, outlook on life and values, which is conducive to the realization of the teaching effect and the achievement of the talent training goal of the application-oriented university.

REFERENCES

- [1] Ning Tianshu, "Practice and Discussion of

Formative Evaluation of College Curriculum — Practice of Evaluation Reform of Tourism English Curriculum,” *Teaching and Education*, 2006 (23): 89-90.

[2]Liu Yinghong, “A Preliminary Study on the Reform of Comprehensive English Curriculum

Evaluation System,” *Journal of Hubei Correspondence University*, 2014 (21): 128-129.

[3]Xiao Yan, “Reform of Application-oriented Undergraduate English Curriculum Evaluation System in the Era of Big Data,” *Modern Economic Information*, 2019 (22): 428.

Research and Application of VR Situational Narrative Techniques in History, Science Education, Mythology Cartoons

Leiming Li^{1,2}, Yan Tang^{1,3}

¹Cooperative Course of Performance, Film & Animation, Sejong University, Seoul, 05006, Korea

²College of Art, South China Agricultural University, Guangzhou, 510642, China

³College of Art, Ningxia Vocational and Technical College, Yinchuan, 75000, China

Abstract: With the continuous development of computer technology and Internet applications, digital technology is widely used in all aspects of social development and people's daily lives, especially VR technology based on the development of computer technology. Since the development of VR, VR has been closely integrated with film and television media with its extremely real immersive experience effects and sound and picture effects. Among them, VR animation is the fastest growing. How to produce animation based on VR and how to express it in narrative techniques are worthy of anxiety for animators. Based on the analysis of VR technology and scenario narrative techniques, this article aims at the limitations of VR scenario narrative techniques, based on the development status of VR cartoons, and discusses the application of VR scenario narrative techniques in history, science, education, and mythical cartoons. The development of animation provides a theoretical basis.

Keywords: VR; Situational narrative technique; Animation; Application

VR, Virtual Reality or virtual reality, is an important product of the development of computer technology and interconnected applications. At present, VR technology has become increasingly mature, combined with different industry forms, and widely used in all aspects of social life. Nowadays, the most important aspect of the development of VR is that it can bring extremely real experience to users. The combination of VR technology and animation is one of the current trends in the development of film and television. It brings a new presentation method for cartoons, especially for educational cartoons such as history, textbooks, and myths. People feel the history of science, education and culture more intuitively. In my country, the development of VR animation is still in the initial stage, and the domestic research and application is still in its infancy, and many mature works have not been created. With the advent of the 5G era and a new round of rapid development of VR-related technologies, the theoretical and practical research in this field becomes more and more important. However, VR, as a new type of cartoon medium, has a broad space for development both in

creative expression and narrative techniques [1]. As a kind of narrative film and television art, cartoons have a strong demand for narrative techniques. VR technology is applied to cartoons, which brings a new scenario narrative technique and provides new creators of historical, educational, and mythological cartoons. The idea has brought more possibilities to animation creation [2]. But it cannot be ignored that in VR cartoons, the audience's immersive and interactive experience is more real, therefore, the creator needs a more superb storytelling technique to meet the needs of the audience. Based on the analysis of VR technology and characteristics, this article bases on the current development status of VR cartoons, analyzes the application of VR scenario narrative techniques in history, science and education, and mythical cartoons, and provides a theoretical basis for the creation of VR cartoon creation paradigms, continue to promote the development of VR animation [3].

1. VR TECHNOLOGY AND SCENARIO NARRATIVE

1.1 VR Technology and Its Development

VR is the abbreviation of Virtual Reality in English, translated into Chinese as "virtual reality", is to use the computer to create a virtual world that can create and experience, so that people can experience all-round changes in vision, touch, smell, and body movements at the same time. To produce a sense of immersion, which essentially brings human consciousness into a virtual world [4]. VR was originally proposed by Jaron Lanier, the founder of the American VPL company in the early 1980s, and its specific connotation "was generated on a computer by comprehensively utilizing computer graphics systems and various interface devices such as reality and control. The technology that provides immersion in an interactive three-dimensional environment technology has become one of the most popular technologies today due to its multi-perception, immersion, interactivity, and autonomy. Judging from the current development of VR technology, the experience that VR can provide also needs some auxiliary equipment, and the recognition level of the environment is not particularly high, which needs to be further developed and improved. Compared with

developed countries, my country's VR technology research can be said to start late, and the development results are relatively backward. However, under the rapid development of advanced technologies such as the Internet and computers, my country also pays more attention to the development of VR technology. At present, VR technology has a wide range of applications in medicine, military, science and technology, business, architecture, entertainment, life, etc., and the development prospect should not be underestimated [5].

1.2 VR Scenario Narrative

Situations, that is, feelings and scenery, and situational narrative, that is, the use of environmental scenery and emotional expressions for narrative are the usual expressions of literature and art and are most often used in "storytelling" in novels and film works. With the development of science and technology nowadays, the presentation of games, animations, and movies in the narrative process has also begun to change, such as using VR for viewing, and MR technology, which integrates naked-eye reality and vitality, and brings game interaction into the Animation watching. At present, the combination of VR technology and cartoons has brought the interaction of viewers as a part of the narrative for the animation narrative and brought a more realistic viewing experience for the audience. This also encourages animation creators to continue to explore new narrative techniques to tell good stories, so that the audience can understand the connotation of the work. VR scenario narrative is the most commonly used narrative at present. Through the presentation of scenario narrative, it can not only fully display the characteristics and advantages of VR technology, but also facilitate understanding and perception. It can be described as complementary advantages and complement each other. VR scenario narrative techniques can be said to be an innovative development of traditional scenario narrative techniques. Through the immersive and interactive experience of VR, the functions of some of the narrative techniques in the animation are deepened and enhanced, but the problems that still arise cannot be ignored. Creators also need to continue to work hard, continue to try and innovate.

2. RESEARCH ON VR SCENARIO NARRATIVE TECHNIQUES IN CARTOONS OF HISTORY, SCIENCE, EDUCATION AND MYTHOLOGY

2.1 Current Status of VR Animation Development

Animation is a special form of film and television art. The key lies in the impact on people's senses. The traditional two-dimensional animation through the rapid continuous playback of still pictures, so that people produce "visual residue" to achieve a dynamic effect. However, with the continuous development of animation and the continuous application of new technologies in animation, the two-dimensional presentation method is increasingly unable to meet

the audience's sensory requirements. New three-dimensional animation came into being and brought people a more three-dimensional sensory experience. The combination of VR technology and animation, and the continuous use of all aspects of animation production, make the development path of animation more abundant and more technological sense. Throughout the application of VR technology in cartoons, it is not difficult to find that most of them are used in documentary cartoons of history, science, education and mythology, such as the VR animation of the historical scene of the 1916 Irish Republican struggle for independence launched by the US BBC company. The documentary "Easter Uprising: Voices of Protesters"; the VR animated documentary "1943: Berlin Blitz" about a "World War II" air raid, etc. Through VR's full-view and wrap-around technology, it is possible to realize the true display of human history or science and education myths in a virtual way, creating an immersive experience. However, it is undeniable that there are still some problems. First of all, many historical, scientific, educational, and mythical cartoons display content in an intuitive scene display, without specific scene narrative, lack of in-depth exploration of the coherence of the event, works not full and deep enough. Secondly, the content of animation works is too singular, lacking in story and artistry. Finally, the animation language of most works is stylized, especially for history, science and education cartoons. The most important role is to show historical facts and teach people scientific education knowledge to enrich people's spiritual life. VR animation does this in this regard. Is not enough. Of course, this is affected by the limitations of current VR technology and the difficulty of making works. I believe that with the continuous development and innovation of technology, it will definitely be solved to produce higher-quality VR animation works.

Therefore, in view of the above-mentioned VR technology's problems in scene narrative and the development status of VR animation, this article attempts to further apply and innovate the application of scene narrative techniques supported by VR technology in the creation of historical, scientific, educational, and mythical cartoons Research.

2.2 Application of VR Scenario Narrative Techniques in Cartoons of History, Science, Education and Mythology

The biggest difference between historical and scientific cartoons and general cartoons is that it presents an objective world of reality to the audience through documentary nature, and perceives the objective existence of nature and history through further deduction. Based on these characteristics of history, science, education, and mythical cartoons, as well as the unique technical requirements and artistic expression characteristics of VR, VR scene narrative techniques can be used to analyze the scene display and video narrative of such cartoons.

2.2.1 Optimizing the experience through scenarios

The scene display in movies and animations refers to the way of expressing content through fixed scenes and single-lens screens. The application in history, mythology, science and education animation is mainly used to display historical scenes, shape historical characters and demonstrate or verify the scientific principles of demonstration. This kind of animation is relatively simple in content, mostly long-lens narrative, which is more common in traditional film and television expressions, and it is easy to express. However, the most important feature of VR is immersion and interactivity, which lies in the interaction with the audience. Such a single long shot appears too dull in VR animation, affecting the viewing effect. Based on this, this problem can be solved through scenario presentation and the experience can be optimized. On the one hand, for historical and educational animations, effective treatment of the story on the basis of respecting objective facts can be more suitable for the effect of VR full-view display. In particular, the content displayed on the two-dimensional plane can be reasonably split and constructed according to primary and secondary, time sequence, logical relationship, etc., to create conditions for the interaction with the audience visually. On the other hand, by considering the special needs of VR animation, using the basic techniques of scene scheduling to make the necessary design of the video content, especially the characters in the animation, by arranging the activities of the characters, the picture has a sense of depth, more artistic and Appreciation, especially in the relatively simple scenes of history, science and education, the picture will have more tension. In short, in the history, science, education, and mythical cartoons, the construction of the scene display needs to be based on the specific content of the theme, using VR technology for specific planning and design, to ensure that each perspective is fully used in the full field of view of VR, and better use of VR Realistic audiovisual and interactive effects.

2.2.2 Enhance interactive effects through image narrative

The video narrative in VR cartoons is not for the purpose of complex and tortuous storytelling. The emphasis is on emphasizing the things themselves and the development process of things. This is especially applicable to the animations of history, science, education and mythology. Therefore, the video narrative technique will not be weakened to a large extent, so the content expression of VR animation can be enriched by enhancing the video narrative. By strengthening the narrative content, on the one hand, the humanity of VR animation can be improved. This is the essential content that historical animation or mythological animation needs to express. On the other hand, it can improve the reproduction of the natural environment, which is one of the contents that

science and education animation needs to present. In fact, in any type of animation, it is impossible for people to be isolated from nature. The use of influence narrative in the display of nature can present an objective nature, highlight a specific historical background, and enhance the audience's sense of the times. The most important feature that distinguishes VR animation from general animation is interactivity, which is crucial to the construction of narrative. In VR animation, to achieve good interaction with the audience, it is necessary to highlight the focus, smooth narrative, and effective communication Information, through the rational design of the interactive mechanism, can enable the audience to accurately understand the picture information. And this kind of interaction should be built on the implicit basis without affecting the audience's perception, and should not be too blunt and straightforward, so that the audience becomes a witness or even a participant in history. This greatly enhances the audience's sense of immersion experience, and can better feel the event, empathize, and trigger thinking.

At present, VR animation is still in the development stage, many mature works have not been created, many are constantly trying, and the research on VR animation is also rare. However, VR technology is the future development trend. VR animation, as a new type of animation expression, has a very broad development space and future. Through the analysis of the current history, science, education, and mythology VR animation, we need to constantly innovate narrative techniques and improve the creation paradigm of VR animation. However, animation creators must always bear in mind that the content of animation and the values and emotions they want to convey are the final criteria for measuring the quality of an animation.

ACKNOWLEDGMENT

The research results of "research and practice of 'double-engine' animation teaching integrating and inheriting VR animation digital interaction and folk art" of 2018 higher education teaching reform project of GUANG DONG province. Project Number: JG18010

REFERENCES

- [1]Shi Licheng, Liu Yidong, "Application of VR scenario narrative techniques in historical, scientific and educational animated documentaries," China TV, 2019(05): 82-88.
- [2]Xu Dan, "The development prospect of the combination of animation and VR technology," Journal of Jiamusi Vocational College, 2017(02): 418-419.
- [3]Tian Feng, "Theoretical research based on three-dimensional animation and virtual reality technology," Electronic World, 2015 (15): 148-149.
- [4]Wang Jiping, "Application of Virtual Reality

Technology in 3D Animation Production,” Digital Technology and Application, 2016(9): 244-244.
[5]Zhang Haihong, “The exploration of the combined

technology of 3D animation production and virtual reality,” Computer Knowledge and Technology, 2016, 12(3X): 249-250.

Application Of Model-based Reinforcement Learning in Adaptive Software System Planning

Yunlin Fu¹, Shusheng Liu², Zhiyu Hu³

¹Marine Engineering College, Dalian Maritime University, Dalian, 116026, Liaoning, China

²School of Computer Science and Information Engineering, Hefei University of Technology, Hefei, 230009, Anhui, China

³Information Science and Technology College, Dalian Maritime University, Dalian, 116026, Liaoning, China

Abstract: Strategy-based adaptive learning is one of the topics of interest in the adaptive software research community. The current research results in this field have proposed the term policy evolution to focus on solving the impact of environmental uncertainty on adaptive decision-making. These work adopt improved methods of reinforcement learning (RL) to continuously optimize the behavior of the system at run time. However, there are still some original problems in the current research, especially arbitrary exploration-exploration trade-offs and random exploration, which may lead to slow learning speed in special cases weak decision-making ability. Using model-free methods, these jobs cannot utilize the essential and rich underlying system knowledge in software engineering to enhance their learning. In this article, we introduce the advantages of model-based RL. By using engineering knowledge, system maintenance and environment interaction model, and predict the consequences of its behavior to improve and ensure system performance. We also discussed engineering issues and proposed a process of building adaptive software using model-based RL, applications that make strategy evolution closer to the real world.

Keywords: Strategy evolution; Reinforcement learning; Bayesian inference; Model-based RL

1. INTRODUCTION

In recent years, the adaptability of software systems has become more and more important because the dynamic operating environment and changes in user requirements have increased management and maintenance costs. Many studies in this field have been widely accepted by IBM as MAPE-K as engineering adaptive software. The reference architecture blueprint of the system (SAS) [1]. MAPE-K combines some core knowledge and includes a control loop for monitoring, analyzing, planning and executing the managed system [2]. One of the most interesting and challenging tasks in MAPE-K is planning. In planning, the system infers context information and uses its knowledge to make appropriate adaptation decisions [3].

2. MODEL-BASED REINFORCEMENT LEARNING

In the field of artificial intelligence, reinforcement learning has been widely accepted as a successful technology through interactive learning. It does not have a clear teacher: an agent independently tries to optimize its behavior in an operating environment with several sources of uncertainty. In order to pursue similar properties, recent research on adaptive software systems has adopted reinforcement learning techniques and achieved remarkable success. Unfortunately, RL often shows extremely slow learning speed when solving complex problems. As mentioned in Section2, the current work on the adoption of RL in the adaptive field is still very primitive, resulting in unrealistic performance. A continuing challenge in machine learning is to develop a learning method that shares the advantages of RL, but learn in a smarter way. In this section, we introduce a method to extend the function of the RL algorithm, called model-based reinforcement learning. As shown in Figure1, typical model-based reinforcement learning can be decomposed into two parallel processes: (a) estimate the model of the underlying system; (b) determine the best behavior based on the estimated model.

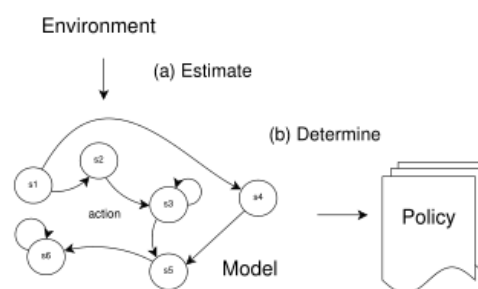


Figure 1 The principle behind model-based two-stage reinforcement learning

3. MODEL-BASED DERIVATION STRATEGY

A common technique for deriving strategies by model is to use dynamic programming to approximate the Bellman equation to find the optimal value function in the belief state. Online algorithms try to approximate Bayesian optimal actions by reasoning about current beliefs, which often leads to short-sighted action selection strategies. Early approximate online RL

algorithms are based on complete information value (VPI) criteria for action selection. It involves in the distribution of the best q-values of MDP is estimated with the support of current beliefs, and then these Q-values are used to calculate the expected "gain" of switching from one action to another. We can use the distribution on the model $P(\theta)$ to sample model and calculate the optimal Q value for each model instead of establishing an explicit distribution on the q value. This produces a sample of Q values that approximates the potential distribution on the Q value.

4. ONLINE PLANNING IN SAS

Reinforcement learning problems are designed to solve the problem of learning from interaction to achieve a certain goal. Specifically, the agent interacts with the environment in a series of time steps. At each time step, the agent observes the state of the environment, and on this basis choose the operation. In the next step, as a result of its operation, the agent receives a digital reward and transitions to a new state. The planning in the software system can be expressed as the interaction between the agent and the environment, as shown in Figure 2. In the interaction model, the software system plays the role of an agent. The system monitors the current state of the environment through its sensors. It selects actions and evaluates feedback rewards based on certain experience or knowledge (i.e., policies). Rewards in SAS usually pass various senses in the form of utility functions factor measurement to evaluate.

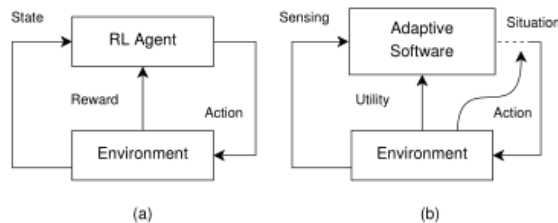


Figure 2(a) System-environment interaction differences between RL and (b) SAS problem settings. Determining the state and action set is the basic process of designing an adaptive software system for online planning. In the early stages of the development process, analysts find and analyze user requirements to obtain the system goals and operating scenarios. In this field of requirements engineering, there are already a lot of work provides guidance. Rolland et al., as shown in Figure 3, describe the process of representing and analyzing scenarios to discover system states, actions, and parameters. State is usually a combination of important conditions of the system, and actions will cause the system to the function or reconfiguration process of the state transition from one state to another state. Finally, the situation is the event that triggers the situation and requires the agent to adapt. After this step, we can obtain the state transition model without any prior knowledge preliminary version.

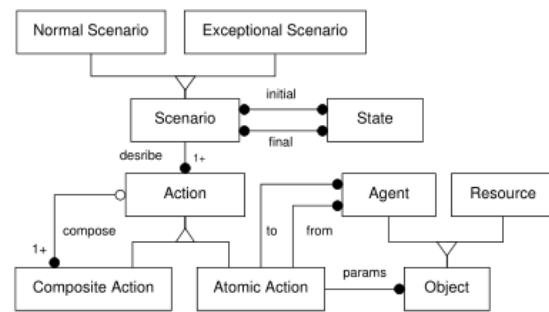


Figure 3. Scene structure, which describes its state, actions and parameters

5. CASE STUDY

To illustrate the above engineering process and verify the performance of the proposed learning method, in this section, we consider a case study inspired by recent technological trends: cloud computing. Virtualization through computing resources (CPU capability, ram, hard disk storage), cloud server can provide different service packages according to the needs of customers. In recent years, by reducing several costs on the client side (initial deployment, hardware maintenance, software licensing, etc.), it has proved to be an effective solution. Let us in consider a case here, a financial company wants to use cloud services to deploy its website. The website will run in two modes: the graphics mode provides more information and consumes more resources than the text mode. The goal is to provide the fastest speed customers provide real-time information on the market. In addition, as the dynamic nature of cloud resources, they also want to minimize leased resources when they are not needed, thereby reducing the cost of paying to cloud providers.

Other factors will also affect the rewards earned, including whether the operation mode is graphical (more inclined) or text; resource usage is small (more inclined) or large. After this step, we can get as shown in Figure 4, the initial version of the state-action transition model. The next step is to model and discover uncertainty. This is a domain-specific process that requires expert analysis. Here, for simplicity, we only build on an uncertainty that affects the system mode: availability of cloud resources. Due to limited resources, it may happen that the cloud provider cannot provide a sufficient amount of requested resources according to customer needs, with a probability of 2%, resulting in delays or unexpected state transitions of the underlying system. Deterministic mapping to system actions, we found that the affected actions are: add more resources, therefore, we assign a trust distribution on each state transition caused by the action. Similarly, for simplicity, we ignore the internal uncertainty of the system is considered, and other transitions with a probability of 1.0 are set to 1.0.

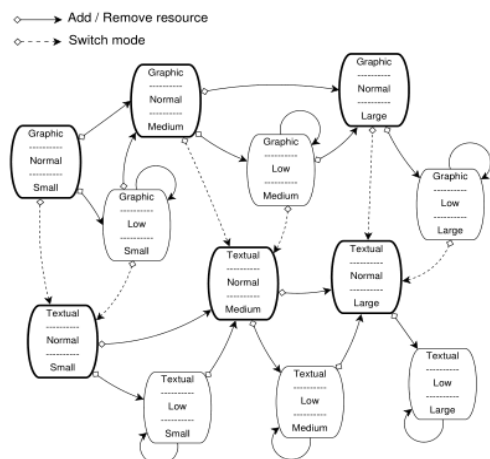


Figure 4 Case study scenario of cloud-based adaptive Web server

6. CONCLUSION

The development of software-assisted technology has achieved great success today. Building intelligent and reliable systems is becoming more and more important. Especially in adaptive software, reliability is the most basic goal. Recent studies have proved that Agents want to act competently in the real world environment, it is necessary to clearly express the knowledge of predicting the consequences of actions.

This article (1) analyzes the limitations of the current research on adaptive software strategy evolution, (2) introduces the advantages of model-based reinforcement learning, (3) The engineering process of using this technology to build an adaptive software strategy evolution model is proposed.

Case studies and experimental results prove that using the model-based RL method and providing knowledge (a priori model), the adaptive software system can obtain higher and more stable performance than previous work.

REFERENCES

- [1]E.D. Nitto, C. Ghezzi, A. Metzger, M. Papazoglou, K. Pohl, A journey to highlydynamic, self-adaptive service-based applications. *Automated Software Engineering*, 15(3-4): 313-341, 2008.
- [2]M. Salehie, L. Tahvildari, Self-adaptivesoftware: Landscape and research challenges. *ACM Transactions on Autonomous and Adaptive System*, 4(2), 2009.
- [3]N. Khakpour, R. Khosravi, M. Sirjani, S. Jalili, Formal analysis of policy-based self-adaptive systems. *SAC 10 Proceedings of the 2010 ACM Symposium on Applied Computing*, 2536-2543, 2010.

The Teaching Design and Teaching Effect of SPOC in Colleges and Universities in China

Yiran Han

School of Communication, Tianjin Foreign Studies University, Tianjin, 300204, China

Abstract: The research aims to explore the teaching design and teaching effects of blended learning in China's higher education system from the perspective of students and teachers. The survey investigated the five SPOC (small private online courses) opened by Tsinghua University in the spring semester of 2016-2017 Teaching design and teaching effect. The method of collecting data includes distributing the Chinese version of the SEEQ questionnaire to students, and interviewing 1 teacher and 4 teaching assistants. The results show that: (1) The final grades of all courses include online participation and grades, face-to-face learning and grades. The composition of homework and exams. However, different courses have different weights for each part: the scores of exams in science courses are more weighted than those in liberal arts or history courses. (2) The shorter the offline discussion time, the online discussion of participation the higher; the students are more satisfied when the lecturer actively participates in the discussion. (3) Generally speaking, students have higher satisfaction with learning value, teacher enthusiasm, organization and breadth of coverage.

Keywords: SPOC; Mixed learning model; Teaching design; Teaching effectiveness

1. INTRODUCTION

Blended learning is a new learning method based on information and communication technology (ICT), which has received great attention in China in recent years. Blended learning combines the advantages of traditional face-to-face learning and e-learning [1]. It allows teachers to lead and inspire and control the teaching process, and enable students to maintain a positive and innovative attitude in the learning process [2]. In mixed learning, teachers can use a variety of teaching designs and teaching methods, which can be flexible according to the aspects that teachers want students to pay attention to choice: The curriculum helps develop students' basic abilities (memory and understanding), while group discussions and seminars promote students' advanced abilities (application, assessment, analysis, and creativity). At present, there are many studies on the effectiveness of mixed learning teaching. SPOC is a MOOC version used locally for students at school. However, China started late in MOOC, and SPOC allocates learning time between online learning and offline courses. There is almost no guidance [3].

2. EXPERIMENTAL METHODS

In order to investigate the teaching design and teaching effect of the school's SPOC, this study selected the following 5 classes from the 25 SPOCs of the school in the spring semester of 2016: East and West art courses (art courses), Chinese modern history courses (history courses), computer the introductory science course (cs course), the introductory physics course (physics course) and the ergonomics course (ergonomics course). The liberal arts, history, cs and physics courses are all bachelor degree courses, which are based on the number of students in each class selected (more than 100 students enrolled in liberal arts courses and history courses, respectively, and less than 50 students enrolled in these liberal arts courses and physics courses, respectively). In addition, this study selected a graduate course in ergonomics and other courses are compared. The research is conducted in two stages: interview and survey.

3. EXPERIMENTAL RESULTS

3.1 Interview Results

Through in-depth interviews with teachers and teaching assistants in five courses, we discovered several patterns of SPOC. The teaching design of the offline learning link. The interview found that different courses have different contents and forms in the offline courses. Physics, CS and art courses are only discussed in the offline courses, while the history courses and ergonomics course combines the course with discussion. In addition, the history course also conducts offline learning in the form of lectures, and invites experts in related fields to share their views. In terms of discussion, the five courses have two forms discussion: The discussion of the physics course includes students discussing the answer to a specific question in the coursework, and then the time to complete the individual work; while in the other four courses, the assistant church leads the discussion on the predetermined theme, and then each group and discussion of the content of the statement.

Discussion of time allocation and group size. The discussion of history, art and CS courses lasts for two sessions (about 90 minutes), the discussion of physics courses lasts for 3 sessions (about 135 minutes), and the discussion of ergonomics courses consists of one class and the composition of a discussion. In order to ensure participation in the discussion, the number of groups in all courses is always maintained at about 4-6 students, which is consistent with Kanchanachaya's research results.

Participation. In SPOC, offline discussions are usually dominated by teachers or teaching assistants, and participation is high. The “online+offline” teaching method further stimulates students’ initiative in learning. The participation of online learning is diverse of courses with relatively little offline discussion time, such as art classes, history classes, and ergonomics courses, have a higher participation in online discussions. The student group of art courses is particularly active, because in special online courses, two teachers and nine teaching assistants will have real-time online discussions, resulting in a high participation rate. On the other hand, weekly offline courses (physics and CS courses) have relatively low participation rates in online discussions.

3.2 Survey Results

Topic information. The questionnaire was distributed to the selected five classes, and a total of 100 questionnaires were recovered, including 71 history lessons (630 students), 12 ergonomic courses (17 students), and 8 physics courses (in 40 school students), 5 cs courses (19 students), 4 arts courses.

Questionnaire survey analysis. Cronbach’s α was used to perform reliability analysis on the questionnaire. The internal consistency α was 0.961, indicating that the results were reliable and suitable for data analysis. Table 1 mean and standard deviation of SEEQ and discussion satisfaction

	History	Arts	CS	Physics	Ergonomics	Overall
Learning/value	4.4±0.5	3.56±1.4	4.2±0.9	4.2±0.4	4.3±0.5	4.3±0.6
Group interaction	4.2±0.6	4.6±0.9	3.9±1.0	4.3±0.5	4.1±0.9	4.2±0.7
Individual rapport	4.2±0.5	3.7±0.8	3.9±1.0	4.2±0.5	4.1±0.7	4.4±0.6

As shown in Table 1, the overall satisfaction of all five courses is high, and the average score of each dimension is above 4.1 points. The historical course has the highest “coverage” score (4.5±0.5), “group interaction” (4.2±0.6), “Personal Harmony” (4.2±0.6) and “Exam/Scoring and Assignment/Reading” (4.2±0.5). There is little fluctuation. The scores of art courses in all six dimensions are flat. The “learning/value” scores of the cs courses and ergonomics courses are higher (4.2±0.9 and 4.3±0.5, respectively), while the physics courses have “group interaction” (4.3±0.5) and “teacher motivation and organization” (4.3±0.5) higher score.

Table 2 Online discussion post frequency

Frequency	History	Arts	CS	Physics	Ergonomics
0-5 times	60	0	1	7	0
6-10 times	9	1	1	1	11
11-15 times	1	2	1	0	1
16-20 times	1	1	1	0	0
21 times or more	0	0	1	0	0
Total	71	4	5	8	12

As shown in Table 2, in online discussions, liberal arts students have published 11 to 15 discussions due to intermittent offline classes and immediate online discussions; history classes have a large number of students and the total number of replies; physics

courses are weekly. There was an offline discussion, and the online discussion was relatively inactive; in the end, the online discussion of ergonomics was more as an assignment submission and topic presentation area, and each student had about 6 to 10 posts. Weekly offline discussion, online forum online discussion participation is relatively low. However, 4 students of the CS course are active on the online forum (more than 6 times), which is different from what the teaching assistant said. This shows the frequency of posting, it is related to the overall organization of the course and the function of the discussion area.

4. CONCLUSION

In terms of students’ evaluation of each course, the history course adopts the teaching mode of “online learning+offline discussion+teaching”, with the highest score in the “content breadth” dimension (average 4.5 points). Students think that there are various classroom format allows them to broaden their knowledge. In contrast, the ergonomics curriculum follows a strict “1+1” teaching model (1 lesson, 1 lesson), in the “content breadth”, “learning/value” The scores of “and” teacher enthusiasm and organization “are higher (4.2, 4.3, and 4.2 points, respectively). The physics class scored higher in” Lecturer Enthusiasm and Organization “and” Group Interaction “(4.3 points, 4.3 Points), probably because the teacher participated in every offline discussion, encouraged students to express their opinions, and responded to the students in a timely manner.

Therefore, for art or history courses, more discussion time and percentage should be allocated in the final grade, so that teachers and students can have more interaction to ensure that the course content is fully understood. For science introductory courses, the discussion is wired. However, courses that do not require an exam may result in a less comprehensive understanding of the content of the course, so it may be possible to include offline lectures to strengthen the online course. Finally, while considering a form of discussion (no offline teaching), the test scores may be necessary to allocate a higher percentage to the final grade to ensure active participation and teaching efficiency.

REFERENCES

- [1]Qiao Chan, Wang Yanhua, “Analysis of SPOC-based general education model for innovation and entrepreneurship,” Private Higher Education Research, 2019, 16(04): 93-96.
- [2]Zhou Qian, Dong Wang, Ping Huang, “On the effective implementation of “SPOC+Flip Class” teaching mode in college football teaching,” Western Journal, 2019(24): 78-80.
- [3]Zhang Nannan, Chai Rebing, “Research on SPOC Mixed Teaching Model,” Journal of Adult Education College of Hebei University, 2019, 21(04): 90-94.

Research on Fault Diagnosis and Analysis of SF6 Gas-insulated Transformers

Jun Zhou¹, Zhi Cao¹, Xitu Hao², Yunbiao Yu¹

¹Shenzhen power supply planning and Design Institute Co., Ltd, Shenzhen, 518054, Guangdong, China

²Shenzhen Power Supply Bureau Co., Ltd, Shenzhen, 518000, Guangdong, China

Abstract: SF6 gas-insulated transformers (GIT) provide good compatibility and safety in dense urban environments, and are valuable in cities. It is earlier to research and use this kind of transformer in China. As it is gradually popularized and applied in the market, it is worthy of affirmation to study its faults. SF6 is chosen as the insulating medium in SF6 GIT. After a fault occurs inside the equipment, certain impurities will appear. In this study, the author analyzes fault diagnosis and analysis, and analyzes the mechanism and detection methods of faults of SF6 gas insulation, and describes the actual fault diagnosis cases.

Keywords: SF6; GIT; Fault diagnosis; Fault analysis

1. INTRODUCTION

In the actual operation of the transformer, the fault will occur due to overheating, partial discharge, and arc. SF6 GIT has certain differences from oil-immersed transformer. It cannot judge the fault by CH4, C2H6, H2, C2H2 and other characteristic gases. It is valuable to find new gases according to the characteristics of characteristic gases. In fact, the application time of SF6 GIT is not long, and the research is not perfect enough, so it is of practical significance to carry out fault diagnosis of SF6 GIT [1].

2. FAULT MECHANISM AND DETECTION MEANS OF SF6 GIT

The biggest feature of SF6 gas transformer is non-flammable, insulation and safety, which is in line with the needs of the development of modern society. In the future, SF6 gas transformer is also worthy of further promotion and use. After combining such gas-insulated switchgear with such transformers, they can be effectively combined into SF6 gas-insulated substations with high safety and reliability. Transformers occupy an important position in urban development around the world, and it is also a general trend to develop SF6 GIT in the future [2].

In this paper, SF6 GIT is analyzed synthetically. SF6 gas is divided into arc discharge, spark discharge and partial discharge. From the energy consumption analysis of the discharge process, the arc discharge with the largest energy consumption is caused by the short circuit of the equipment circuit, and the spark discharge with the second energy consumption is the capacitance discharge in a short time. There will be obvious differences between the decomposition products generated and the decomposition products of

the arc discharge. And the partial discharge with the smallest energy consumption will gradually accumulate the decomposition products due to the long-term partial discharge. In addition, SF6 decomposition will be formed due to overheating. Generally speaking, the decomposition of SF6 will form SO2F2 and SOF2 due to oxidation. In the arc decomposition or thermal decomposition, SOF2 is the main product, while the content of spark or partial discharge is higher, and the content of arc is relatively lower. Therefore, it is helpful for the discharge property of internal fault to compare the content of spark or partial discharge. The decomposition, oxidation and reaction of SF6 with water are easy to generate SO2. Thermal decomposition is the most common fault, and the metal overheating causes the fault. As a result, the reaction of SOF2 with water generates SO2, and there will be a small amount of CF4 itself. Compared with the original value, if CF4 increases significantly, it indicates that the discharge failure may be related to the solid insulating material. HF will be formed by sulfur fluoride and water, and is relatively unstable. And it indicates internal failure in the equipment if HF is detected. CO and CO2 can be detected all the time due to the high temperature of the transformer in normal operation. However, if the detected content is significantly higher than the normal content, there may be internal fault and it is related to the solid insulation material [3].

In terms of qualitative and quantitative analysis methods, gas chromatography and detection tube technology are common. The content of SO2, SO2F2, SOF2, SF6, CF4 and air can be detected by using suitable chromatographic column with TCD detector and FPD detector in gas chromatography. The content of CO can also be detected by TCD detector and suitable column. In the field rapid detection, HF, CO and SO2 can be detected by the detection tube technology. The detection methods are routine and the results can be obtained quickly. However, it is worth noting that gas chromatography detection needs to be equipped with a certain standard concentration of impurity gas in order to accurately, qualitatively and quantitatively determine the impurities existing in SF6 decomposition. It needs to be based on a large number of data, and the standards of analysis and judgment also need more standardized results. And the accumulation of early data needs more time [4].

3. ACTUAL FAULT DIAGNOSIS CASE OF SF6

GIT

SF6 gas will have characteristic gas after its failure, and its content can be detected to accurately analyze the condition of the transformer in time, followed by an electrical test, a comprehensive analysis of the results, and then a more reliable report for transformer failure can be obtained combined with the transformer's own background information, and the insulation of the transformer, the type and location of the fault, and reasonable suggestions can be specified in the report. The author carried out the protection work of SF6 GIT in 2019. The weather was fine on the day of the accident and there were no thunderstorms. The transformer was operated two years ago, and a rated voltage was 110 kV and a rated capacity was 31500 kV A. GNAN / GDAN was selected for cooling.

First of all, SF6 gas composition was analyzed. Immediately after the accident, the main transformer gas was detected, and the components CF4 and HF were included. Combined with the previous test data, the content of CO and CO2 increased significantly in addition to the two new types of gas. According to the comprehensive analysis, the newly added HF represents the internal fault of the equipment, and the newly added CF4 represents the discharge fault. The solid insulation may be implicated, which needs to be further confirmed. The increased levels of CO and CO2 further indicate that solid insulation materials may be implicated. However, the overall new content and the increased content are not high, and SOF2 is not detected, so the failure may not be serious. And then, analysis of electrical test was conducted. According to the results of DC resistance test, the no-load current A is 0.248A (200V), B is 10A (80V), and C is 0.249A (200V). The transformation ratio A of 110Kv/10.5kV is 6.0423, B is 5.9259, and C is 6.0423. In addition, internal inspection was conducted. The gas inside the transformer was recovered, processed in time, and the transformer was operated again for internal inspection. During the inspection, it

was analyzed from the sense of smell: a peculiar smell was formed inside the transformer, which was the decomposition of SF6; the observation of phase B high-voltage winding shows that there are carbon black particles near the upper electrostatic plate, and the continuous observation shows that there are obvious carbon black particles attached to the low-voltage high-voltage insulating cylinder. It directly proves that the early diagnosis is the same as the conclusion of the discharge fault formed by the solid insulation material.

4. CONCLUSION

Inspired by the characteristic gas, the fault diagnosis and analysis of SF6 GIT can also start with the characteristic gas. Different faults and different environments will cause a series of reactions after SF6 gas decomposes, and the formed characteristic gas can effectively guide the diagnosis of internal faults. The detection method is also relatively simple, it needs not to cut off the power during the sampling process, and the operation condition of the transformer is obtained through real-time monitoring, which provides the most solid foundation for the safe and reliable operation of the power grid equipment.

REFERENCES

- [1]Zhou Anchun, Gao Liying, Ji Xiaotong, "Fault Analysis and Field Repair of Current Induced Thermal Discharge in Valve Side Bushing of Dry Type SF6 Gas-insulated Converter Transformer," Grid Technology, 2018, 042(005): 1401-1409.
- [2]Cao Wenbin, Wang Xianpei, Tian Meng, "Fault Diagnosis of SF6 Transformer Based on KELM and AT," Transformer, 2018, 055(012): 72-76.
- [3]Sun Xuefeng, Gao Peng, Li Fei, "Application of Online Monitoring Device in Fault Diagnosis of Transformer," Construction Engineering Technology and Design, 2018, 000(024): 3739.
- [4]Tong Li, "Application and Research Status of SF-6 Gas-insulated Bushing of Converter Transformer," Power Equipment Management, 2019 (5).

Research on EDP Problems

Meng Xiao

School of Mathematics and Big Data, Chongqing University of Science and Technology, Chongqing, 401331, China

Abstract: Today's social and environmental problems are becoming more and more serious, leading to rising sea levels and putting many island nations in danger of disappearing, eventually resulting in large-scale displacement of people (EDPs) due to environmental changes. Therefore, countries and the United Nations need to work together to further explore effective solutions to EDP issues. Here we searched and processed the sea level data and population data of relevant countries on the ECMWF website and the national official website. By the FBPROPHET model, it was predicted that sea level changes in the future, subsequently, combining the change of sea level and the GM (1,1) model, the future EDP population were predicted (For example, in 2020, the sea level in Maldives is expected to rise by 0.2438m, and the number of EDPs will reach 46,702).

Keywords: Rising sea levels; EDP; Environmental changes

1. INTRODUCTION

With the rise of sea levels caused by natural disasters and environmental damage, many island nations are in danger of disappearing completely, resulting in large-scale displacement of people due to environmental changes [1]. These people who are displaced by environmental changes (EDP) not only need to be relocated, but they also risk losing their unique culture, language and lifestyle [2]. We should address the issue of environmentally displaced persons from a long-term perspective, and the United Nations should know clearly when, where and how to participate in the growing EDP problem. Therefore, how to further explore an effective solution mechanism for the problem of environmentally displaced persons has extremely important practical significance for social development [3].

2. PREDICT THE AMOUNT OF EDP AND CULTURAL RISKS

2.1 Forecast of Rising Sea Level

First, we checked the global sea level data on the ECMWF website, preprocessed the data with Python (Code 1), and established the FBPROPHET time series prediction model to predict sea level height, which is

$$y(t) = g(t) + s(t) + \varepsilon_t \quad (1)$$

Then, use python (Code 2) to import the relevant data, and get the results shown in Figure 1, Figure 2:

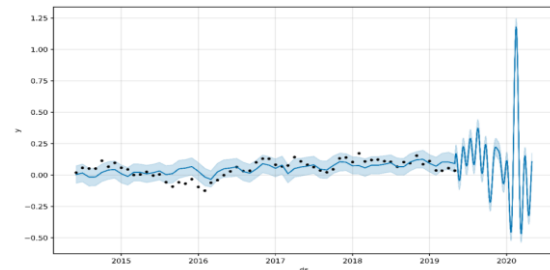


Figure 1 Abnormal changes in sea level

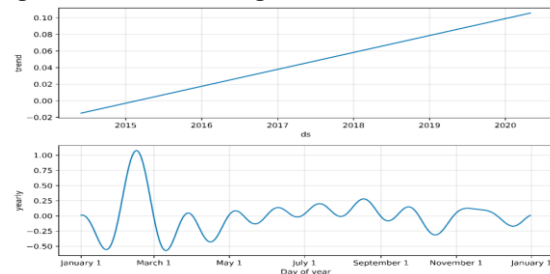


Figure 2 Trend of sea level altitude change

From these two graphs, we can see that the abnormal phenomenon of sea level height is on the rise, and the fluctuation is getting larger and larger. This phenomenon will lead to the continuous increase of sea level height, which will flood some island families and make their people homeless (Figure 1, Figure 2).

2.2 EDP Population Forecast

Building a grey prediction mode:

We assume that $x^{(0)} = (x^{(0)}(1), x^{(0)}(2), \dots, x^{(0)}(n))$ is a 10-element sequence of the number of EDP populations from 2010 to 2019. We can accumulate the data in each time in to get the accumulation sequence of $x^{(0)}$, that is

$$x^{(1)} = (x^{(1)}(1), x^{(1)}(2), \dots, x^{(1)}(n)) \quad (2)$$

Where $x^{(1)}(k) = \sum_{i=1}^k x^{(0)}(i) (k=1, 2, \dots, 10)$ we can newly

define the gray derivative of $x^{(1)}$ as

$$d(k) = x^{(0)}(k) = x^{(1)}(k) - x^{(1)}(k-1) \quad (3)$$

Let $z^{(1)}$ be the mean sequence of the sequence $x^{(1)}$:

$$z^{(1)}(k) = 0.5x^{(1)}(k) + 0.5x^{(1)}(k-1) (k=2, 3, \dots, n) \quad (4)$$

Then $z^{(1)} = (z^{(1)}(2), z^{(1)}(3), \dots, z^{(1)}(n))$

At this time, we define the gray differential equation model of as:

$$d(k) + az^{(1)}(k) = b \quad (5)$$

Call $x^{(0)}(k)$ as the gray derivative, is the development system, $z^{(1)}(k)$ is the whitening background value, and b is the amount of gray interaction. Substituting $k=2, 3, \dots, 10$ into the formula

$$\begin{cases} x^{(0)}(2) + az^{(1)}(2) = b, \\ x^{(0)}(3) + az^{(1)}(3) = b, \\ \dots\dots\dots \\ x^{(0)}(n) + az^{(1)}(n) = b, \end{cases} \quad (6)$$

We put

$$Y_N = (x^{(0)}(2), x^{(0)}(3), \dots, x^{(0)}(n))^T, u(a, b)^T, B = \begin{bmatrix} -z^{(1)}(2)1 \\ -z^{(1)}(3)1 \\ \vdots \\ -z^{(1)}(n)1 \end{bmatrix}$$

(7)

Y_N is called the data vector, B is the corresponding data matrix, and u is set as the parameter vector, then the GM (1,1) model can be represented by the matrix equation $Y_N = B \cdot u$.

For the parameter u , if $(B^T \cdot B)^{-1}$ exists we use the least squares method to find the parameter $\hat{u} = (\hat{a}, \hat{b})^T = (B^T \cdot B)^{-1} B^T Y_N$.

Which is specifically expressed as

$$a = \frac{CD - (n-1)E}{(n-1)F - C^2}, \hat{b} = \frac{DF - CE}{(n-1)F - C^2}$$

Among them, $C = \sum_{k=2}^n z^{(1)}(k), D = \sum_{k=2}^n x^{(0)}(k)$ (8)

$$E = \sum_{k=2}^n z^{(1)}(k)x^{(0)}(k), F = \sum_{k=2}^n (z^{(1)}(k))^2 \quad (9)$$

By consulting relevant information, we have made reasonable assumptions. From the beginning of 2020, the number of EDP population will be 10% of the total population of the country, and the sea level will rise. The annual increase in the number of EDP population as a percentage of the total population of the country is fixed. Value: 0.1 percent, which means that the number of EDPs in the country will account for 10.1 percent of the total number of people in the country in 2021, and so on. We will build the gray prediction model of EDP, and use MATLAB to write code (Code 3) to get the EDP population from 2010 to 2019. (Figure 3)

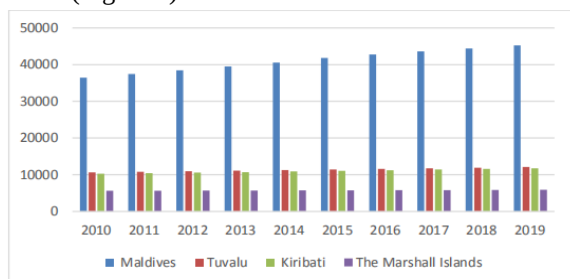


Figure 3 2010-2019 EDP population

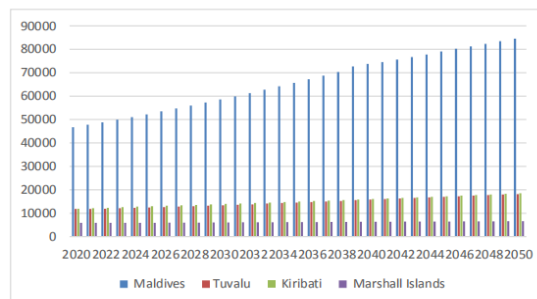


Figure 4 2020-2050 EDP population

And use the GM (1, 1) model to predict the number of EDP population from 2020 to 2050, such as (Figure 4)

2.3 Study the Impact of the State on Cultural Loss

2.3.1 Constructing a comparison matrix

When determining the weight of each indicator, the consistent matrix method is used, that is:

(1) Do not compare all factors together, but compare them in pairs.

(2) Relative scales are used for comparison to reduce the difficulty of comparing factors with different properties as much as possible and improve accuracy.

(3) Try to reduce the impact of decision makers' subjective factors on results based on the actual situation.

Suppose you want to compare the influence of n factors $C_1, \dots, C_n$ on the previous layer (such as the target layer). For any two factors C_i and C_j , use a_{ij} to express the ratio of the degree of influence of C_i and C_j on O , and measure a_{ij}

On a scale of $1 \rightarrow 9$. In this way, you can compare the matrix $A = (a_{ij})_{n \times n}$ in pairs, also known as the judgment matrix. Obviously

$$a_{ij} > 0, a_{ji} = \frac{1}{a_{ij}}.$$

2.3.2 Model solving

For the loss of cultural risk, we analyze the data in the data to obtain the judgment matrix of the middle layer factors on the highest layer as

$$A_1 = \begin{bmatrix} 1 & 1/4 & 4 & 3 & 3 \\ 2 & 1 & 7 & 5 & 5 \\ 1/4 & 1/7 & 1 & 1/2 & 1/3 \\ 1/3 & 1/5 & 2 & 1 & 1 \\ 1/3 & 1/5 & 3 & 1 & 1 \end{bmatrix}$$

It is obtained that $CI = 0.018$ and $CR = 0.0161$. The consistency can be passed, and the vector of the weight of the middle layer to the highest layer is obtained: $[0.2636, 0.4758, 0.0538, 0.0981, 0.1087]$. At the same time, according to the analysis of big data, the judgment matrix of Maldives in the indicator layer on the factors of the middle layer is:

$$X_1 = \begin{bmatrix} 1 & 2 & 5 & 3 \\ \frac{1}{2} & 1 & 2 & 1 \\ \frac{1}{5} & \frac{1}{2} & 1 & 2 \\ \frac{1}{3} & 1 & \frac{1}{2} & 1 \end{bmatrix}$$

Using the model, we built using MATLAB (Code 5), the results are $CI = 0.077$, $CR = 0.0865$, and the consistency can be passed to calculate the permutation weight vector of B1, B2, B3, and B4 to A1 as [0.4955, 0.2134, 0.1506, 0.1405].

Similarly, the permutation weight vector of B1, B2, B3, and B4 to A2, A3, and A4 can be calculated as [0.0736, 0.5495, 0.2476, 0.1293], [0.5288, 0.1718, 0.2186, 0.0808], [0.5189, 0.1943, 0.1500, 0.1368], [0.1770, 0.1444, 0.5448, 0.1338]. (For other judgment matrices, see Appendix Matrix)

Finally, according to the calculation formula in 3.3.4, the four regions (Maldives, Toulouse, Kiribati, and

Marshall Islands) at the scheme level are given the ranking weight of the highest level (culture loss) [0.264, 0.360, 0.244, 0.132].

REFERENCES

- [1] B. Moges, Wagena, D. Goering, A. S. Collick, E. Bock, D. R. Fuka, A. Buda, and Z. M. Easton, Comparison of Short-Term Streamflow Forecasting using Stochastic Time Series, Neural Networks, Process-Based, and Bayesian Models. Environmental Modelling and Software, 2020.
- [2] X. L. Liu, and R. Chen, Threshold factor models for high-dimensional time series. Journal of Econometrics, 2020.
- [3] J. W. Li, and D. D. Zhu, Construction and Forecast of China's Macroeconomic Index--Based on Grey System Theory. Time Finance, 2020 (06): 5-6.

Key Technology Design of LBS Application Based on Android Platform

Jie Yu

Zibo Vocational College, Zibo, Shandong, 255000, China

Abstract: This article designs and implements an LBS application based on the Android platform. This application is a light-weight application that provides many practical functions such as basic positioning, POI retrieval, Place details page, and route planning. Through a "chain" operation, the application can quickly provide POI suggestions based on the user's own location to meet user related needs. This article focuses on the key technical design of LBS application.

Keywords: LBS; Android; Map; POI

1. SYSTEM OVERVIEW

Most of the mature LBS applications currently running on the market are too complicated, and fast map services will become an indispensable requirement for people. This article is devoted to the research and construction of a light-weight application, focusing only on the most commonly used functions, searching for POI points in the surrounding environment that are helpful to users by positioning itself, and giving route planning and optional strategies [1]. Finally, a chain call mode is implemented, that is, the function is called from its own position as a starting point, and each module is a single entrance. When the route planning scheme module is called and the navigation route is drawn on the map, the call ends and the application completes a service and back to the starting point, at this time the user has successfully obtained some detailed information of the target location and surrounding environment, and know how to get there.

Mainly carry out the following business:

After entering the application from the start interface, Baidu Map is displayed and the initial positioning operation is performed.

The user can jump to the surrounding POI search by clicking on his position. For a certain POI point, he can query its detailed information, namely the Place details page. After that, you can navigate according to the selected route plan, and perform related functions according to the user's intention [2].

All operations of user business should be intuitive and easy to operate.

2. BAIDU LBS OPEN PLATFORM

The LBS open platform defines itself as an open and comprehensive service platform for developers. On the one hand, through the investigation and insights of the market environment, the professional LBS laboratory analyzes and obtains the most front-end user needs, integrates massive data resources, and simultaneously feeds back or pushes relevant data to developers in a timely manner. On the other hand, the LBS open platform has established a technical support service matrix, has a strong technical support team, and uses multiple channels to solve various technical problems that developers may encounter during the development process.

2.1 Position SDK

The positioning SDK is a set of Baidu LBS positioning service interfaces, focusing on hybrid positioning services [3]. The interface is free and open, but developers need to apply for their own keys. The key application only needs to be registered as a Baidu developer, and it can be easily obtained by using the form of "apk digital signature sha1 value +"; "+ package name" on the management platform. Developers can easily implement the positioning function by calling this SDK, and the positioning effect is accurate and efficient.

To use the positioning SDK, in addition to importing the locSDK.jar file and the corresponding version of liblocSDK.so, you must also set the AndroidManifest.xml configuration file in the project. First, declare the positioning service component.

```
<service android:
name="com.baidu.location.f" android:
enabled="true" android: process=":remote">
</service>
```

After that, there are related permissions added, the main permissions are as follows:

```

<!--This permission is used for network positioning-->
<uses-permission
android:name="android.permission.ACCESS_COARSE_LOCATION"></uses-permission>
<!--Used to read the current status of the phone-->
<uses-permission android:name="android.permission.READ_PHONE_STATE"></uses-permission>
<!--Internet access, network positioning requires Internet access-->
<uses-permission android:name="android.permission.INTERNET" /><!-- Used to access wifi network
information, wifi information will be used for network positioning-->
<uses-permission android:name="android.permission.ACCESS_WIFI_STATE"></uses-permission>
<!--This permission is used to obtain wifi access permission, wifi information will be used to locate the
network-->
<uses-permission android:name="android.permission.CHANGE_WIFI_STATE"></uses-permission>
<!--Obtain operator information to support the provision of interfaces related to operator information-->
<uses-permission
android:name="android.permission.ACCESS_NETWORK_STATE"></uses-permission>

```

2.2 Map SDK

Maps Android SDK is a set of program interface based on Android mobile devices and supports Android 2.1 and above. Developers can easily access Baidu map services and massive amounts of data by calling the SDK, so as to quickly develop map applications suitable for Android devices, and can build rich and interactive map applications. All services currently provided by the SDK are free of charge, and there is no limit to the number of times the interface can be used, but like the positioning SDK, you need to register as a Baidu developer and obtain the relevant Key.

The SDK provides a series of functional services, including:

- (1) Provide multiple map layer display and map operation functions, and support gesture operation.
- (2) Support the three major search functions in the surrounding area, area and city. You can use a certain point as the center, within a specified rectangular area, with a specified distance as the radius, and enter a keyword in a city for POI search.
- (3) Provide the ability to convert between geographic coordinates and addresses. The latitude and longitude information and actual geographic information can be converted.
- (4) Support route planning service, and route navigation can be carried out based on starting and ending location information and query strategies.
- (5) Support overlay layer. Layers include its own location layer, POI search result layer, route layer, public transportation layer, custom layer, etc., which can effectively meet the various needs of developers.
- (6) You can query and open the panorama.
- (7) Support Baidu official application for advanced line navigation.
- (8) Provide LBS cloud services. Developers use LBS cloud to store and share location data, and support

efficient retrieval.

3. KEY MODULE DESIGN

3.1 Data Storage Design

Because the system uses a "chain" structure and all function calls are based on its own location information, the correlation between modules also requires some parameters. These parameters need to be passed along with the jump between modules. Choose to use Bundle to transfer data or Shared Preferences to store data. Bundle can transfer a lot of data between two activities, but it cannot be persisted; Shared Preferences can be used to store light data, keep it durable, and can be read across activities [4].

3.1.1 Share preferences storage

Shared Preferences is a light-weight data storage method. Its essence is based on XML files to store key-value key - value data. Shared Preferences can usually be used to store configuration information and has persistent characteristics. Its storage location is in the "/ data / data / <package name> / shared _ prefs" directory of the phone. Shared Preferences itself can only obtain data and does not support storage and modification. Storage modification is achieved through the Editor object.

First get the Shared Preferences object according to the context, get the Editor object through the edit () method of the Shared Preferences object, then store the key-value key - value data through the Editor object to modify the Shared Preferences object, and finally submit the data through the commit () method.

3.1.2 Bundle storage

The Bundle object can save the application state. Before the Activity is suspended or destroyed, the Activity's on Save Instance State () method will be executed to save the state, which can be restored in on Create (Bundle) in the new Activity. Use Intent and Bundle to cooperate to pass some information between adjacent activities, including POI latitude

and longitude information, POI UID, etc., for use in the new Activity.

3.2 Positioning module design

The positioning layer uses a hybrid positioning method to obtain latitude and longitude information, reverse geocoding gives specific location information and gives zoom level, and positioning accuracy; the positioning layer provides an update location button, and the user can choose between positioning, tracking, and compass Switch quickly. At the same time, in the positioning module, users can quickly switch between street view and satellite view.

3.2.1 Design of peripheral POI search module

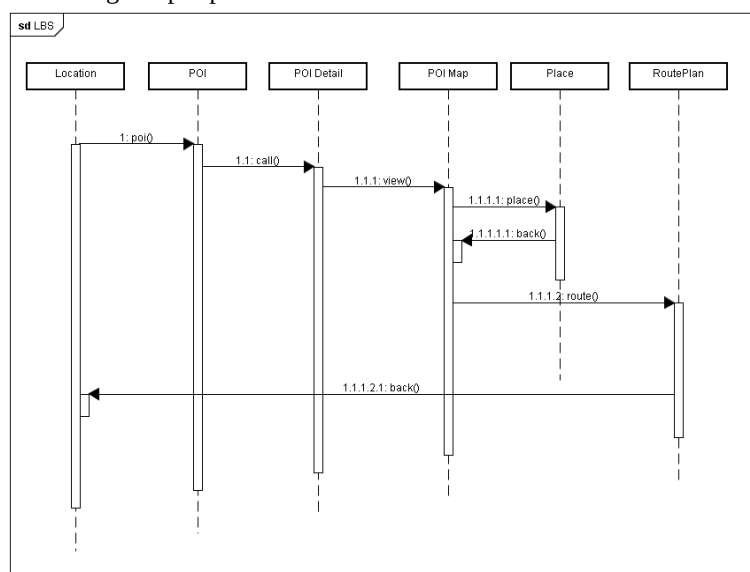


Figure 1 The overall timing diagram of the program

3.2.2 Design of offline map module

The offline map module can download and manage maps, provide offline support for any other modules that require map display, and can reduce a large amount of user traffic. Other modules will give priority to calling offline map resource display when requesting to display the map.

3.2.3 LBS chain call design

Each key module uses Bundle and Share Preferences to store parameters and related necessary information for linking. Basically, all the key modules are single-entry and single-exit design, seamlessly connected, and the entire activity chain ends in giving the line plan.

The LBS application includes several types of services that have the greatest user demand, and provides precise positioning, rich POI retrieval, expanded Place details page, clear route planning and other functional services. Compared with various

After jumping into the POI search Activity, first get the parameters from the Bundle object, display a list of commonly used POI types, support fuzzy search, according to the POI type selected by the user, get the detailed information of the surrounding POI types from the Baidu server, display and display in a list. The content includes the specific name and detailed address of the POI and the distance from its position, and supports a custom radius range. When the user clicks on an item, the POI point is marked on the map. The whole process is shown in the figure below Figure 1.

existing LBS applications, the application is more portable and is an application developed based on practical significance, which has certain market value and value-added potential.

REFERENCES

- [1]Y. Z. Zhuang, Design and implementation of mobile service framework based on LBS .Beijing University of Posts and Telecommunications, 2012.
- [2]J. Ji, Analysis of mobile phone map market in the first quarter of 2014. Sutu Research Institute, 2014.
- [3]R. Q. Chen, Design and Implementation of Electronic Map Service Software Based on Android Mobile Phone. University of Electronic Science and Technology of China, 2012.
- [4]Y. S. Zhai, Design and implementation of mobile phone map based on Android platform, Xidian University, 2012.

Enumeration Formulas for the Standard Young Tableaux of Approximate 4 and H Shapes

Lu Chen, Chuanjuan Sun

Department of Mathematics, Northeastern University, Shenyang, 110000, China

Abstract: This paper mainly studies the enumeration formulas of approximate 4-type and h-type chart. In the process of calculation, we mainly rely on the knowledge including the connection between the order statistics and the standard Young tableaux (SYT), the methods of multiple integral and combination identity. The following are the representations of the two types of SYT-type charts:

$$(n+2)^{m+p+1} \setminus (n^m) | \{(1,2)\} \setminus ((n+1)^p) | \{(m+2,1)\}$$

And

$$(n+2)^{m+p+1} \setminus ((n+1)^p) | \{(1,2)\} \setminus (n^m) | \{(m+2,2)\}$$

First, the shapes of the two SYT-type charts are analyzed and it is conjectured whether there is a certain relationship between the enumeration formulas of the two SYT-type charts. Then the results of two SYT-type charts are calculated to see if the relationship between them is consistent with hypothesis.

Keyword: Order statistics; Multiple integral; Standard young tableaux

1. INTRODUCTION

Young tableaux is a common chart in combinatorial mathematics. The standard Young tableaux can more concisely describe symmetric and general group representations and further study their properties, so it is an important topic in combinatorial representation. In recent years, many scholars have studied this field. For example, in [1-4], Ping. S calculated hollow type,

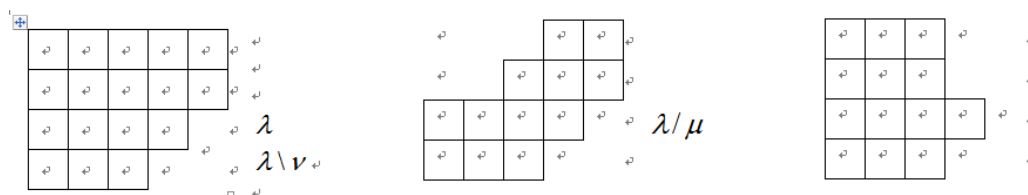
truncated SYT-type, $(n^m) \setminus (2)$ SYT-type and SYT-type with similar trapezoidal shape using nested order statistics.

Set that a positive integer n can be expressed as the sum of d integers, that is, the splitting of n . A splitting of any positive integer n is $\lambda = (\lambda_1, \lambda_2, \dots, \lambda_d)$, and $\lambda = \lambda_1 + \dots + \lambda_d, (d \geq 1)$, and the following conditions meet:

$\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_d, \lambda_i > 0, (1 \leq i \leq d)$, Then λ is called the d -splitting of positive integer n , and λ_i is called the distribution of the splitting.

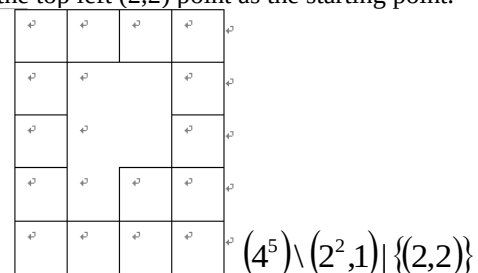
Ferrer's diagram is an important figure in the study of combinatorial counting. A simple explanation from the known definitions is to put a positive integer column $\{1, 2, \dots, |\lambda|\}$ in the square of the Ferrer's

diagram of type λ , and satisfy the strict increment of each row from left to right and each column from top to bottom of the filled number. Different shapes will be generated according to different placements, and thus corresponding permutation and combination problems will arise. When we represent the shape of a chart, "/" indicates deletion from upper left corner, "\" indicates deletion from upper right corner. For example: $\lambda = (5^2, 4, 3)$, $\mu = (3, 2)$, $\nu = (2^2)$, As shown in the following figure, you can see there are λ , λ/μ , $\lambda \setminus \nu$



The representation method can be more clearly understood by charts, for example, the truncated shape of the SYT-type chart λ/μ indicates that the SYT-type chart of type λ has deleted the SYT-type chart of type μ from the upper left corner; the truncated shape of the SYT-type chart $\lambda \setminus \nu$ indicates that the SYT-type chart of type λ has deleted the SYT-type chart of type ν from the upper right corner. If you want to represent a digged figure such as $(4^5) \setminus (2^2, 1) | \{(2, 2)\}$, The exact form is as

follow .Dig a table of $(2^2, 1)$ from the 4*5 table with the top left (2,2) point as the starting point.



From the above, we can get the representation of type

4 and h studied in this paper.

2. BASIC KNOWLEDGE

The main applications of this study are the knowledge of uniformly distributed order statistics, Young tableaux enumerations and multiple integrals. The following describes the basic knowledge applied from these aspects.

Definition 2.1 [5] Set $X_1, X_2, \dots, X_n$ to be n random variables with joint distribution. The corresponding order statistics are X_i , all X_i are arranged in a monotonous and undiminished order. If $X_{i:n}$ is the smallest value in $X_1, X_2, \dots, X_n$, $i=1, 2, \dots, n$, Then $X_{1:n}, X_{2:n}, \dots, X_{n:n}$ is the order statistic for the corresponding $X_1, X_2, \dots, X_n$.

$$f_{1,2,3,\dots,n,n}(x_1, x_2, \dots, x_n) = n!, 0 < x_1 < x_2 < \dots < x_n < 1 \quad (1)$$

In this paper, we apply the knowledge of standard Young tableaux enumeration. Each row of SYT-type chart corresponds to a set of independent order statistics. Therefore, when we study complex graphs, we can regard it as nested order statistics, that is, the distribution of the number of SYT-type chart equals to nested order statistics. At present, the research on the combination of nested order statistics and Young tableaux enumeration has obtained some important results that can be applied. The main content can be found in reference. In this paper, we mainly study the

$$\Omega = \left(\begin{array}{ccccccccc} x_0 & < & x_1 & < & \dots & < & x_{n-1} & < & x_n \\ & & \wedge & & & \wedge & & \wedge & & \wedge \\ & & y_1 & < & \dots & < & y_{n-1} & < & y_n & < & x \end{array} \right) \quad (2)$$

There is multiple integration result as follow:

$$\int_{\Omega} \dots \int \frac{(y_1 - x_0)^m}{m!} dx_1 \dots dx_{n-1} dy_1 \dots dy_n = \frac{(x_n - x_0)^{n-1} (x - x_0)^{m+n} - (x_n - x_0)^{m+n} (x - x_0)^{n-1}}{(n-1)!(m+n)!} \quad (3)$$

Other important integration results applied in the calculation process:

$$\int_a^b (x-a)^{k_1} (b-x)^{k_2} dx = \frac{k_1! k_2!}{(k_1 + k_2 + 1)!} (b-a)^{k_1+k_2+1}$$

$$\int_{a < x_1 < x_2 < \dots < x_n < b} \dots \int \frac{(x_1 - a)^k}{k!} dx_1 dx_2 \dots dx_n = \frac{(b-a)^{k+n}}{(k+n)!}$$

3. MAIN RESULTS

This paper mainly studies two types of standard

The order statistics emphasized in the definition are monotonous and unabated, while the Young tableaux enumeration studied in this paper is strictly increasing, so it is also necessary to pay attention to it. Another property is introduced.

Property 2.1 [6] If $X_{1:n}, X_{2:n}, \dots, X_{n:n}$ is the order statistic from $U(0,1)$, then the probability density function of $X_{i:n}$ is:

$$f_{i:n}(x) = \frac{n!}{(i-1)!(n-i)!} \{x\}^{i-1} \{1-x\}^{n-i}, 0 < x < 1$$

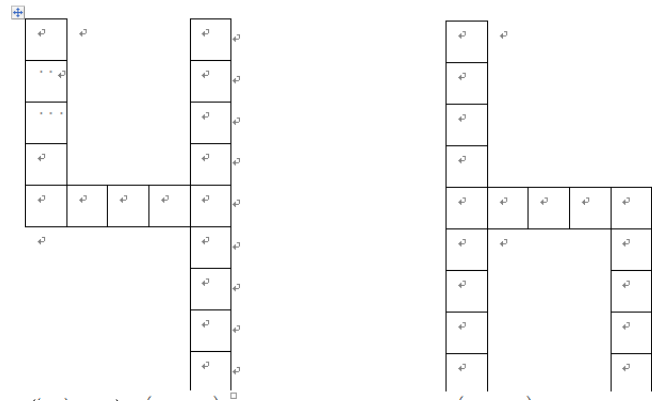
Then, the joint density function of $X_{1:n}, X_{2:n}, \dots, X_{n:n}$ is:

application of nested order statistics on $U(0,1)$ which is applied to the enumeration formula of standard Young tableaux.

Another tool used in the research of nested order statistics is multiple integration, which plays an important role in the calculation process and helps to solve some calculation problems. The following content focuses on some properties that can be used and important integration results.

Property 2.2 [7] For the integral region

Young tableaux shapes, which are similar to 4-Shape and h-shape. Before the calculation, for the two shapes are similar, they are put together for research. Although there are different places in the process of calculation, from the final results, the SYT-type chart enumeration formulas of the two types of standard Young tableaux shapes are the same. The results are presented below. The two types of standard Young tableaux shapes studied are as follows:



$$(n+2)^{m+p+1} \setminus (n^m) | \{(1,2)\} \setminus ((n+1)^p) | \{(m+2,1)\}$$

$$(n+2)^{m+p+1} \setminus ((n+1)^p) | \{(1,2)\} \setminus (n^m) | \{(m+2,2)\}$$

types of standard Young tableaux shapes are as follows:

The nesting order statistics corresponding to two

$$S_{(n+2)^{m+p+1} \setminus (n^m) | \{(1,2)\} \setminus ((n+1)^p) | \{(m+2,1)\}} = \left(\begin{array}{ccccccc} 0 < x_0 & & < & & & y_0 \\ & \wedge & & & & & \wedge \\ & x_1 & & < & & & y_1 \\ & \wedge & & & & & \wedge \\ & \vdots & & < & & & \vdots \\ & \wedge & & & & & \wedge \\ x_m < z_1 < \dots < z_n < y_m & & & & & & \\ & & & & & & \wedge \\ & & & & & & t_1 \\ & & & & & & \wedge \\ & & & & & & \vdots \\ & & & & & & \wedge \\ & & & & & & t_p < 1 \end{array} \right) \quad (4)$$

$$S_{(n+2)^{m+p+1} \setminus ((n+1)^p) | \{(1,2)\} \setminus (n^m) | \{(m+2,2)\}} = \left(\begin{array}{ccccccc} 0 < t_p & & & & & & \\ & \wedge & & & & & \\ & \vdots & & & & & \\ & \wedge & & & & & \\ & t_1 & & & & & \\ & \wedge & & & & & \\ x_0 < z_1 < \dots < z_n < y_0 & & & & & \\ & \wedge & & & & & \wedge \\ & x_1 & & < & & & y_1 \\ & \wedge & & & & & \wedge \\ & \vdots & & & & & \vdots \\ & \wedge & & & & & \wedge \\ & x_m & & < & & & y_m < 1 \end{array} \right) \quad (5)$$

According to the above research contents, we get the corresponding theorems by calculation.

Theorem

1 $(n+2)^{m+p+1} \setminus (n^m) | \{(1,2)\} \setminus ((n+1)^p) | \{(m+2,1)\}$
type SYT-type chart enumeration formula is:

$$H_{(n+2)^{m+p+1} \setminus \binom{n}{m} \setminus \{(1,2)\} \setminus \binom{n+1}{p} \setminus \{(m+2,1)\}} = \binom{2m+n+1}{m} - \binom{2m+n+1}{m-1} \quad (6)$$

Theorem

SYT-type chart enumeration formula is:

$2(n+2)^{m+p+1} \setminus \binom{n+1}{p} \setminus \{(1,2)\} \setminus \binom{n}{m} \setminus \{(m+2,2)\}$ type

$$H_{(n+2)^{m+p+1} \setminus \binom{n+1}{p} \setminus \{(1,2)\} \setminus \binom{n}{m} \setminus \{(m+2,2)\}} = \binom{2m+n+1}{m} - \binom{2m+n+1}{m-1} \quad (7)$$

From theorem 1 and 2, we can see that the SYT-type chart enumeration formulas of

$(n+2)^{m+p+1} \setminus \binom{n}{m} \setminus \{(1,2)\} \setminus \binom{n+1}{p} \setminus \{(m+2,1)\}$

type

$(n+2)^{m+p+1} \setminus \binom{n+1}{p} \setminus \{(1,2)\} \setminus \binom{n}{m} \setminus \{(m+2,2)\}$

type are consistent.

3. PROOF PROCESS

The steps of the proof process are roughly divided into three steps: first, divide the known integral region according to the integration order; then, calculate according to the corresponding integration order; finally, simplify the results.

The proof process of Theorem 1 is as follows:

Proof of Theorem 1: According to the order of integration, it is divided into the following four parts

3.1 Integrate $z_1, z_2, \dots, z_n$, integral region is

$$D_1 = \{x_m < z_1 < \dots < z_n < y_m\}$$

3.2 Integrate $x_0, x_1, \dots, x_{m-1}, y_0, y_1, \dots, y_{m-1}$, integral region is

$$H_{(n+2)^{m+p+1} \setminus \binom{n}{m} \setminus \{(1,2)\} \setminus \binom{n+1}{p} \setminus \{(m+2,1)\}} = (2m+n+p+2)! \int_D \dots \int 1 dx_0 \dots dx_m dy_0 \dots dy_m dz_1 \dots dz_n dt_1 \dots dt_p \quad (9)$$

Then

$$I = \int_D \dots \int 1 dx_0 \dots dx_m dy_0 \dots dy_m dz_1 \dots dz_n dt_1 \dots dt_p$$

According to the order of integration, the first three parts are integrated and the result is as follow.

$$I = \iiint_{D_4} \frac{(y_m - x_m)^n}{n!} \left| \begin{array}{cc} \frac{x_m^m}{m!} & \frac{x_m^{m+1}}{(m+1)!} \\ \frac{y_m^{m-1}}{(m-1)!} & \frac{y_m^m}{m!} \end{array} \right| (1-t_1)^{p-1} dx_m dy_m dt_1 \quad (10)$$

Using the knowledge of property 2.2 to calculate the above integral, we can get:

$$I = \frac{1}{(2m+n+p+2)!} \left[\binom{2m+n+1}{m} - \binom{2m+n+1}{m-1} \right] \quad (11)$$

Then

$$H_{(n+2)^{m+p+1} \setminus \binom{n}{m} \setminus \{(1,2)\} \setminus \binom{n+1}{p} \setminus \{(m+2,1)\}} = \binom{2m+n+1}{m} - \binom{2m+n+1}{m-1} \quad (12)$$

The proof of theorem 1 is completed.

The proof process of Theorem 2 is as follows:

Proof of Theorem 2: According to the order of integration, it is divided into the following four parts

3.3 Integrate $t_2, \dots, t_p$, integral region is

$$D_3 = \{t_1 < t_2 < \dots < t_p < 1\}$$

3.4 Integrate x_m, y_m, t_1 , integral region is

$$D_4 = \{0 < x_m < y_m < t_1 < 1\}$$

According to the content of reference [4], we can see:

$$\text{Note } D = S_{(n+2)^{m+p+1} \setminus \binom{n}{m} \setminus \{(1,2)\} \setminus \binom{n+1}{p} \setminus \{(m+2,1)\}}$$

1. Integrate $z_1, z_2, \dots, z_n$, integral region is

$$D_1 = \{x_0 < z_1 < \dots < z_n < y_0\}$$

2. Integrate $x_1, \dots, x_{m-1}, x_m, y_1, \dots, y_{m-1}, y_m$, integral region is

$$D_2 = \begin{pmatrix} x_0 < y_0 \\ \wedge & \wedge \\ \vdots < \vdots \\ \wedge & \wedge \\ x_m < y_m < 1 \end{pmatrix}$$

3. Integrate $t_2, \dots, t_p$, integral region is

$$H_{(n+2)^{m+p+1} \setminus ((n+1)^p) \setminus \{(1,2)\} \setminus (n)^m \setminus \{(m+2,2)\}} = (2m+n+p+2)! \int \dots \int_D 1 dx_0 \dots dx_m dy_0 \dots dy_m dz_1 \dots dz_n dt_1 \dots dt_p \quad (13)$$

$I = \int \dots \int_D 1 dx_0 \dots dx_m dy_0 \dots dy_m dz_1 \dots dz_n dt_1 \dots dt_p$ According to the order of integration, the first three parts are integrated and the result is as follow.

$$I = \int \dots \int_{D_4} \frac{(y_0 - x_0)^n}{n!} \left| \begin{array}{cc} \frac{(y_0 - 1)^m}{m!} & \frac{(y_0 - 1)^{m+1}}{(m+1)!} \\ \frac{(x_0 - 1)^{m-1}}{(m-1)!} & \frac{(x_0 - 1)^m}{m!} \end{array} \right| t_1^{p-1} dx_m dy_m dt_1 \quad (14)$$

Using the knowledge of property 2.2 to calculate the above integral, we can get:

$$I = \frac{1}{(2m+n+p+2)!} \left[\binom{2m+n+1}{m} - \binom{2m+n+1}{m-1} \right] \quad (15)$$

Then

$$H_{(n+2)^{m+p+1} \setminus ((n+1)^p) \setminus \{(1,2)\} \setminus (n)^m \setminus \{(m+2,2)\}} = \binom{2m+n+1}{m} - \binom{2m+n+1}{m-1} \quad (16)$$

The proof of theorem 2 is completed.

According to the above proof process, after observing the results obtained from the calculation of the shapes of the 4-type and h-type standard Young tableaux, We

get the conclusion that the SYT-type chart enumeration formulas of the two types of standard Young tableaux are the same, and the result is as follow.

$$H_{(n+2)^{m+p+1} \setminus (n^m) \setminus \{(1,2)\} \setminus ((n+1)^p) \setminus \{(m+2,1)\}} = H_{(n+2)^{m+p+1} \setminus ((n+1)^p) \setminus \{(1,2)\} \setminus (n)^m \setminus \{(m+2,2)\}} \quad (17)$$

REFERENCE

- [1]P. Sun, Note of the enumeration formula of standard Young tableaux of truncated shape $(n^m)/(2)$ Electronic Journal of Combinatorics, 2015, 46: 126-133.
- [2]P. sun, Enumeration of standard Young tableaux of shifted strips with constant width. The Electronic Journal of Combinatorics, 2017, 24(2).
- [3]P. Sun, Evaluating the Numbers of Some skew standard Young tableaux of truncated shapes. The Electronic Journal of Combinatorics, 2015, 22(1).

[4]P. Sun, Enumeration formulas for standard Young tableaux of nearly hollow rectangular shapes. Discrete Mathematics, 2018.

[5]X. P. Li, Basis of probability theory. Beijing: Higher Education Press, 1997.

[6]R. H. Sun, Applied mathematical statistics. Beijing: Science Press, 1998.

[7]Y. Wang, Distribution and Application of Two kinds of $(n^3) \setminus (n-k) \setminus \{(2,j)\}$ type nested order statistics. Shenyang: Northeastern University, 2017.

Research on the Use and Dissemination of Internet + Public Welfare Model in China

Di Jin

School of Science, Hangzhou Normal University, Hangzhou, 311121, China

Abstract: According to the fifth survey of the status of Internet technology and communication capabilities of 531 non-profit organizations in China, there is indeed a gap in the application of digital media between Chinese non-profit organizations. The use and spread of the Internet in industry information sharing, institutional promotion, and public welfare concepts. There is a small gap in advocacy and credibility improvement. There are gaps in the application of public welfare organizations in Internet applications, including access to Internet resources, knowledge and information management, online data analysis and Internet collaboration. In the Internet era, the development status of public welfare organizations will depend on whether public welfare organizations can actively seize the opportunities and challenges of Internet technology and obtain digital application capabilities. The reduction of Internet technology will inevitably improve the communication strategies of public welfare organizations.

Keywords: Public welfare organizations; Network technology and communication capabilities; Digital divide

1. INTRODUCTION

"Internet+" has become a new technology model that has been developed in all walks of life in recent years. It has reintegrated the resources of traditional industries [1]. The innovation of the Internet has made public welfare more diverse, and the combination of Internet and public welfare has been played in the field of public welfare. In the context of "Internet+", public welfare organizations have broadened financing channels, diversified social channels, transparent cooperation, cross-border cooperation, resource sharing, interactive response, donor and recipient diversity, etc. features [2]. Secondly, the way people participate in public welfare projects has also changed. Compared with the existing passive information reception, people are now called active information sharers. In the virtual social network, the public welfare circle is formed large and scattered. The network structure reflects more public welfare forces. Walking, reading books, taking photos, and even a chess game may be ways to pass on love. Popular cultural methods are gradually formed. Finally, the Internet provides technical support and platforms for public welfare organizations. Because the Internet is open and transparent [3]. As a member

of China's most important public service sector, "Internet+" provides more opportunities for grassroots organizations. "Internet+" is the public project provides more virtual channels for public participation and timely understanding of public service.

2. RESEARCH METHODS

NGO2.0, co-sponsored by the Institute of Knowledge Management of the University of Science and Technology of China and NGO2.0, focused the fifth research on the Internet use and communication functions of nonprofit organizations on the Internet communication functions of nonprofit organizations. The survey collected a total of 600 Institutions: The goal of data analysis is 531 grassroots public welfare institutions in China, except for incomplete data.

The research collected sample information via the Internet. Channels such as Weibo, qq, and WeChat were used to disseminate research information. Questionnaires were published through online platforms, such as China Development News, Charity Forum, Charity Service Network, China Charity Network, and many others Industry websites to communicate information to more public institutions. The experts of the NGO2.0 project team are mainly composed of the Internet of public welfare institutions at home and abroad, the heads of many public welfare institutions, some public welfare technology applicants, and scholars who have studied public welfare experts. They use Internet technology, information dissemination and management skills, challenges faced, and issues that need improvement. A nonprofit organization has designed a questionnaire. Nonprofit organizations have already raised a question about the use of Internet communication functions. According to the frequency of related issues, setting and weighting the first index and the second index respectively. The settings of these indicators and weights can more accurately reflect the current status of public institutions using the Internet.

3. RESULTS AND DISCUSSION

In this study, the research team focused on the use and dissemination of grassroots non-profit organizations, and analyzed the infrastructure and Internet of non-profit organizations in the following way: that is, to investigate the status of communication management in terms of basic functions.

Generally speaking, the difference between developed regions and poor regions will directly lead to the

formation of the digital hardware gap of public welfare organizations in the region. However, actual research shows that the type of regional and non-profit organizations does not indicate such hardware differences. According to the two of the research team. In the study, only 12.62% of non-profit organizations without hardware (offices, computers, mobile devices) were double the fourth survey Table 1 Get industry information from organizations in different regions

Channels to industry information	Different regions		
	Central areas	Western areas	Eastern areas
Information website for public welfare industry	72.09%	88%	83.17%
Electronic bulletin of public welfare organizations	53.49%	64%	66.34%
Public organization WeChat Official Accounts	97.67%	99.5%	96.53%
Public organizations weibo	73.64%	79.5%	76.24%
Public organizations QQ group	99.22%	97%	94.06%

According to the survey results (as shown in Table1), the proportion of grassroots public welfare organizations through Weibo, qq and other promotional organization channels is 93.4%. In large-scale public welfare activities, the organizers use WeChat, qq, Weibo and other social media to promote public participation is 89.45%. However, public institutions only use 51.6% of the publicity functions of emerging Internet functions such as micro Internet, micro video, and live broadcast. From the perspective of the division of labor between the east and west regions, there is little difference between organizations in different regions. The number gap between different regions is small. In

(24.13% of hardware) conducted two years ago. This shows that with the popularity of computers and the Internet. The "digital hardware divide" of Chinese grassroots public welfare organizations is unclear. With the development of society and the popularity of the Internet, the digital divide brought by computer hardware is narrowing.

terms of using the Internet to improve the transparency and credibility of nonprofit organizations, the social network penetration rate of nonprofit organizations is high, and the digital divide between nonprofit organizations is not large. Most organizations publish project activities and progress through social networks (91.15%). Through the Internet, the organization's business goals and missions have reached 84.56%. 63.09% of institutions include fixed media partners such as newspapers, televisions, and the Internet. 60.45% of institutions publish their annual financial status through online channels.

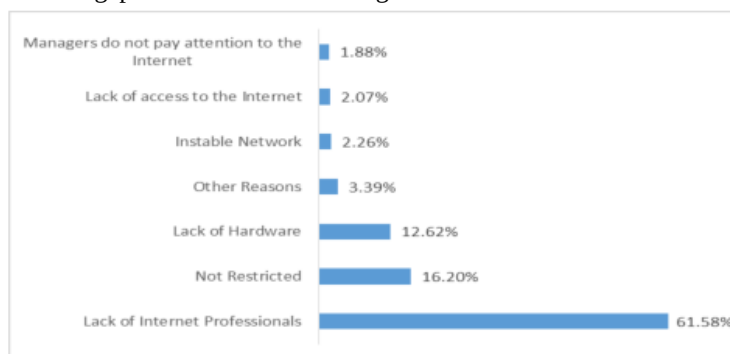


Figure 1 Restrictions on Internet use

The results are shown in Figure 1. More than half (61.58%) of nonprofit organizations believe that the main reason for being restricted by Internet technology in the operation and management process is the lack of professional Internet technicians or related professional and technical personnel in the organization lacking volunteer services. Both education level and professional level are high. They do not consider internet technology as an obstacle to organizational development. Other options include no funding, no full-time employees, funding difficulties

and insufficient funding. This percentage is only 3.39%. You may find non-profit organizations Internet professionals in your organization will affect the use of the Internet by your organization. It is no longer limited to hardware facilities, network technology, and the importance of Internet use in the past.

4. CONCLUSION

The Internet is a platform, and technology is a tool. "Internet+" technology enables everyone to participate in public welfare activities through the

Internet and technology. In this process, you need to integrate social resources and develop new public welfare models. We need to be in various fields and industries. The new Internet technology is used in order to make public welfare more selective, better spread, manage public welfare organizations and bridge the digital divide.

With the advent of the "Internet+" era, the Internet and mobile Internet will play an increasingly important role in bridging the digital divide. Non-profit organizations can use the openness of the Internet and grass-roots interests to conduct more publicity to non-profit organizations. And communication, participate in public welfare projects with the enthusiasm of the public, and provide technical support services for non-profit organizations. Improve organizational communication strategies and make them perfect.

REFERENCES

- [1]S. H. Ahn, A Study on Governance System of Exemplary Veterans Organizations, NGO, Government, School & University, Research Center, Institute with a Focus on the Promotion Scheme of Patriotism Education. Journal of Patriots and Veterans Affairs in the Republic Korea, 2017, 16(2): 77-113.
- [2]Y. Akimoto, and G. Scott, Communication network i.e. internet, for production plant computer system for distributing canned bakery product for customer, has NGO computer systems including mutual data transfer unit with distribution center computer system. WO2014105992-A1.
- [3]L. A. Brainard, and P. D. Siplon, The Internet and NGO-government relations: Injecting chaos into order. Public Administration and Development, 2002, 22(1): 63-72.

Review and Prospect of Green Road Research at Home and Abroad

Xin Bian

Shandong Women's University, Jinan, 250300, China

Abstract: This form of green road originally originated in the planning of Boston Park system in the United States. After a long period of development, the landscape elements are gradually expanded and enriched and the landscape, culture, society, ecology and many other aspects are integrated in the functional aspect. At present, there are many researches on green roads at home and abroad. Through the integration and review of these research progress, the further promotion of green road in China is discussed, and the future planning and construction of green road is prospected.

Keywords: Green road; At home and abroad; Research progress; Review; Prospect

1. INTRODUCTION

Europe and the United States are the main sources of the modern green road. It was first born at the end of the last century. After decades of development and evolution, it not only refers to the mere mall, but gradually develops towards the direction of network corridors. In recent years, with the continuous improvement of people's consciousness of ecological environment, the research on green road has gradually become a hot field, which integrates many disciplines, such as forest ecology, conservation biology, landscape ecology, landscape design, urban planning, etc. It has also obtained many valuable research results [1].

2. CONCEPTUAL INTERPRETATION OF GREEN ROAD

Green road refers to a kind of green and linear opening space, which usually refers to the tree-lined path that allows pedestrians, bicycles and so on to enter. The green road is usually attached to various artificial corridors or natural roads, such as scenic belts, ridges, valleys, rivers and lakes. In many places at home and abroad, there are successful practices for green roads, such as Changsha Green Road, Wuhan Green Road, degree Green Road, Pearl River Delta Green Road Network, etc. The application of green road in landscape design is earlier. It was originally conceived as a corridor that intersected the landscape. In the current field of academic research, the concept of green road is widely accepted as a linear network system structure which includes planning, design and construction, and later management. This system includes many functions, such as landscape, culture, recreation and ecology, and is the sustainable use of land. The concept contains a lot of deeper content,

such as the sustainable development of green road, multi-function, linear contour. The green road can be connected with other green spaces, which can supplement the non-linear green space system, improve the integrity and comprehensiveness of the green space system, and show greater value in ecological protection [2].

3. CLASSIFICATION OF GREEN ROAD

According to the relevant research, green roads can be divided into different types. The green roads in Europe and the United States mainly include the complex green roads and green road network, scenic roads and cultural repair routes, natural ecological corridors, tree-lined roads and trails, such as recreational green channels, urban water corridor and other types. The original green road in China mainly adopts the combination of points, lines and surfaces. The main types include retelling green space, protected green space and so on. In recent years, with the influence and inspiration of foreign relevant experience, many new types of heritage corridors, scenic roads, urban recreation green roads, recreation belts around the city, belt green spaces and belt parks have been added [4]. In terms of function, green road mainly has ecological function, recreation function, economic function, social and cultural function, aesthetic function and so on. The green road can form the inner independent habitat and construct the biological habitat. It can reduce the degree of urban landscape fragmentation, and provide the energy position flow in different green spaces. The design of green road reflects the leisure function, follows the people-oriented design purpose, provides people with the opportunity of leisure sports, close to nature, and relaxing body and mind. The establishment of green road can improve the overall landscape of the city. It is also helpful to the sustainable development and competitiveness of the city. The design of the green road on historical and cultural relics can reflect the preservation of historical relics and the protection of cultural heritage. The green road has a variety of design forms that can shape a good urban landscape [3-4].

4. RESEARCH PROGRESS OF GREEN ROAD AT HOME AND ABROAD

During the course of green road development, Bobby Hurley's research holds that the development of green road mainly goes through five periods: the embryonic green road planning period from 1867 to 1900, the landscape green road planning period from the

beginning to the middle of the 20th century, the environmental green road planning period from the 1960-70s, the naming and development stagnation period of the green road movement in the 1980-90s, and the international movement period from 1990 to present. As far as green road planning and design is concerned, Rodney Rogers' research suggests that green road planning decision-making mainly includes ecological opportunity, ecological attack, ecological defense, ecological protection and so on. These decisions should be applied to different realistic situations respectively. Lindsey Hunter's research shows that the green road planning process needs to synthesize and investigate the basic situation, to evaluate the elements of the green road, and then make a comprehensive comprehensive evaluation and analysis to form a reasonable planning of green road. In addition, different aspects of green road planning, including needs determination, regional assessment, access connectivity, adaptability, accessibility, scope determination, integrated evaluation, etc., should be taken into account. George Lynch's studies have shown that the width and size of the green road are proportional to the number of mammals in it. For example, 60 m of green roads are capable of meeting the needs of many bioenergy exchange migrations and biodiversity. In other non-shore green areas, it takes 600-1200 m to create the ideal landscape structure. For the corridor width below 1200m, its interior is difficult to maintain stable habitat [5].

5. DOMESTIC RESEARCH PROGRESS OF GREEN ROAD

In the planning and design of urban green road and in urban green space system, the function of green road can control the spread of urban land, and connect other existing green space to form a unified whole, according to the research of Li Da. Zhao Junliang's research shows that green road has good integration in ecology, culture, space, plants and so on, and can form unique landscape style characteristics. Qian Wuren's study holds that the valley, as a form of green road, is a natural space ecological corridor, which has great significance and value for tourism market construction, environmental restoration and resource protection. In recent years, many studies have also mentioned the application of price advanced technology in green road planning and design. According to Sun Xinhan's research, GIS technology can be used to determine the planning and design of green road network quickly and reasonably through green road network planning, accessibility analysis, suitability analysis, weight determination and factor selection. Zhou Qian's research shows that by using multi-scale remote sensing image segmentation method, the interference degree model is established, and the optimum design width and buffer width of wetland ecological corridor are determined. It can provide the basis for corridor structure design. According to Zheng Gongming's

research, the scenic roads include green roads, cultural routes, heritage corridors, and recreational, historical, cultural, natural, scenic and even archaeological values from the perspective [6].

6. FUTURE RESEARCH PROSPECT OF GREEN ROAD

Green road has many comprehensive functions. At present, the research on green roads at home and abroad is mainly focused on positive aspects, but there are some problems that are controversial, such as invasive alien species, landscape homogenization and so on. Therefore, in the future research direction, we should pay attention to starting from the new angle and direction, and reasonably analyze the advantages and disadvantages of green road. At home and abroad, there are many researches on the design and planning of green road, but the design methods of the elements of green road system, such as plant landscape, boundary treatment and space composition, are not enough. Therefore, in the future research, we should pay more attention to the construction standards as the basis and adopt a more detailed and characteristic one-to-one design approach combined with the actual situation and characteristics. In addition, the current green road research is mainly reflected in the ecological, functional and other aspects, but it is given priority to individual research. The future research will develop towards multi-technology and multi-disciplinary integration, such as the integration of green road planning and construction with integrated pipe gallery, urban sponge, urban slow moving system, and so on, so as to improve the overall benefit of green road planning and design [7-10].

7. CONCLUSIONS

Green road is a special green space, which has high ecological and application value in urban development and construction. The design of green roads can not only improve the living environment of residents, but also improve the microclimate, which plays a very important role in improving the urban environment. Therefore, we should conduct a more detailed and in-depth study on the green road to improve its fit in the planning and construction in the city and make it play a greater ecological and functional value.

REFERENCES

- [1]J. W. Jiang, Study on Landscape Design of Slow Space of Urban Waterfront Green Road. Beijing Forestry University, 2019.
- [2]Y. D. Wang, Exploration of Cultural Heritage Corridor Construction Based on Ecological Restoration. Beijing Forestry University, 2019.
- [3]J. X. Dai, Ecological Corridor Planning in Taixing District of Yangtze River. Central South University of Forestry and Technology, 2019.
- [4]X. D. Lyu, Landscape Design of Green Road in Sicun Road, Zhengzhou. Central South University of

Forestry and Technology, 2019.

[5]F. Hong, Study on Landscape Corridor Construction of Yufu River in Jinan City Based on Urban Waterfront Green Road Planning. Shandong Jianzhu University, 2019.

[6]M. J. Hu, A Study on Restorative Experience and Its Influence on Behavioral Intention of Recreationalists in Green Road. China University of Geosciences, 2019.

[7]R. Fan, W. Z. Li, and R. H. Wu, Study on Space Visual Attraction of Green Road Around Taihu Lake Based on UAV Image Segmentation. Chinese Landscape Architecture, 2019, (05): 74-79.

[8]J. Liu, L. Yang, and X. W. Zhang, A Study on the Relationship between Sound Scene Perception and

Landscape Evaluation of Historic Block -- A Case Study of Sanfang Seven Lane in Fuzhou. Chinese Landscape Architecture, 2019, (01): 36-40.

[9]M. Y. Sun, Y. C. Zou, X. F. Yu, H. Yu, and M. Jiang, Study on Ecological Aesthetic Perception and Evaluation System of Wetland Landscape. Wetland Science, 2018, (06): 700-706.

[10]Z. Zeng, N. Y. Zhu, D. Wang, H. S. Cheng, X. L. Fan, P. Huang, S. R. Lan, and X. H. Li, A Study on Urban Green Road Optimization Strategy Based on Tourist's Recreation Motivation and Behavior -- A Case Study of Fuzhou Fudao. Journal of Shandong Agricultural University (natural science), 2018, (04): 639-645.

Analysis on the Risk of Money Laundering and Its Countermeasures under P2P Network Lending Mode

Qingqing Duan

Guangdong University of Science & Technology, Guangdong, 523083, China

Abstract: in recent years, with the rapid development of Internet technology and the increasing demand of market-side capital lending, the development of P2P network lending has stepped into a fast lane. Due to the lack of supervision and the lack of risk awareness of investors, the problems exposed by P2P network lending also emerge in endlessly, which has attracted the attention of the regulatory department. However, it is difficult for P2P network lending companies to prevent and control the risks caused by platform money laundering Degree also increases rapidly. Based on the development mode and trend of P2P network lending in China, this paper analyzes the main money laundering behaviors and risks of P2P companies, and then puts forward countermeasures for the money laundering risks of P2P companies.

Keywords: P2P; Network Lending; Money Laundering; Risk

1. ANALYSIS ON THE DEVELOPMENT MODE AND TREND OF P2P NETWORK LENDING IN CHINA

1.1 P2P Network Lending Concept

P2P is the abbreviation of the English peer-to-peer (or person topson), also known as point-to-point network lending, which is a new private micro lending platform with the development of Internet technology. In P2P network lending, the borrower and the lender match directly on the lending platform through the Internet, and then complete the whole process of fund lending. Its social value is mainly reflected in three aspects: meeting the needs of personal funds, developing personal credit system and improving the utilization rate of social idle funds. P2P first appeared in the UK, marked by the Zopa lending platform established by James Alexander, Richard Dewar, etc., and then developed rapidly in various countries around the world [1-2].

With the rapid development and popularization of Internet technology, P2P micro lending has gradually changed from a single offline mode to offline online parallel mode, resulting in P2P Online lending platform, which is a financial model for individuals to provide small loans to other individuals through a third-party platform under the premise of charging certain interest, its customers mainly include customers who lend funds and customers who need loans. P2P network lending platform can alleviate the

problem of consumption imbalance caused by uneven income in different stages through this lending method, so that more people can enjoy P2P micro credit services [3].

1.2 P2P Network Lending Mode and Development Trend in China

At present, there are two main business models of P2P companies in China: pure online and hybrid. Pure online lending is represented by auction lending and Hongling venture capital. All lending activities are completed through the network. The website itself does not participate in specific lending business and belongs to a pure intermediary lending platform. The mixed mode is represented by Yixin. The lending activities are not completed through the network. The website only provides relevant lending information. The specific lending is completed by more than 30 branches in the country. The company itself participates in the lending business and provides guarantee for the lending business. Recently, the company has also developed financial products. In the whole lending process, P2P As an independent third party, the online lending platform provides services such as reviewing the borrower's credit degree, publishing lending information, recovering overdue loans, and performing legal procedures to the borrower and the borrower, while financial intermediaries such as banks no longer link the borrower and the borrower [4].

In June 2018, there was a thunder storm in P2P institutions, which led to the regulatory authorities vigorously rectifying the P2P industry, and the market was significantly impacted. Affected by this, in the third quarter of 2018, the transaction volume of online loan industry was 304.4 billion yuan, down 58.99% year-on-year and 38.26% month on month. Among them, the turnover in September was 93.4 billion yuan, a year-on-year decrease of 60.74%, a month on month increase of 6.86%. There were 14 platforms with a transaction scale of more than 1 billion yuan, accounting for 7.3% in total, higher than 6.92% in August; the number of platforms with a transaction scale of less than 10 million yuan accounted for 60.67%, higher than 59.86% in August; the number of platforms with a transaction scale of 10 million yuan to 100 million yuan decreased. The whole industry has the characteristics of transaction scale differentiation again, the general decline of the

industry's transaction scale in the stage of risk outbreak has been improved, the industry's overall transaction has rebounded, and the operation of the industry's platform has become more stable.

2. ANALYSIS ON THE MAIN MONEY LAUNDERING BEHAVIORS AND RISKS OF P2P COMPANIES

2.1 Absorb a Large Amount of Funds from Unspecified Social Objects with High Returns

P2P companies provide information collection, information disclosure, loan matching and other services to borrowers and lenders, and build information intermediary service platforms for individuals, institutions or enterprises with investment and financing needs. For example, a P2P company carries out network lending business in many cities in Central South, southwest, East China, North China and other regions. Asset service types include mortgage and pledge, supply chain, credit loan and other types. Services: by querying the company's customer information, there are already millions of registered users, and the average annual return rate of investors is more than 12.2%. The company absorbs a lot of funds by issuing high-yield products of different periods and types, and attracts a large number of investors by means of flash buying and follow-up investment. There are obvious signs of absorbing a lot of funds from unspecified objects in the society through high return.

2.2 Control Multiple Companies to Achieve the Goal of Company Accounting

In order to effectively avoid the supervision of anti money laundering and do a good job in money laundering, some P2P companies open multiple corporate accounts and personal accounts in multiple banks. The legal persons who open accounts participate in each other's shares, have the same legal representative, shareholder and account opening agent, have the same or close registered address, and even have dozens of companies under the control of P2P companies. Obviously, there is a company's business model. In case of discrepancy between the actual situation of the account transaction of the company and the surrounding, the fund fast in and fast out transition is obvious. The subsidiary provides operation and capital operation for the P2P parent company, whose purpose should be to transfer accounts between the company's accounts and use the transitional fund.

2.3 The Complexity of Capital Transaction Shows Obvious Characteristics of Group Division of Labor

P2P money laundering companies have complex upstream and downstream fund transactions, and each account has a clear division of labor. There are special accounts for receiving funds from third-party over-the-counter investors, and special accounts for fund transition. Through multiple accounts layer by layer split transition, team and group operation will transfer part of the funds to inter-bank accounts, and

part of them will be invested in securities companies and trust companies. Through the separation and transfer of account funds, money laundering can be carried out in different fields. For example, through the issuance of financing loans, the recovery of the principal and interest of car loans, the recovery of the principal and interest of small loans, and even transfer some transactions to public enterprises and individual customers, to enterprises and individuals with capital needs for fund lending or bridge use, so as to realize the complexity of capital transactions.

2.4 Lack of Effective Supervision over the Opaque Operation and Circulation of Investment Funds

P2P companies have unclear specific investment targets in various investment projects. Users have no idea what specific targets their funds will invest in when they invest. The disclosure of investment information is not true and the level of operation is not high. There is a lack of effective supervision. It is easy to form a "design loan demand as a product for sale to investors, or collect funds first, and then find loan targets". If the fund in the fund pool is misappropriated or run, the risk of the fund pool is very high, which may cause three kinds of adverse consequences, such as the risk of fund-raising fraud brought by the roll run, misappropriation of the fund in the fund pool for its own platform, resulting in bad debts. Deficit, there is also term mismatch, once investors due to lack of confidence in the concentration of cash withdrawal, it is very easy to break the capital chain, resulting in cash withdrawal difficulties and social risks.

2.5 Network Virtualization Promotes P2P Companies to Become a New Means of Money Laundering

With the rapid development of mobile payment, most network credit platforms are completed through the form of third party payment, such as Alipay. The hidden, anonymous and instant nature of network lending platform makes it more difficult for regulators to track capital flows. With the help of online banking and third-party payment, money launderers can transfer money anonymously and quickly without facing the banking staff and counter. Promote money launderers to realize the transfer of illegal income in an instant, effectively avoid the identification and fund monitoring of financial institutions, and complete the transfer of funds or monetary value through the Internet or mobile network. After the operation of P2P platform, financial institutions can not accurately know the source of these funds and the previous transfer situation.

3. P2P COMPANY MONEY LAUNDERING RISK RESPONSE STRATEGY ANALYSIS

3.1 We Will Improve the Regulation of P2P Network Lending.

In fact, Internet lending is a network version of private lending, which has led to many uncertainties due to its use of the Internet platform. At the same time, the services provided by the Internet lending

platform are obviously beyond the business scope of simple intermediary information service providers. As a new financial model, the timely follow-up of laws and regulations is more urgent. With the continuous outbreak of P2P network lending risk events in recent years, the government departments are gradually regulating and increasing the supervision in this field, but from the perspective of the overall supervision effect, there is still a large room for improvement. It is necessary for government departments to gradually issue relevant management measures, guide and stipulate operators to do well in self construction of network platform from several key aspects, optimize market operation environment of P2P network lending industry, gradually guide operators of network platform to actively perform their own anti money laundering obligations, strengthen internal mechanism construction, and integrate anti money laundering system construction of network lending platform with public funds management. As a key regulatory field, we should strengthen supervision from multiple dimensions and levels.

3.2 Build a Systematic P2P Network Lending Anti money Laundering System.

Influenced by the Internet of P2P network lending, in order to supervise its money laundering activities, it is necessary for many departments to build a systematic management system. First, according to the P2P network lending mode, it is supervised by the CBRC, and when money laundering activities are involved, it needs to be supervised by the anti-money laundering monitoring center of the people's Bank of China; second, in the daily anti money laundering performance process, each bank's entry institution continuously monitors the P2P network lending company's funds, once it is found suspicious, it shall be reported to the superior bank and the anti-money laundering center of the people's Bank of China through the suspicious transaction report; Third, when it comes to money laundering and other illegal activities, it needs the public security organ to file a case for handling and follow-up. Therefore, there are many departments involved in the anti-money laundering work in the P2P network lending process. If they only focus on the supervision part in the management process and do not share information, it will not be conducive to the improvement of efficiency. Therefore, in the process of anti-money laundering of P2P network lending, it is necessary to open up all links to achieve mutual information. By building a systematic management mechanism, we will integrate the information of CBRC, the anti-money laundering center of the people's Bank of China, banking financial institutions and public security organs, and effectively improve the effectiveness of P2P network lending anti money laundering.

3.3 Strengthen the Supervision and Transparency of P2P Network Lending Funds.

It can be seen from the P2P company's fund supervision that although the third-party company's fund custody agreement has been signed, the custody is formalized obviously, and the risk of funds being misappropriated is great. It is necessary for the supervision department to issue relevant rules and regulations, clarify the fund custody responsibilities, ensure that the funds are effectively managed, and regularly disclose the use of funds in this account to the public, so as to prevent investors' funds from entering the network first. The online lending platform has its own account number and formed a fund pool. Secondly, it is necessary to standardize the responsibilities and management of the guarantee company, guide the selection of qualified and reputable companies to sign the guarantee agreement, and publicize the situation of the guarantee company. In view of the current serious related guarantee problem, the relevant departments should strengthen the punishment to prevent the spread of formalism and protect the rights and interests of investors. There is also the rapid development of P2P network lending company business, but the lack of proper information disclosure for its specific business and operation, which makes investors in a complete information disadvantage position. In case of fund chain break and other problems, the first loss is the vast number of investors, of course, we should strengthen the supervision of insider trading, if all parties consider their own interests in the absence of relevant financial supervision mechanism, insider trading is easy to occur.

3.4 Improve Investors' Awareness of Anti money Laundering and Risk Control.

Affected by the rapid development of P2P network lending, the majority of investors in China lack of awareness of the risk of network lending business, lack of awareness of P2P network lending companies' participation in money laundering, resulting in no pre prevention psychology. Once money laundering is involved, the safety of funds cannot be guaranteed. In response to this phenomenon, we should increase publicity, improve the public's awareness of online lending and its potential risks through public service advertising and outdoor publicity, and give full play to the role of various regulatory departments in P2P. The publicity manual for the money laundering risk of online lending is made. Through the way of outdoor delivery and free collection, as well as the production of various H5 and other new publicity animation, the public's awareness of the money laundering risk of P2P online lending companies is effectively improved, and the money laundering risk is effectively prevented.

ACKNOWLEDGEMENT

Intermediate financial accounting, excellent resource sharing course of Guangdong University of Science & Technology.

REFERENCE

[1]Y. Q. Zhao, On the development status and risks of P2P network lending in China. Economic Research Guide, 2018, (16).
[2]Z. Wang, Analysis of money laundering risk and Countermeasures of P2P network lending mode. Nanfang finance, 2012, (11).

[3]J. H. Wang, and C. Li, Risk analysis and response to money laundering under the network lending mode. Finance and economy, 2011, (09).
[4]S. S. Yang, and Z. Liu, Suggestions on money laundering risk and anti money laundering policy of P2P online lending platform. Finance, 2015, (4).

The Application of Private Cloud in the Information Construction of Universities

Jian Sun¹, Pengfei Gao², Dongsheng Yang¹

¹University of Aerospace Engineering, Beijing, 100000, China

²Unit of Strategic Support Force, Beijing, 100000, China

Abstract: In view of low resource utilization and difficult maintenance of existing computer information systems in some universities, cloud computing technology has introduced to integrate existing computer software and hardware resources to build a college private cloud platform and promote existing computer software. Moreover, it's accessible to improve the utilization rate, reliability and scalability of hardware resources and reduce the input cost of college computing resources.

Keywords: Private cloud; Infrastructure as a service; Platform as a service; Software as a service

1. OVERVIEW OF PRIVATE CLOUD

People working, learning and living environment has changed dramatically given the maturity of cloud computing technology and the rise of the industry. Traditional computer and network resource usage models have caused a great waste of computing resources and network resources. The concept of cloud computing and the maturity of technology will allow us to use computing resources into a new mode, Pay-as-you-go distribution model, which is the centralized resource management.

After many years of information construction, the application systems constructed by various universities range from tens to hundreds, and the virtualization architecture in use is also diversified. At the same time, with relatively low use and management efficiency of IT resources and insufficient availability, the pressure of management and maintenance has increased. supporting the development of smart campuses in colleges ensuring data centers realize intelligent, automated, ecological and high-availability operations, and reducing management and maintenance pressures, energy conservation and emission reduction are urgent problems to be solved by college IT management departments. Cloud computing, big data and the Internet of Things have become the new driving forces for the future development of the IT industry with the prevalence of information technology. Cloud computing, a key field of IT development in the future, is also the main technical support for big data and Internet of Things technologies. The above problems have been solved benefit from the flourishing of cloud computing and related technologies [1].

The national education reform clearly stated that

colleges and universities should rely on high-quality resources and advanced technology to improve the management mode of teaching resources, and integrate existing teaching resources to build efficient and practical educational facilities [2].

The definition given by the American National Standards Institute is that cloud computing technology is a resource utilization model, which can access configurable computing resources (networks, servers, storage, applications, services, etc.) through the network in a simple and on-demand way. It can integrate some unused computer resources scattered in various corners to make full use of them, thereby reducing computing costs. The application models of cloud computing services are mainly divided into three types: public cloud, private cloud and hybrid cloud [3-4].

1.1 Public Cloud

The public cloud is operated by the cloud service provider, the third party. When an enterprise needs to outsource certain business applications for a certain reason, the cloud service provider will host its infrastructure or related applications, and provided them to enterprises in the form of service. Internet giants are currently the main cloud computing service providers in China. The business form is mainly IaaS+PaaS-based open platform services, such as cloud host, cloud storage, open database and other basic IT resource services, as well as website cloud and game cloud, the one-stop hosting services. The isolation and data security of the public cloud cannot be well guaranteed because it's shared by multiple organizations.

1.2 Private Cloud

Private Cloud is used to create cloud infrastructure and software and hardware resources in the firewall to share the resources in the data center for organizations and departments of the enterprise. The form of service is usually for large enterprises to build a platform in the internal data center of the enterprise according to the cloud computing architecture, and provide cloud computing services for internal users and internal needs.

To create a private cloud, in addition to hardware resources, cloud platform (IaaS) software is generally required; open source cloud platform software mainly includes OpenStack, CloudStack, Eucalyptus, etc.

1.3 Hybrid Cloud

Cloud platform providers take into account the cloud

computing services of both public and private clouds. Typical examples include cloud platforms that provide cloud computing services for both internal and external users, such as AWS. Hybrid cloud is also a connection between an internal private cloud and an external public cloud platform. You can schedule the use of resources between the public cloud and the private cloud. In addition, some people call the cloud platform that crosses the virtualization management program as a hybrid cloud.

Enterprises can deploy some applications with special requirements on the public cloud and deal with applications that handle sensitive data and critical data on the private cloud, and other applications both in public and private clouds.

If the egress bandwidth is limited or a partially isolated environment is required, the private cloud is the only option for the cloud platform.

2. THE STATUS QUO OF INFORMATIONIZATION IN UNIVERSITIES

In recent years, information construction in colleges and universities has made great progress. Information centers and other similar organizations are responsible for the information construction, and management and operation of colleges. The application systems built range from tens to hundreds, campus Network has become the platform of communication in majority of colleges and universities, which provides convenience for teachers and students. But today, many colleges and universities are still in the mode of equipping their employees with a single computer, and professional labs are still in the old mode of connecting multiple computers through switches to a local area network, the Information Center still adopts a single server dedicated to one or several business model, there are many problems.

2.1 Low Utilization Rate of Hardware Resources

The deployment mode of one system with one application leads to several troubles, the current utilization rate of server hardware resources is insufficient, the average load of 70% of the servers is less than 30%, and computing resources are seriously wasted. For staff and personal computers, the CPU usage rate generally does not exceed 20%, the memory utilization rate fluctuates between 20% and 60% for a long time, and the usage rate of hard disks and other auxiliary storage devices is less than 20%. In the current terminal usage mode, the computer's hardware performance is not being played, and about 75% of the hardware resources are idle [5].

2.2. Service Quality is Difficult to Guarantee

Servers are all single-point loads at present. Once the server fails, there must be corresponding services that cannot be used. It is even more difficult to ensure the terminal of the college. The current establishment of the center is to protect all the terminals of the college. In fact, achieving real-time response and service is difficult [6].

2.3 Cloud Training Lacks Environment

Currently, information technology is booming, cloud computing, big data, artificial intelligence continue to heat up, and have moved from the laboratory to commercial use. Among them, cloud computing, an effective support for big data and artificial intelligence, is also the basic condition for conducting cutting-edge research in many disciplines. Therefore, it is urgent to train composite talents who understand technology and precision, from the principles, technology and practical operation of cloud platforms (building, Operation and maintenance, use) and other dimensions to deepen the understanding of the cloud platform. Among them, theoretical courses such as the principles and technologies of the cloud platform are relatively easy to set up, but the theory needs to be combined with practice to deepen understanding, learn to apply. However, the current practical training courses of the cloud platform require back-end cloud computing support. Many colleges still lack a practical training platform or only have a small-scale, schematic environment, which cannot completely cover the practical training course system of the cloud platform.

3. DEMAND FOR PRIVATE CLOUD CONSTRUCTION

The construction of private cloud platforms in colleges and universities should meet the technical requirements of system applications for the underlying platform, which is a good way to complete the unified platform management scheduling and monitoring of existing IT resources, guarantee application stability effectively, reduce maintenance costs and cost pressures. In addition, the platform should also support teaching, management and scientific research [7-8].

3.1 Support Information Center Construction

Cloud IaaS platform promotes integrating resources, such as the physical servers and storage devices. Virtualization technology has been used to compute resources pool and storage resources pool, which builds a small and medium cloud computing data center and allows to compute resources, storage resources using in need flexibly, furthermore, the platform also give an impetus to manage the data center in a unified manner, shorten the on-line period of new services, make it easier to maintain and manage, and improve the operation quality of various business systems.

3.2 Support the Construction of Scientific Research Conditions

In the process of researching on current scientific research projects, the hardware platform does not match the time of the scientific research project according to its long time purchase. Private cloud can provide a temporary platform for scientific research projects to be carried out in the early stage. In addition, the private cloud make it possible to reduce laboratory construction costs, protect important data and research results, meet the high-frequency access

and large-capacity storage needs of universities, and the needs of users' personalized experimental environments. The cloud computing R&D and big data R&D based on cloud platform make the advantages of high efficiency and sharing of cloud computing fully play in the teaching experiment platform of universities, and effectively meet the needs of the integration of production, teaching and research, and the integration of experimental teaching resources in the universities.

3.3 Support Information Teaching

Many universities still adopt pseudo-distributed or stand-alone mode when doing cloud computing and big data related experiments. Its application experiments, made in such an experimental environment, lack unified management and process tracking, which caused the correlation between experiments to be difficult to understand, thus the experimental data obtained is not match the fact usually. cloud platform maintenance, system R&D and other cloud computing experiment teaching must be carried out on the basis of cloud platform, cloud platform-based computing R&D, big data R&D, and business system to enable students to complete cloud computing learning of engineering practice and experimental operation. Through this process, students tend to understand how the on-demand service model refine the social division of labor, further improve the quality of services and the overall production efficiency, so as to learn the social significance of cloud services, not just its technical capabilities.

4. PRIVATE CLOUD ADVANTAGES

4.1 Improve Safety

The private cloud application prevents the direct contact between the portable storage device and the computer, reduces the transmission path of computer viruses, and improves the security of data. In the current computer usage model, computer labs in universities and teacher office computers connect to a large number of mobile storage devices frequently. Almost all of these mobile storage devices carry viruses, such as Trojan horses, worms, etc. The system enables to place all the hardware facilities centrally and uses the B/S architecture mode for services, which makes it easier to prevent the direct contact in mobile storage devices and cut off a transmission channel of viruses, Trojans, and worms [9].

4.2 Promote Sharing

The sharing of hardware resources helps to save costs. All hardware and software resources are concentrated in the data center, and users can access the cloud system and obtain services through the browser to facilitate user sharing. Private cloud systems provide services to users through three service models: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). Users pay for computer resources on demand as they do with

water and electricity. The system automatically reclaims the resources and allocates it to other users when it's not needed. Comparing with the existing usage model, the same amount of computer resources can meet several times or even more than ten times the customers use taking advantage of private cloud system, which built in cloud computing technology.

Software resources and information sharing can facilitate users to apply resources at any time. In recent years, the university network has basically achieved full coverage, and teachers and students can work and study online at any time. Teachers can sign files, download materials, etc. whenever necessary through the Internet device in using private cloud model, students study online and handle various assignments through the platform whenever they need [10].

4.3 Convenient Operation and Maintenance

Compared with the traditional O&M system, the system in the cloud computing has been expanded to some extent, mainly involving three aspects: One is the operation and maintenance of the business platform, an important content of O&M and the key to the stable operation of the system, mainly including the cloud operation platform, database and Operating system and other content; second, cloud platform operation and maintenance, mainly including cloud management and monitoring platform, designed to ensure the efficiency and quality of cloud platform operation and maintenance; third, cloud platform hardware operation and maintenance, an important content of security guarantee and service system construction, mainly including security equipment, network and server. Therefore, in the operation and maintenance practice, it is necessary to clarify the scope of operation and maintenance and improve the efficiency and quality of operation and maintenance. Although the scope of operation and maintenance has indeed increased, the physical location has been further reduced, and the main body of operation and maintenance is in the data center of the university, which is conducive to the establishment of rules and regulations, the operation of institutions, task assignment and personnel control. Uncontrollable operation and maintenance can be gradually transformed into controllable operation and maintenance [11].

5. CONCLUSION

Cloud computing-related technologies, the core technology for the construction of smart campuses in colleges and universities, are the first choice for the management and application of IT resources operation and maintenance in colleges and universities. Taking into account the conditions of universities, the existing soft and hard resources are used to build a cloud platform that is suitable for each university. IT resources are managed in a unified manner, which makes it possible to use them effectively, reduce management and operation costs,

improve business sustainability and data security, In addition, it enables them to support teaching and scientific research effectively, and improve the efficiency and quality of teaching management.

REFERENCES

- [1]Z. Y. Meng, Research and Practice of Cloud Platform Construction in Universities, Science and Technology Innovation, 2018, 27.
- [2]Z. Y. Hu, Constructing Digital Teaching Resource Platform Based on Cloud Computing Concept, Contemporary Education Research and Teaching Practice, 2016, 01.
- [3]J. H. You, Application of Hybrid Cloud in Practical Teaching of Higher Vocational Education, Computer Knowledge and Technology, 2015, 25.
- [4]W. S. Cai, J. W. Feng, and L. L. Deng, Architecture of University Cloud Experiment Platform Based on Hybrid Cloud, Modern Computer, 2018, 08.
- [5]M. Y. Li, and N. J. Xu, Exploration of Private Cloud Architecture in Universities, Fujian Computer, 2017, 04.
- [6]W. Zheng, Discussion on the Practice of University Information Construction under the Private Cloud Model, Office Operations, 2018, 15.
- [7]J. Liu, The application of cloud computing in the information construction of colleges and universities, Automation & Instrumentation, 2017, 09.
- [8]W. Lin, The application of cloud computing in the education information construction of medical colleges, News and Writing, 2016, 11.
- [9]Q. Xue, Analysis on the Application of Private Cloud Technology in Higher Vocational Colleges, PC Fan, 2016, 10.
- [10]B. M. Li, The Construction of Digital Teaching Resources in Universities Based on Cloud Computing, Journal of Jinan Vocational College, 2017, 02.
- [11]Z. B. Lu, Design and Research of Data Center System of Training Room Based on Cloud Computing, Journal of Qingdao University (Natural Science Edition), 2017, 02.

Prediction Analysis of Coal Price in Qinhuangdao Port Based on Regression Method

Xueyu Zhang^{1,2}, Aimei Xiao^{1,*}

Shandong University of Technology, Zibo, 255000, China

Abstract: This paper explores the influencing factors of coal price, and USES multiple regression, ARIAM, stratified regression and other methods to make short-term prediction of qinhuangdao coal price, and analyzes the importance of each influencing factor. According to the principle of supply and demand, the CEIC database and the data provided by the competition officials were selected. After data cleaning and logarithmic elimination of dimensional influence, a multivariate analysis model was established and regression coefficients were compared to obtain the influence of each influencing factor. The validity of the model is proved by F test. Considering the novel Coronavirus epidemic, add two additional influencing factors of oil price and currency circulation. First, the interpolation method was used to obtain the data of each influencing factor separately, and then the stratified regression analysis was used to predict, so that the influence of each influencing factor and sudden factor was better considered, making the prediction result more accurate.

Keywords: Multiple linear regression; Fitted curve; Functions; Hierarchical regression

1. INTRODUCTION

Coal is one of the basic energy sources, and the price of coal is not only regulated by relevant state departments, but also affected by the domestic coal market. In addition, factors such as climate change, travel patterns and the international coal market also affect coal prices. In order to set coal price reasonably and make coal enterprises sustainable development, the following problems need to be solved. The mathematical model is established and the main factors affecting the coal price are given. The main factors that influence the thermal coal price of Qinhuangdao port are sorted. Considering the structural and important changes of coal price influencing factors caused by various situations in the future, a comprehensive prediction model of coal price is established and the prediction results are given.

2. MODELING

Based on the idea of quantitative analysis, this paper Table 1 Results of linear regression analysis

considers the relationship between market supply and demand and selects seven independent variables, namely thermal power generation, export coal quantity, raw coal production, international coal price, thermal coal (5500) national market price, national average coal price and Qinhuangdao port inventory [1-7]. Multiple linear regression analysis was conducted with Qinhuangdao Port coal price (5500). The time unit was selected as weeks, and the range was 52 weeks from April 30, 2019 to May 1, 2020. The data were sourced from CEIC economic database (Global Economic Database, China economic Database and World Trend Database). In order to eliminate dimensional influence, logarithmic processing was conducted on the data.

From the Table 1, we can see that the thermal power generation, export coal, raw coal production, thermal coal (5500) national market price, international coal prices, national average coal price, Qinhuangdao port inventory as the independent variable, and Qinhuangdao port coal price as the dependent variable in a linear fashion. Regression analysis, from the above table, we can see that the R-squared value of the model is 0.927, which means that thermal power generation, export coal, raw coal production, Thermal coal (5500) national market price, international coal price, national average coal price, Qinhuangdao port inventory can be explained Reasons for 92.7% change in coal price in Qinhuangdao port. The model was found to pass the F-test ($F = 76.703$, $p = 0.000 < 0.05$) when the model was tested ($F = 76.703$, $p = 0.000 < 0.05$), also That is to say, thermal power generation, export coal, raw coal production, thermal coal (5500) national market price, international coal price, national The average coal price, at least one of which is in Qinhuangdao port inventory, has an impact on the price of coal in Qinhuangdao port.

The model formula is: Qinhuangdao port coal price = $1193.590 - 7.600 \times \text{thermal power generation} - 0.027 \times \text{exported coal} - 0.523 \times \text{raw coal production} - 1.675 \times \text{thermal coal (5500) national market price} + 1.198 \times \text{International coal price} + 0.139 \times \text{national average coal price} - 0.002 \times \text{Qinhuangdao port stocks}$.

	Nonstandardized coefficient	Standardized coefficient	t	p	VIF	R ²	Adjustment R ²	F

	B	Standard error	Beta						
Constant	1193.590	697.330	-	1.712	0.094	-	0.927	0.915	F(7,42)=76.703,p=0.000
Thermal power generation	-7.600	2.565	-0.330	-2.962	0.005**	7.201			
Export coal	-0.027	0.011	-0.142	-2.435	0.019*	1.968			
Raw coal production	-0.523	0.339	-0.260	-1.543	0.130	16.430			
Thermal coal (5500) National Market price	-1.675	0.667	-1.008	-2.510	0.016*	93.407			
National average coal price	0.139	0.630	0.036	0.221	0.826	15.458			
Qinhuangdao port inventory	-0.002	0.001	-0.361	-3.893	0.000**	4.978			

Affected by the novel Coronavirus epidemic, the economic development of all countries has been affected to different degrees. Therefore, stratified regression is used to study the model changes caused by the increase of independent variable (X), and is

usually used to test the stability of the model, and to study the mediating or regulating effects [8,9].

A hierarchical regression model was established, and the parameters of the model were shown in Table 2.

Table 2 Results of stratified regression analysis

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7
Constant	802.605 (19.530**)	-54.477 (-0.514)	-28.048 (-0.215)	950.129 (5.057**)	1120.608 (8.338**)	1105.916 (7.380**)	275.329 (1.609)
Thermal power generation	-16.216 (-5.652**)	-9.319 (-4.576**)	-9.632 (-4.306**)	-11.932 (-6.902**)	-4.678 (-2.928**)	-4.667 (-2.889**)	-4.055 (-3.419**)
Thermal coal market price		1.322 (8.353**)	1.290 (7.022**)	-1.431 (-3.068**)	-2.037 (-6.003**)	-2.022 (-5.802**)	-0.425 (-1.183)
Export coal			-0.007 (-0.354)	-0.015 (-1.022)	-0.046 (-3.977**)	-0.046 (-3.903**)	-0.023 (-2.450*)
International coal prices				1.178 (6.110**)	1.588 (10.751**)	1.589 (10.642**)	0.845 (5.261**)
Qinhuangdao port inventory					-0.003 (-6.998**)	-0.003 (-6.696**)	-0.000 (-0.656)
Cash flow						0.000 (0.232)	0.002 (5.031**)
The price of oil							0.976 (6.324**)
Sample size	52	52	52	52	52	52	52
R ²	0.390	0.748	0.749	0.860	0.932	0.932	0.965
Adjusted R ²	0.378	0.738	0.733	0.848	0.925	0.923	0.959

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7
F	F(1,50)=31.94 9,p=0.000	F(2,49)=72.83 1,p=0.000	F(3,48)=47.73 0,p=0.000	F(4,47)=72.23 1,p=0.000	F(5,46)=126.5 67,p=0.000	F(6,45)=103.3 12,p=0.000	F(7,44)=170.9 90,p=0.000
ΔR^2	0.390	0.358	0.001	0.111	0.072	0.000	0.032
ΔF	F(1,50)=31.94 9,p=0.000	F(1,49)=69.77 0,p=0.000	F(1,48)=0.126 ,p=0.725	F(1,47)=37.33 7,p=0.000	F(1,46)=48.97 8,p=0.000	F(1,45)=0.054, p=0.818	F(1,44)=39.98 9,p=0.000

3. EXPERIMENTAL ANALYSIS

Summing up the analysis, we can see that international coal price will have a significant positive impact on the price of coal in Qinhuangdao Port. As well as thermal power generation, export coal, thermal coal (5500) national market price, Qinhuangdao port inventory will have a significant positive impact on Qinhuangdao Port coal prices have a significant negative influence on the relationship. However, the amount of raw coal production and the national average coal price do not have any influence on the coal price in Qinhuangdao Port. Therefore, the main factors influencing coal price are international coal price, thermal power consumption, coal inventory, raw coal mining quantity, export coal quantity and so on. China market coal price. The effect of each factor is: international coal price > thermal coal (5500) national market price > Qinhuangdao port inventory > thermal power. Electricity generation > raw coal production > exported coal quantity > average coal quantity.

From the Table 1, a linear regression analysis with thermal power generation as the independent variable and coal price at Qinhuangdao port as the dependent variable was conducted from the above table shows that the R-squared value of the model is 0.390, which implies that thermal power generation can explain the price of coal at Qinhuangdao Port 39.0% reason for the change. The model was found to pass the F-test ($F = 31.949$, $p < 0.05$) when the model was tested, that is, it shows that thermal power Electricity generation will certainly have an effect on coal prices in Qinhuangdao Port as well as the model formula is: Qinhuangdao Port coal prices = $802.605 - 16.216 \times$ Thermal Electricity Generation. The final specific analysis shows that the value of the regression coefficient for thermal power generation is -16.216 and shows a significant ($t = -5.652$, $p = 0.000 < 0.01$), implying that thermal power generation will have a significant impact on the price of coal at Qinhuangdao Port Negative impact relationships.

4. CONCLUSION

Multiple regression analysis is more concise and convenient, and can intuitively analyze each factor; the accuracy of regression analysis is relatively high. The influence factors of currency circulation and international oil price are taken into account, and the stratified regression model is adopted to better

consider the influence of uncertain factors, making the long-term prediction more accurate. The data sources of this model are sometimes dirty when they are acquired. Therefore, when the model is established, the data is pre-cleaned and the influence of this part is ignored. In addition, based on the data of other variables, the multiple linear regression model established in this paper can be directly applied to further improve the accuracy of the model. The data model established in this paper has a certain popularization value. When each dependent variable is known, coal prices in other regions or ports can be simulated and predicted directly based on this model. The model has good practicability for forecasting the economic situation of coal production materials in the region.

REFERENCES

- [1]The SPSSAU project (2020), SPSSAU (Version 20.0) [Online Application Software], Retrieved from <https://www.spssau.com>.
- [2]D. D. Sun, Selection of the linear regression model according to the parameter estimation, Wuhan University Journal of Natural Sciences, 2000, 5(4): 400-405.
- [3]M. R. Barassi, Microeconometrics; methods and applications by a colin cameron, Pravin K. Trivedi, 2005.
- [4]W. H. Green, Econometric analysis, China Social Science Press Beijing, 1998.
- [5]J. P. Jia, Analysis of supply and demand in China's coal market and its price, Modern Economic Information, 2013, 10: 307.
- [6]X. L. Wang, Y. J. Chen, J. Zhang, and Y. X. Tian, Coal price prediction model and empirical evidence, Statistics and Decision Making, 2008, (17): 118-119.
- [7]M. Li and S. H. Lv, Coal price prediction model and its application, Journal of Wuhan University of Science and Technology (Natural Science Edition), 2007, 04: 434-437.
- [8]B. Liu and D. Y. Gong, Analysis of coal market in the first half of 2019 and forecast for the second half of the year, Coal Economic Research, 2019, 39(07): 29-33.
- [9]X. Wei, Conventional energy price, international CER price and carbon trading price in China, Xi'an University of Petroleum, 2019.

Research on the Cost Control of Manufacturing Enterprises Under the Background of Epidemic Prevention and Control Normalization

Haijun Liu, Ma Bin

Xi-An Sunward Aeromat Co.Ltd, China

Abstract: China's market economy in the process of international practice, has been sustained development, under the epidemic situation, "crisis" and "opportunity" coexist. Enterprises are committed to meeting the needs of consumers. The change of consumption trend will inevitably force enterprises to transform and upgrade. Enterprises mainly engaged in traditional manufacturing industries are faced with strong competition and pressure for transformation. How can enterprises control their costs in this environment, improving the competitiveness of enterprises is a problem that every manufacturing enterprise needs to think about. Through a brief exposition of the cost control theory of manufacturing enterprises, this paper analyzes the current situation and problems faced by manufacturing enterprises in China, some suggestions are given to solve these problems, which can be used for reference for the transformation and development of manufacturing enterprises.

Keywords: Manufacturing Enterprise; cost Control; Enterprise Development

1. INTRODUCTION

The epidemic situation of NCP has great influence on the normal order of production and life in the society. At present, we must continue to optimize the business environment in the normal epidemic prevention and control, solve various practical difficulties faced by enterprises, do a good job in assisting enterprises to stabilize their posts, and strive to minimize the losses caused by the epidemic. In order to produce and sell products, an enterprise has to consume both material materials and labor. The monetary form of consumption is the product cost of the enterprise [1]. The cost control of an enterprise is to formulate various cost targets in advance according to the elements of product cost components, and to require each department to control the cost within a certain range according to the requirements of the cost targets, and the implementation of the target cost of the departments to monitor and check the situation, found problems solved in a timely manner, and finally in accordance with the cost of the completion of the target for reward and punishment behavior and measures [2]. From the component elements of cost,

the scope of cost control mainly includes: manufacturing costs, management costs, sales costs, financial costs. From the control process, the content of cost control mainly includes: cost forecast, target cost formulation, cost management, cost Accounting, cost audit, cost analysis. Only by strengthening cost control from the connotation of cost control, enterprises can reasonably monitor all kinds of consumption in production, save expenses and reduce product costs, thus increase the profit level and improve the market competitiveness of enterprises; In order to improve the level of business management and ensure the rationality of expenses and the effectiveness of management, to provide a basis for business forecasting and decision-making, and to evaluate the performance of various departments, so as to tap the potential of reducing costs, to promote the continuous improvement of the economic efficiency of enterprises [3]. Therefore, only on the basis of a full understanding of cost control, constantly improve the understanding of cost control, pay attention to the effect of cost control, standardize cost control procedures and systems, to enable enterprises to really achieve the minimum input to obtain the maximum output of the ideal operating state. In China, there are many manufacturing-based small and medium enterprises, which are the backbone of China's economic development and have contributed to the development of China's traditional industries, but in recent years, with the continuous development of the market economy in line with international practice, China's economic level and comprehensive strength have been continuously improved, these manufacturing enterprises are also facing increasing market competition pressure. In this global economic crisis environment, how to reduce the cost, improve the quality of products, reduce the sales price and improve the competitiveness of these enterprises through cost control is a problem that Chinese manufacturing enterprises will face.

2. THE RELATED THEORY OF ENTERPRISE COST CONTROL IS EXPOUNDED

Manufacturing enterprises play an important role in the whole enterprise environment and economic development of our country and are the main pillar industries of our country's economy, therefore, before

we study the cost control of manufacturing enterprises, we first make a brief introduction to the relevant theories of cost control. The theory of cost control is an important means of cost control in the process of business management. It consists of cost prediction, decision-making, planning, checking and accounting, there are three steps to good control. First of all, it is necessary to establish standards and systems that are in line with the characteristics of the enterprise itself, and then use these standards and systems as a prerequisite for the establishment of objectives, and to clarify the economic objectives of the units and individuals in the enterprise, finally, set up a certain reward and punishment system through these goals, and then achieve the cost control level. The related theories of cost control include cost-benefit theory, cost reduction theory, strategic cost control theory and so on.

3. PROBLEMS EXISTING IN THE COST CONTROL OF CHINESE ENTERPRISES

During the epidemic prevention and control period, as the main force of China's economic development, facing the international market economic environment, China's manufacturing enterprises also have many problems in the process of cost control to improve their competitiveness, these problems are mainly manifested in the R & D and design of products, the selection and purchase of raw materials and equipment, the production, sales and service of products and other links.

3.1 Problems in Product Development and Design

During the period of epidemic prevention and Control, in the OF R&D DESIGN OF PRODUCTS, most manufacturing enterprises did not pay attention to the cost OF R & D design, and even many enterprises did not control the cost OF OF R&D design of products, they focus more on the performance of the product and less on the economy of the product [4]. They use data to focus on the apparent cost and ignore the HIDDEN cost OF R&D, there IS NO INVESTMENT in of R&D.

3.2 Problems in the Process of Raw Material Procurement

During the period of epidemic prevention and control, many enterprises only pay attention to the surface cost of purchase, ignore the input of mechanical equipment and estimate the cost of quality and freight Enterprises in the process of not paying attention to these cost details, the price and cost control will be directly linked to [5], this wrong concept of cost control in the enterprise product quality problems, also brings the recessive crisis for the enterprise development; many enterprises only attribute the responsibility in the purchase to the purchase department, neglects with other industrial chain's communication and the connection, in the process of purchasing, the purchasing department only purchases according to the price comparison, ignoring the demand of raw material quality and so

on The purchasing department of the manufacturing enterprise also neglects the contact with the material supplier [6], reduces the supplier's level through various undercutting ways, causes the enterprise to be in the inferior position in the later raw material purchase.

3.3 Problems Existing in the Production of Products

During the epidemic prevention and control period, enterprises paid too much attention to cost control in the production link of products. Although paying attention to cost control can reduce the problems in this link, many enterprises still have many problems in this link, for example, the distribution of material and labor costs is not reasonable, and some enterprises have reduced the wage cost of labor in the production link, which makes the cost of materials increase continuously, thus causing workers to have a feeling of being tired of working, as a result, the production capacity of enterprises is reduced; the utilization level of materials is low, and many enterprises still waste materials in the manufacturing process. Many materials become useless after one use, and can not be used again, these phenomena have a huge impact on the overall cost of products.

3.4 Problems in Product Sales and Service

During the epidemic prevention and control period, during the sales process of products, enterprises neglected to pay attention to the cost of after-sales service and did not take the after-sales service as the key link of cost control, the neglect of this link causes the enterprise not to proceed with the customer feeling to carry on the image maintenance and the establishment, causes the customer after buying a product because the after-sales service is not in place to refuse the next purchase, then reduced the manufacturing enterprise product sales ability and the competitive power.

4 IMPROVING THE COST CONTROL STRATEGY OF MANUFACTURING ENTERPRISES

During the epidemic prevention and control period, in view of the above-mentioned manufacturing enterprises' different problems in different links, the author puts forward some effective countermeasures to these problems according to the present situation of social and economic development and China's national conditions, i hope that these strategies for the transformation and competitiveness of enterprises to provide help and reference significance.

4.1 Product R& D and Design of the Response Strategy

During the epidemic prevention and control in product research and development design, enterprise should according to oneself circumstance, establish an effective target cost control strategy in the product development design link to establish the need to reduce the cost of the target, based on this target cost control, make the manufacturing enterprises in the product development design process to achieve the effect of cost control optimization; Companies can

also in research and development design link through the cooperation with suppliers, the part that their demand for transfer to supplier, pushing suppliers to design suitable for their own product demand parts, from different angles according to oneself circumstance reasonable use of social resources to minimize the cost of the enterprise, make the interest presents maximum optimization.

4.2 The Strategy of Raw Material Purchasing

Along with the development of the outbreak, in raw materials procurement procedures, should be comprehensive product demand, choose the price, shipping and the quality of the equilibrium state of raw materials, the enhancement enterprise internal communication and cooperation between production and purchasing, make the raw material purchasing is the materials they need to fully understand the enterprise in the product manufacturing quality requirements, on these requirements to choose reasonable price of raw materials, also want to increase under the condition of high-tech equipment procurement to new technology, use of the equipment to improve product manufacturing capability, and enhance the cooperation with suppliers, make the enterprise with suppliers to achieve a win-win situation through cooperation.

4.3 The Strategy of Product Production

With the development of the epidemic, there will be some fluctuations in the international market, which requires foreign trade enterprises to timely adjust their development strategies. On the one hand, the export market of enterprises may change. For example, the export market used to be mainly concentrated in the United States, and then we should consider turning to the European Union market, southeast Asian market or other developing countries market. On the other hand, enterprises should make a precise positioning of their production development through digital means, strengthen innovation through market innovation, scientific and technological innovation, management innovation and other ways, and expand the market with unique product advantages. In the process of product production, manufacturing enterprises should improve the level and ability of enterprise managers, so that managers can timely find problems in the production process of enterprises, and reasonable control of each link, so that the production of enterprises in a state of continuous progress and development; Enterprises should also improve the rational use of resources according to their own conditions, set up effective systems to improve the enthusiasm of employees and awareness of saving, so as to maximize and optimize the rational application of materials in enterprise production, and ultimately promote the effective control of costs.

4.4 Product Sales and Service Links to Deal with the Strategy

During the period of epidemic prevention and control,

in product sales and service, enterprise should pay attention to the product propaganda, on the analysis of customers and after-sales service, to understand the characteristics and the pulse, the customer to the customer as the center, intensify propaganda, increase sales, sales are helpful to reduce the enterprise to improve the cost control, with good after-sales service attitude for customers with good reputation and corporate image, allows customers to choose enterprise product for a long time, like the enterprise brand; Enterprises should introduce foreign effective cost control methods, use good marketing means and strategies for product sales, and accurate accounting and estimation of enterprise costs. Enterprise leaders should be clear about the cost input in each link, and the attention to details in these links provides help for enterprise cost control.

5. CONCLUSION

From the above description, we find that during the epidemic prevention and control period, people's consumption patterns have changed, and the characteristics of avoiding contact and reducing the risk of infection have led to the increasing popularity of e-commerce. Therefore, the digital transformation of consumption is mainly driven by e-commerce. Digital transformation has also changed consumers' consumption habits, preferences and time to some extent. By grasping the above characteristics of consumers through big data and other digital means, producers can make more accurate production adjustments, produce more products that consumers like, and guide consumption and create demand through research and development rather than blindly adapting to consumer demand. In manufacturing enterprise's production process, from product development design, the equipment selection, purchasing raw materials, to production, sales and service and so on each link all need to control costs, the cost control in these links is influence each other, under the influence of this kind of each link effect will last the whole cost of the enterprise, through to the industrial chain in different links of cost control, can make the enterprise stand in whole macroscopic cost control, puts forward effective control strategy, and improve the cost control, therefore, The research on cost control in manufacturing enterprises can help enterprises transform and enhance their competitiveness, which is also very necessary.

REFERENCE

- [1]He Rong, "Research on the Effectiveness of Cost Control in Manufacturing Enterprises." *Modern Economic Information*, 2015(21):216.
- [2]The building. "Analyses the manufacturing cost management." *Journal of old brand marketing*, 2019 (12): 43-44.
- [3]Well XiaoYi, "Small batch production manufacturing cost control research." *Value engineering*, 2011, 30 (4): 111.

- [4]Guo Liping, "Reflections on Manufacturing Cost Control." Business, 2013(20): 64.
- [5]Dong Chunhua, "Implement manufacturing cost control present situation and reform measures," 2015 (25): 15.
- [6]GengNa, "Manufacturing cost control problems and countermeasures analysis." Journal of finance (academic), 2015 (16): 72 + 83

Research on Financial Agglomeration Degree Based on Entropy Weight Toppsis Method: Taking 101 Counties in Hebei Province as Example

Xinyu Wang*, Wenyao Xu, Ying Lu, Yafeng Li

School of Economics and Management, North China University of Technology, Beijing 100144, China

Abstract: County finance is the foundation of financial system in our country. Based on its importance, the degree of county finance development can directly affect financial system's development efficiency. The financial agglomeration is the basic law of financial resources spatial movement, the measurement of agglomeration degree can reflect the level of financial development comprehensively and intuitively. This paper constructs indicators from three aspects of financial scale, financial environment and financial institutions, entropy weighted TOPSIS method are used to measure financial agglomeration degree. On this basis, the financial agglomeration degrees of 101 counties in Hebei Province during 2013-2018 are calculated, and the following conclusions are drawn: There is a regional and gradient distribution of financial agglomeration in Hebei Province. On the whole, the level of financial agglomeration showing a descending trend, and an index has much more influence on financial agglomeration degree which is Resident Savings Deposits. Depend on this, Hebei Province should increase investment in the establishment of county financial institutions, and make a rational distribution, and give full play to the advantages of financial agglomeration effect to create a better development environment for financial agglomeration.

Keywords: Financial agglomeration degree; TOPSIS method; Entropy weight; County finance

1. INTRODUCTION

With the continuous development of China's economy and financial industry, financial agglomeration has attracted more and more attention at home and abroad. Because financial agglomeration can allocate financial resources more effectively and reasonably, improve the utilization efficiency of financial resources, and provide support for the upgrading of industrial structure and economic transformation, more and more financial institutions begin to organize transactions and production activities through cooperation among enterprises. Agglomeration has become the basic form of modern financial industry organization. In the county area, Agricultural Bank of China and postal savings bank innovate the financial

service mode by setting up the "three rural" financial business department. Based on the county, village banks support agriculture and small and micro enterprises. Ant financial service group launched a trillion plan in thousands of counties, relying on online commercial banks to launch "Wangnong loan" products. Scientific measurement of financial agglomeration degree can better analyze the evolution trend of financial agglomeration and accelerate the development of financial agglomeration. This paper will take Hebei Province as an example, using entropy weight method to measure the level of county financial agglomeration.

2. LITERATURE REVIEWED

Financial agglomeration is a kind of financial spatial feature. In recent years, the development trend of financial agglomeration in Chinese cities has become more and more obvious. At present, many cities including Xiamen have clearly proposed the establishment of regional financial center planning [1]. The construction of regional financial center not only promotes the upgrading of the industrial structure of their cities, it also promotes the upgrading of industrial structure of neighboring cities [2].

For the evaluation methods of financial agglomeration, scholars at home and abroad have different research judgments. At present, there are four main categories. One is entropy weight method. Chen Linxin and others use entropy weight method to measure the level of financial agglomeration from four aspects: the overall scale of finance, banking industry, securities industry and insurance industry [3]. Feng Lin and others used TOPSIS to evaluate the financial agglomeration level of 90 county-level units in Shandong Province [4]. Zhang Chao and others used entropy method to measure the financial agglomeration of ten counties in Ningbo based on three dimensions: financial development scale, financial development efficiency and financial development environment [5]. The other is factor analysis. Chen Qian and Tian Zhiwei selected 12 indexes to study the financial analysis of 33 listed forestry enterprises [6]. The third is hofindar index, which is used by Jiang ran to measure and evaluate the agglomeration of financial industry in the Pearl River Delta [7]. Fourth, Chun-Xiao Nie calculated the

correlation dimension in the financial market as a measure of clustering structure in the correlation coefficient matrix [8]. Some scholars will combine various methods to build models to reduce errors, like Zheng Zhiyong, who made model based on the grey relational Topsis index comprehensive evaluation method and Tyre index decomposition [9].

All of the above studies provide some reference for this paper. For the existing research of financial agglomeration in China, the choice of variables is mainly the macro areas with large economic volume, high economic growth value and rapid economic development, such as regions, provinces, cities, and vice provinces. There is no research on financial agglomeration at the county level. From the micro point of view, county development is the foundation of regional economic development. It is of great significance to pay attention to the dynamic change of county financial agglomeration and stabilize the cornerstone of regional and even national economic development, so as to improve the efficiency of economic development. In addition, the number of counties in Hebei Province ranks the second in 34 provincial administrative divisions of our country, which is huge, but the economic ranking is backward, and the economy of each county has its own characteristics, its complexity makes the region have a large research gap. Therefore, this paper selects evaluation indicators from three aspects of financial scale, financial environment and financial institutions, draw lessons from Deng Danqing and other scholars' analysis methods to establish the model [10], measures the level of financial agglomeration in Hebei Province by Using Entropy TOPSIS method, finds out problems and puts forward countermeasures and suggestions to give full play to the effect of financial industry agglomeration in Hebei Province to provide support for financial development in Hebei Province.

3. DATA SELECTION AND MODEL BUILDING

3.1 Data Source

This article selects the statistical analysis from 2013 to 2018. the balance of loans from financial institutions at year-end, the balance of saving deposits of residents, the amount of investment in fixed assets, and region GDP are derived from the /China County

Statistical Yearbook/ for each year. The number of financial institutions in each year and employees of financial institutions is derived from /the Hebei Financial Yearbook/. According to the data published /Hebei Financial Yearbook in 2017/, in order to make the established evaluation system of fiscal agglomeration level accurately, this paper excludes all municipal jurisdictions from the 166 county-level units under the jurisdiction of Hebei Province at the end of 2017, and obtained 101 county-level units. Because the number of financial institutions and financial employees counted in the /Hebei Financial Yearbook/ is not specifically counted in each county, when calculating the number of financial institutions and financial employees in each county, The method is to multiply the ratio of the population of each county to the population of the city directly under the county by the number of county financial institutions or the number of financial employees in the year.

3.2 Selection of Indicators

The selection of evaluation indicators is directly related to the rationality of the logical relationship of the entire evaluation system and the accuracy of the calculated evaluation results. Judging from the existing relevant researches, most scholars mainly measure finance agglomeration in terms of financial density, financial scale and financial depth. Based on related ideas, this paper considers that the level of county finance agglomeration can be measured and defined by agglomeration of financial scale, agglomeration of financial environment, and agglomeration of financial institution. We use the balance of institutional loans and the balance of residents' savings deposits measure the financial scale, the financial environment is measured by the county's GDP and fixed asset investment, and the financial institutions are measured by the number of county-level financial institutions and the number of financial practitioners. We use the balance of institutional loans at year-end and the balance of residents' savings deposits measure the financial scale, the financial environment is measured by the county's GDP and fixed asset investment, and the financial institutions are measured by the number of county financial institutions and the number of financial employees.

The first level (X)	The second level (X^i)	The third level (X_j^i)
Financial agglomeration Level (X)	Financial scale (X^1)	The balance of loans of financial institutions at the end of the year (X_1^1)
		The balance of urban and rural residents' savings (X_2^1)
	Financial environment (X^2)	GDP (X_1^2)
		investment in fixed assets (X_2^2)
	Financial institutions (X^3)	The Number of financial institutions (X_1^3)

		The Number of financial professionals (X_2^3)

3.3 Establishment of Evaluation Model

At first we create the original matrix $X = (x_{ij})_{m \times n}$,

x_{ij} represents the output of i indicator in j region.

Due to the difference between the quantity level and the dimension of each indicator, and the different magnitude and dimension of each indicator, it is necessary to adopt dimensionless method for the indicators. Each indicator represents county's finance agglomeration level. The larger the indicator is, the greater the degree of measurement and the higher finance agglomeration level is. Therefore, this paper chooses the method of range standardization to standardize the indicators. The indicators in the article are all positive indicators, which are converted as follows:

$$X'_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}} \quad (1)$$

Calculation of specific gravity value:

$$f_{i,j} = a_{i,j} / \sum_{i=1}^m a_{i,j} \quad (2)$$

f_{ij} represents the characteristic proportion of the j index under the i evaluation unit.

3.4 The Calculation of Financial Agglomeration Level
In this paper, entropy weight method is used to weight the single index of financial agglomeration level in Hebei Province and counties. TOPSIS is a statistical analysis method. According to the approximation degree of evaluation object to ideal solution and negative ideal solution, the advantages and disadvantages of the scheme are sorted. TOPSIS combined with entropy weight method can get rid of the shortcomings of the same weight of the previous evaluation indicators, while substituting the entropy weight of the real reflection indicators can assist the research better study the impact of these indicators on the county financial level.

Calculation of entropy:

$$H_j = -\frac{1}{\ln m} \left(\sum_{j=1}^m f_{ij} \ln f_{ij} \right) \quad (3)$$

Calculate entropy weight:

$$\delta_j = \frac{1 - H_j}{n - \sum_{j=1}^n H_j} \quad (4)$$

Determine positive ideal solution S^+ and negative ideal solution S^-

$$S_j^+ = \sum_{1 \leq i \leq m} \max(\gamma_{ij}) \quad j = 1, 2, \dots, n \quad (5)$$

$$S_j^- = \sum_{1 \leq i \leq m} \min(\gamma_{ij}) \quad j = 1, 2, \dots, n \quad (6)$$

The positive ideal solution is the best value to reach all indexes of the evaluation object. Negative ideal solution refers to the worst value of each index of the evaluation object. This paper takes the positive index, so the positive ideal solution is the maximum value and the negative ideal solution is the minimum value.

Calculation of Euclidean distance:

$$dis_i^+ = \sqrt{\sum_{j=1}^n [\delta_j * (S_j^+ - \gamma_{ij})^2]} \quad (7)$$

$$dis_i^- = \sqrt{\sum_{j=1}^n [\delta_j * (S_j^- - \gamma_{ij})^2]} \quad (8)$$

Calculate the close degree between each evaluation unit and ideal solution:

$$C_i = \frac{dis^-}{dis^- + dis^+} \quad i = 1, 2, \dots, m \quad (9)$$

According to the degree of closeness, the evaluation units are ranked according to their advantages and disadvantages, the higher the C_i value, the higher the ranking, the higher the level of financial agglomeration is.

4. ANALYSIS AND EVALUATION OF COUNTY FINANCIAL AGGLOMERATION LEVEL

4.1 Calculation Results of Financial Agglomeration Level of Counties in Hebei Province

First, standardize each group of data, and then combine formula (3) - (9) through calculation, According to the entropy value and weight of each index, the evaluation results of financial agglomeration level, financial environment, financial scale and financial institutions of each county in the first level and six indicators in the third level are calculated.

Table 2 The top 10 ranks of county financial aggregation level for each year during 2013-2018

2013		2014		2015		2016		2017		2018	
Yutian	0.7359	Yutian	0.7659	Yutian	0.6905	Xianghe	0.7279	Xianghe	0.7605	Xianghe	0.8435
Zhengding	0.7197	Zhengding	0.7181	Zhengding	0.6704	Gu'an	0.6463	Gu'an	0.6326	Gu'an	0.7308
Luan	0.6902	Luan	0.6959	Xianghe	0.6437	Zhengding	0.5657	Zhengding	0.4651	Dachang	0.4575
Qianxi	0.6361	Qianxi	0.6263	Luan	0.6341	Yutian	0.5158	Luan	0.4409	Zhengding	0.4210
Laoting	0.5994	Laoting	0.6197	Gu'an	0.5801	Luan	0.4840	Yutian	0.4296	Yongqing	0.3761

Xianghe	0.5736	Xianghe	0.5857	Laoting	0.5642	Dachang	0.4434	Dachang	0.4141	Luan	0.3690
Luannan	0.5423	Luannan	0.5607	Qianxi	0.5575	Laoting	0.4070	Ningjin	0.3610	Yutian	0.3600
Wenan	0.4900	Ningjin	0.5051	Luannan	0.5004	Qianxi	0.4022	Laoting	0.3608	Ningjin	0.3203
Ningjin	0.4897	Wenan	0.4807	Ningjin	0.4814	Ningjin	0.3932	Qianxi	0.3459	Laoting	0.2959
Kuancheng	0.4478	Gu'an	0.4635	She	0.4272	Luannan	0.3691	Yongqing	0.3447	Qianxi	0.2811

Table 3 The last ten ranks of county Financial agglomeration level for each year during 2013-2018

2013		2014		2015		2016		2017		2018	
Huaian	0.1352	Huaian	0.1381	Wuqiao	0.1320	Wuqiao	0.0961	Xinhe	0.0219	Xinhe	0.0203
Wuqiao	0.1409	Wuqiao	0.1389	Neiqiu	0.1349	Linxi	0.1001	Baixiang	0.0229	Baixiang	0.0204
Yangyuan	0.1428	Laiyuan	0.1411	Shenze	0.1354	Neiqiu	0.1009	Shangyi	0.0305	Shangyi	0.0292
Laiyuan	0.1453	Neiqiu	0.1466	Huaian	0.1385	Shenze	0.1057	Boye	0.0398	Boye	0.0324
Shenze	0.1453	Shenze	0.1511	Yangyuan	0.1471	Julu	0.1172	Haixing	0.0426	Haixing	0.0415
Jize	0.1472	Jize	0.1522	Jize	0.1501	Nanhe	0.1205	Fuping	0.0530	Shunping	0.0435
Julu	0.1527	Yangyuan	0.1594	Julu	0.1520	Yangyuan	0.1210	Shunping	0.0543	Guyuan	0.0495
Neiqiu	0.1600	Julu	0.1675	Zanhuang	0.1581	Wuyi	0.1237	Guyuan	0.0548	Fuping	0.0503
Fucheng	0.1602	Guantao	0.1683	Lingshou	0.1603	Jize	0.1245	Guangzong	0.0578	Wangdu	0.0538
Guantao	0.1660	Zanhuang	0.1703	Guantao	0.1633	Zanhuang	0.1246	Wuqiang	0.0595	Guangzong	0.0538

4.2 Gradient Division and Gradient Analysis

According to the calculation results of 2013-2018 and the comprehensive ranking of financial agglomeration degree of 101 counties in Hebei Province, 101 counties in Hebei Province show obvious gradient distribution. The first echelon is mainly distributed in the east of Hebei Province, adjacent to Bohai Sea, and located in the core area of Beijing Tianjin wing urban agglomeration. As a national comprehensive transportation hub, this region usually has the location advantage of connecting multiple provinces. It develops in coordination with Beijing, Tianjin and Hebei, and is close to the Bohai Sea. It is suitable to establish trade ports and carry out free trade. For example, Yutian County, Luan county, Leting County, Qianxi County in Tangshan area, Xianghe County in Langfang City, Kuancheng Manchu Autonomous County in Chengde City, Zhengding County in Qinhuangdao City, Ningjin County in Chengde City, etc. the financial agglomeration evaluation of these counties is relatively high, with an average value of 0.4-0.6 in the past five years.

The second echelon is mainly located in the south of Hebei Province. There are many cultural ancient cities and developed tourism industry, which can attract

more financial resources, such as Pingshan County, Zhao county and Yuanshi County in Shijiazhuang City, Weixian County, Cixian county and Shexian County in Handan City, Cangxian County, Xianxian County in Cangzhou City, Jingxian County in Hengshui City, etc. The evaluation of these counties in four years is slightly lower than the first gradient, between 0.3 and 0.4.

The third echelon is relatively scattered, involving different counties in different cities, such as Qingxian, Gucheng, Fucheng, Wuyi, Yi, Lulong, Linzhang, Nanhe, etc., with a general degree of concentration, between 0.1 and - 0.3;

The last echelon, relatively speaking, is not superior in geographical location and has no obvious location advantages, such as Baixiang County, Xinhe County, Guangzong County in Xingtai City, Shangyi County, Guyuan County, Kangbao County in Zhangjiakou City, Boye County, Fuping County, Shunping County, Wangdu County in Baoding City, etc. Due to the low regional production volume, low residents' income, low savings, too few regional financial institutions, and gold lack of financial services, financial agglomeration evaluation is usually below 0.1.

Table 4 Representatives of the first echelon of financial agglomeration in county regions from 2013-2018

The first echelon	2013	2014	2015	2016	2017	2018	Average
Xianghe	0.5736	0.5857	0.6437	0.7279	0.7605	0.8435	0.6892
Zhengding	0.7197	0.7181	0.6704	0.5657	0.4651	0.4210	0.5933
Yutian	0.7359	0.7659	0.6905	0.5158	0.4296	0.3600	0.5829
Luan	0.6902	0.6959	0.6341	0.4840	0.4409	0.3690	0.5523
Qianxi	0.6361	0.6263	0.5575	0.4022	0.3459	0.2811	0.4748
Leting	0.5994	0.6197	0.5642	0.4070	0.3608	0.2959	0.4745
Ningjin	0.4897	0.5051	0.4814	0.3932	0.3610	0.3203	0.4251
Wenan	0.4900	0.4807	0.4213	0.3464	0.3048	0.2587	0.3836

Table 5 Representatives of the second echelon of financial agglomeration in county regions from 2013-2018

The second echelon	2013	2014	2015	2016	2017	2018	Average

She	0.4078	0.4127	0.4272	0.3340	0.3010	0.2758	0.3598
KuanchengManzuzizhi	0.4478	0.4504	0.4065	0.3250	0.2692	0.2327	0.3553
Cang	0.4369	0.4349	0.4118	0.3179	0.2677	0.2343	0.3506
Changli	0.4416	0.4500	0.3933	0.2912	0.2749	0.2192	0.3451
Wei	0.3551	0.3814	0.3826	0.3037	0.2830	0.2551	0.3268
Xian	0.3656	0.3860	0.3809	0.3122	0.2680	0.2457	0.3264
Jing	0.3931	0.3978	0.3689	0.2953	0.2589	0.2253	0.3232
Pingshan	0.3890	0.3873	0.3248	0.2875	0.2639	0.2245	0.3128
Zhao	0.3617	0.3671	0.3315	0.2606	0.2311	0.1957	0.2913
Ci	0.4362	0.4205	0.4085	0.2104	0.1589	0.1300	0.2941

Table 6 Representatives of the third echelon of financial agglomeration in county regions from 2013-2018

The third echelon	2013	2014	20 15	2016	2017	2018	Average
Qing	0.3411	0.3435	0.3217	0.2501	0.2218	0.1913	0.2783
Yuanshi	0.3069	0.3197	0.3088	0.2506	0.2185	0.1964	0.2668
Gucheng	0.2833	0.3081	0.2904	0.2276	0.2023	0.1758	0.2479
Linzhang	0.2667	0.2828	0.2785	0.2230	0.1980	0.1785	0.2379
Yi	0.2671	0.2755	0.2446	0.1837	0.1677	0.1369	0.2126
Lulong	0.2492	0.2650	0.2363	0.1554	0.1361	0.1063	0.1914
Wuyi	0.1729	0.1743	0.1650	0.1237	0.1105	0.0944	0.1401
Fucheng	0.1602	0.1757	0.1689	0.1359	0.1183	0.1057	0.1441
Nanhe	0.1172	0.1341	0.2173	0.1205	0.1103	0.1124	0.1353

Table 7 Representatives of the fourth echelon of financial agglomeration in county regions from 2013-2018

The fourth echelon	2013	2014	2015	2016	2017	2018	Average
Wangdu	0.1062	0.1119	0.0850	0.0692	0.0718	0.0538	0.0830
Kangbao	0.0932	0.0998	0.1037	0.0737	0.0624	0.0559	0.0814
Shunping	0.1051	0.1011	0.0884	0.0633	0.0543	0.0435	0.0759
Guyuan	0.0815	0.0844	0.0879	0.0640	0.0548	0.0495	0.0704
Guangzong	0.0719	0.0801	0.0840	0.0662	0.0578	0.0538	0.0690
Fuping	0.0659	0.0607	0.0583	0.0546	0.0530	0.0503	0.0571
Boye	0.0712	0.0752	0.0669	0.0477	0.0398	0.0324	0.0555
Shangyi	0.0437	0.0444	0.0504	0.0369	0.0305	0.0292	0.0392
Xinhe	0.0357	0.0359	0.0387	0.0273	0.0219	0.0203	0.0300
Baixiang	0.0285	0.0350	0.0323	0.0271	0.0229	0.0204	0.0277

4.3 The Analysis of the Evolution Trend of Financial Agglomeration Level

Judging from the data variation of county finance

Table 8 The rank of Financial agglomeration trends

Top ten positive changes		Top ten negative changes	
Yongqing	↑47	Ci	↓39
Dachang	↑33	Jingjing	↓34
Nanhe	↑24	Gaoyang	↓21
Fengning	↑18	Zhangbei	↓18
Wei	↑17	Qinglong	↓17
Ren	↑16	Anxin	↓13
Chengan	↑15	Changli	↓12
Huailai	↑15	Laiyuan	↓12
Guan	↑15	Tang	↓12
Quzhou	↑14	Suning	↓11

Yongqing County is the one which extremely affected by financial scale, Dachang the Hui Nationality Autonomous County and Nanhe County largely positively changed, what's more, Yongqing county and Dachang the Hui Nationality Autonomous County all belong to Langfang City, Nanhe county locates in

agglomeration in Hebei province from 2013 to 2018, the level of county finance agglomeration had small fluctuations.

south Hebei. According to data analysis, Dachang the hui nationality autonomous county all positive affected by three indicators in the secondary indicator, which improved balancelly the ranking of county financial agglomeration. The ranking of financial agglomeration of Dachang the Hui Nationality

Autonomous County rose 33 places, from 36th place to 3rd place. It's predicted that county financial agglomeration of Langfang City will accelerate the trend of financial agglomeration with Yongqing County and Dachang the Hui Nationality Autonomous County, which drive the degree of fit of financial agglomeration.

Nanhe County was positively affected by financial environment, the ranking rose from 82nd place to 58th place. From Nanhe county's relatively weak economic background, The GDP was ranked at the end of Hebei Province, and the degree of financial agglomeration was not high. Since government has continued to increase the trace investigation of financial risks, clear up financial environment. The government finds out the financial risks of the whole county, and investigates, tracks, and rectifies illegal financial organizations and illegal financial activities. The government carefully deployed the township people's government and its competent departments and clarifies the accountability system. The government's measures to defuse financial risks have created a good financial ecological environment and improved financial environment index parameters.

From the three evaluation indicators of financial scale, financial environment, and financial institution, the

Table 9 Hierarchical comparison of financial agglomeration degree from 2013 to 2018

	Financial agglomeration degree	2013	2018
X^1	C_i	0.3828	0.3411
X^2	C_i	0.2484	0.2272
X^3	C_i	0.2275	0.1135

5. CONCLUSIONS AND SUGGESTIONS

This paper used entropy weight method and TOPSIS method measure of financial agglomeration degree in Hebei Province in 2013-2018. The calculation results indicate that the level of county financial agglomeration degree in Hebei Province shows obvious agglomeration distribution and gradient distribution, and among the rest, the financial agglomeration level of counties in the eastern Hebei Province, near the Bohai Sea and in the areas of coordinated development with jing-jin-ji area is relatively high, while that of Baoding City, Xingtai City and Zhangjiakou City is relatively backward, and the financial agglomeration level of counties is relatively low. The development trend of Hebei's overall financial agglomeration is declining, and it is greatly influenced by the indicator of the Resident Savings Deposits.

In view of the development status of county financial agglomeration in Hebei Province, the following development suggestions are put forward:

First, the government should strengthen the integration cooperation between Beijing, Tianjin and Hebei, deepen the cooperation field, and bring the county into the scope of cooperation. Hebei should pay more attention to the leading role and awesome

three county with the largest negative changes are Ci County, Jingxing County, Gaoyang County. Compared with 2013, their fit degree all showed a weak trend, especially for Ci County, its ranking in 101 counties fell directly from upper place down to the middle place.

Financial environment of counties in Hebei Province are relatively stable, which accord with gradual and steady development of Hebei Province. The external environment included relevant social credit mechanism, government support and judicial enforcement still has broad development; its internal financial service level such as the development of innovative frontiers of financial products and the effect of financial ability still need to be improved.

The aggloration of financial institution of counties is closely related to the area and population of county. The larger the county area is, the greater county population capacity is, and the degree of financial agglomeration will be higher. At present, except for a small number of county changing area, county boundaries are clearly demarcated, the land area in Hebei is basically stable. Although affected by the characteristics of transprovincial and internal county population movement, the relatively stable population characteristics make the financial scale change less.

role of regional financial development, increase the utilization and supply of financial resources and promote the coordinated development of the overall financial economy. Through multiple cooperation, give full play to the location and transportation advantages of Hebei Province, expand the channels of foreign exchanges, and accelerate the effect of financial agglomeration and financial radiation effect. Second, improve the financial infrastructure, establish more county financial service institutions, and supplement capital for small and medium-sized banks to improve the county financial service level, providing convenience for the development of local enterprises, and attract more enterprises in developed areas such as Beijing to increase investment in the development of Hebei County economy, so as to provide the effective strength for the development of Hebei County Economy and finance.

Third, Relaxing restrictions on financial products moderately. To encourage financial institutions improved and innovate county financial products, we can provide targeted tax, subsidy and other policy support, increase the strength of providing small and medium-sized loans to small and medium-sized enterprises, promote the upgrading and transformation of county industry in Hebei Province, and achieve the

purpose of comprehensively optimizing the industrial structure and industrial layout of Hebei Province. Fourth, the government should strengthen the development and construction of Internet financial platform, create a high-quality Internet financial environment in Hebei Province. The future development trend is digital currency. Therefore, the development of Internet Finance in Hebei Province should also keep pace with the times, cultivate financial services and financial auxiliary industries, establish an open and innovative financial market through pilot projects, and accelerate the development of Hebei Financial Industry by playing the role of radiation effect.

Fifth, improve the financial supervision system, implement local financial policies, strictly implement the laws, regulations and relevant policies on administrative penalties for Financial Violations issued by the central government, and promote the formation of ecological closed-loop in Hebei financial circle.

ACKNOWLEDGEMENTS

The authors acknowledge Research Start-up Funds of North China University of Technology (110051360002); Basic Scientific Research Project of the Beijing Municipal Education Commission in 2018 (110052971921); the subject of innovation and Entrepreneurship Plan for University students in North China University of Technology (203050360019XN176).

REFERENCES:

[1]Kong Peiyi, Jiang Hang. Analysis on key factors of building Xiamen free trade zone into a regional international financial center based on d-anp, *Modern city research*, 2019, (03): 83-90.
 [2]Zheng Wei, Lu Yuanquan. Spatial structure of China's financial supply and upgrading of industrial structure: a study based on the perspective of local financial development and regional financial center construction, *International finance research*, 2019,

(02): 13-22.

[3]Chen Linxin, he Yiqing, Wang Yun, Jia Weiqiang. SD Simulation of spatial panel data of financial agglomeration, economic development and ecological efficiency, *Systems engineering*, 2017, 35(01): 23-31.
 [4]Feng Lin, Liu Huajun, song Jianlin. Evaluation of county financial agglomeration based on entropy weight TOPSIS method: a case study of Shandong Province, *Journal of Shandong University of Finance and economics*, 2016, 28(02): 1-9.
 [5]Zhang Chao, Zheng changjuan, Li Shuyan. Measurement of county financial agglomeration level in Ningbo based on entropy method, *Journal of Hubei University of Arts and Sciences*, 2019, 40(02): 24-28.
 [6]Chen Xi, Tian Zhiwei. Research on financial risk evaluation of listed forestry enterprises based on factor analysis and agglomeration analysis, *Financial theory and practice*, 2017, 38(01): 103-108.
 [7]Jiang ran, financial agglomeration and economic growth in Pan Pearl River Delta region: Based on data analysis from 1982 to 2007, *Economic Research Guide*, 2010, (20):60-61.
 [8]Chun-Xiao Nie. Dynamics of agglomeration structure in financial correlation matrix, *Chaos, Solitons and Fractals: the interdisciplinary journal of Nonlinear Science, and Nonequilibrium and Complex Phenomena*, 2017, 104.
 [9]Zheng Zhiyong. Evaluation and analysis of the level of financial agglomeration in Yangtze River Delta and Beijing Tianjin Hebei region -- TOPSIS index comprehensive evaluation method and Theil index decomposition based on grey correlation, *Journal of Fuqing Branch of Fujian Normal University*, 2020, (01): 26-35+46.
 [10]Deng Danqing, Du qunyang, Feng Lidan, Jia Yuping. Exploration on evaluation index system of global science and technology innovation center -- Empirical Analysis Based on entropy weight TOPSIS, *Science and technology management research*, 2019, 39(14): 48-56.

Using Remote Sensing for Classifying Planting Area and Area Extraction

Na Yao¹, Jie Chen¹, Aiguo Liu²

¹College of Information Engineering, Tarim University, Alaer, 843300, China

²College of Humanities, Tarim University, Alaer, 843300, China

Abstract: Accurate crop location information is of great significance to agricultural economy and food security, so there is a great demand for crop mapping. In this study, an ISODATA algorithm is used to identify crop planting areas in western China, where cotton and red jujube have substantial quantities. Applying the training samples of identified crops obtained by GPS, six kinds of cotton, corn, jujube (different varieties), building area, water (river, reservoir) and desert are classified, and two types of cotton and jujube area information are extracted. The average overall recognition accuracy is 74.21%, and the highest accuracy is 90.19%. These results show that the accuracy of crop identification is very high. The method in this study is very effective for identifying crop distribution and extracting regional information. This study can provide valuable enlightenment for crop condition monitoring and yield estimation in this area.
Keywords: Identification; Planting area; Area extraction; Remote sense

1. INTRODUCTION

Accurate extraction of crop information is greatly significance to remote sensing estimation, agricultural production planning and disaster monitoring. Remote sensing technology has become the main method for quickly and accurately obtaining crop planting area due to its macro, comprehensive and dynamic advantages. Extensive research has been carried out on the planting area [1-5].

The method of extracting crop planting area is generally based on image classification. The research focuses on the selection of data sources with pixels or sub-pixels as the basic processing unit, optimization of sampling methods, feature extraction, selection of classifiers, model establishment, and accuracy evaluation. Wang Qitian etc al [6]. Applied the object-oriented classification method to extract the winter wheat planting area in Tai'an City, Shandong Province using the TM data source, and comparing the classification results of the spectral angle method, the method had higher classification accuracy. Zhang Feng etc al [7]. Applied object-oriented classification methods and used TM images as data sources to extract the cultivated land information of rice planting areas in Thailand to achieve qualitative and quantitative accurate description of land resource using. CHEN yanli etc al [8]. Also applied Object-oriented Classification to extract rice planting area in South,

Achieving higher accuracy. In recent years, there are also new methods to obtain the area of crops, and have achieved good results [9-12].

However, in the face of the characteristics of vast territory and lack of manpower, this paper used free remote sensing images to extract crop area, and the method used cluster analysis. After experiments, it was found that the accuracy was good.

2. MATERIALS AND METHODS

2.1 Study Area

The study area was a 6180-km² city (Figure 1). Local people raised corn, cotton, red jujube, etc, and also different types of trees were planted for greening. We want to classify the following crops: cotton, corn, red jujube (different varieties), architectural District, water (rivers, reservoir), and desert and then extract areas of cotton and red jujube separately. Although this area was not monitored using remote sensing, Other Province was monitored by remote sensing and cotton areas were extracted (Huang Qing 2010, Li Min2011, Wang Kai 2015).

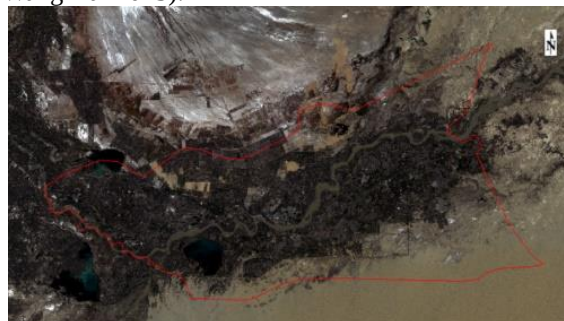


Figure 1 Imagery of remote sensing. Imagery is from landsat8 Operational Land Imager (OLI) and resolution is 30m.

2.2 Data

Landsat 8 is a scientific product intended for use with specialized remote sensing. The satellite returns to the same place on Earth occur every 16 days and at the same time of day. It records new scenes depending on the weather below and other collection requirements. Landsat 8 scenes are georeferenced and orthorectified to elevation data. They are in the UTM/WGS 84 coordinate system. The ground resolution (how much distance each pixel represents on Earth) of the bands is generally 30 meters. Band 8 containing panchromatic data at 15-meter resolution is an important exception. Bands 10 and 11 are up sampled to 30-meter resolution from data collected at 100-meter resolution. The image we used has 7 bands. Six Landsat 8 images from May

21 to October 12 in 2016 were selected during the growing seasons of crops, as Table 1.

Table 1 Landsat 8 images used in this study

No.	Scene ID	Acquisition date	Acquisition time (GMT)
1	LC81460322016142LGN00	May 21,2016	05:15:15
2	LC81460322016190LGN00	July 08,2016	05:15:34
3	LC81460322016206LGN00	July 24,2016	05:15:39
4	LC81460322016222LGN00	August 09,2016	05:15:41
5	LC81460322016270LGN00	September 26,2016	05:15:53
6	LC81460322016286LGN00	October 12,2016	05:15:58

2.3 Method

The Environment for Visualizing Images (ENVI) is a Remote Sensing Image Processing Platform that was designed and developed for extracting information from remote sensing images by Exelis Visual Information Solutions Company. The ENVI can read more than 80 data formats and can analyze information in images. The data formats from Landsat 8 are TIFF and TXT formats. The images were downloaded according to latitude 40. And longitude 81. With World Wide Reference System (WRS) PATH of 146 and WRS ROW of 32. The images have different features with different growth periods, so we downloaded 5 Scene Images from July to October, 2016.

Image in ENVI must be preprocessed before classification because of the errors produced by the sensor itself and the influences of atmosphere and light on the reflection of objects. Images preprocessing include two steps: 1) Radiometric Calibration; 2) Fast Line-of-sight Atmospheric Analysis of Hypercubes (FLAASH) Atmospheric Correction. Scale factor is 0.10 and output interleaved is band interleaved by line format (BIL) for Radiometric Calibration. Selecting the Mid-Latitude Summer as Atmospheric model and choosing Urban as Aerosol model in the step of FLAASH Atmospheric Correction. Classification is a workflow of three steps: 1) layer stacking of origin image, Normalized Difference Vegetation Index (NDVI) image and Iterative Self-Organizing Data Analysis (ISODATA) classification image; 2) training sampling based on GPS data; 3) Classification And Regression Tree (CART) algorithm for classification; 4) compute areas of cotton field and red jujube field.

ENVI version 5.3 was used to calculate various vegetation indices. NDVI was used:

$$NDVI = (R_{NIR} - R_R) / (R_{NIR} + R_R), (1)$$

Where R_{NIR} = NIR reflectance and R_R = red reflectance.

The image from Landsat 8 has different features, so Iterative Self-Organizing Data Analysis (ISODATA) algorithm was used to classify firstly. Number of classes is set for 10 as maximum value and 5 as minimum value, respectively. Maximum number of iterations is 10 and the value of Change Threshold is 5%, while the value of Maximum Class Stdv is 1 and the value of Minimum Class Distance is 5. A classified image was outputted as initial classified image. Layer

stacking was used to fuse origin image with 7 bands, NDVI image with 1 band and ISODATA classification image with 1 band to a synthetic image with 9 bands.

Global Positioning System (GPS) was needed to achieve correct information of image from Landsat 8. We used Androids GPS test in mobile phone to acquire longitudes and latitudes of sites in which we can know the type of crops planted by field observation. The positioning accuracy is 10 m in this system with coordinate system of World Geodetic System 1984 (WGS84). 2 sites were located with corn and 10 sites with Cotton and 10 sites with red jujube. Then training samples were selected from images according with longitude and latitude of every site in ENVI synthetic image. 485 pixels were sampled as Cotton samples, and 329 pixels were sampled as red jujube samples, and 48 pixels as corn samples, and 472 pixels as architectural District samples, and 679 pixels as water samples, and 1844 pixels as desert samples. CART algorithm was used to facilitate synthetic image classification. We computed areas based on numbers of pixels of every class by formula (2):

$$AEAR = \text{Number} \times 900m^2 (2)$$

3. RESULT AND DISCUSSION

Six classes of cotton, corn, red jujube (different varieties), architectural District, water (rivers, reservoir), and desert were assorted on six remote sensing imagery as shown in Table 1. In Figure 2, the class of 1 presents cotton and 2 presents red jujube. The image of Figure 2 was from No. 4 from in Table. 1. After the treatment in this paper, the calculated area of cotton and red jujube can be seen in Table 2 and Table 3, the accuracy rate is up to 90.19%.

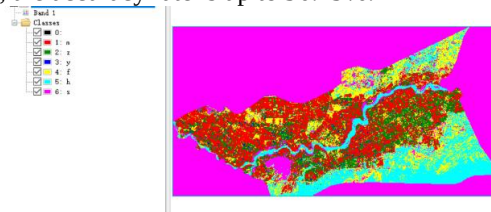


Figure 2 Classification of remote sensing imagery (LC81460322016222LGN00, August 09, 2016)

The accuracy of GPS positioning affects the accuracy of sampling, especially for small planting area, because it is difficult to distinguish different categories of pixels with 30 m resolution image. Moreover, the same type planting area has different image feature, but we identified the same kind of pixels with different features as the same kind of training samples. We

sampled architectural District training data, water training data and desert training data according to experience without GPS positioning. The error of

training samples leads to the accuracy of final classification results.

Table 2 Accuracy of cotton area

No.	Scene ID	Calculated value(mu)	Reference(mu)	Accuracy (%)
1	LC81460322016142LGN00	1052473.1	2029388	51.86
2	LC81460322016190LGN00	1380341.25	2029388	68.02
3	LC81460322016206LGN00	1337494.95	2029388	65.91
4	LC81460322016222LGN00	1684102.05	2029388	82.99
5	LC81460322016270LGN00	1830462.3	2029388	90.19
6	LC81460322016286LGN00	1635225.3	2029388	80.58

Table 3 Accuracy of red jujube area

No.	Scene ID	Calculated value(mu)	Reference(mu)	Accuracy (%)
1	LC81460322016142LGN00	971838	715087	64.10
2	LC81460322016190LGN00	974031.65	715087	63.79
3	LC81460322016206LGN00	967274.6	715087	64.73
4	LC81460322016222LGN00	808240.75	715087	86.97
5	LC81460322016270LGN00	786552.95	715087	90.01
6	LC81460322016286LGN00	848368.25	715087	81.36

4. CONCLUSION

This paper applies ISODATA algorithm to classify crop planting areas. Six classes of cotton, corn, red jujube (different varieties), architectural District, water (rivers, reservoir), and desert were identified, while two classes of cotton and red jujube area information were extracted. Average identification accuracy of cotton was 73.26% and Average identification accuracy of red jujube was 75.16%. So, average overall identification accuracy was 74.21%, while the highest accuracy is up to 90.19%. These results indicate that the accuracy of crop identification is well. This study can provide foundation for crop condition monitoring and yield estimation in the region.

ACKNOWLEDGMENTS

The authors are thankful for the support from Key Laboratory of Modern Agricultural Engineering, Tarim University (No.: TDNG20170503).

REFERENCES

- [1]T. Kurosu, M. Fu, Jita, and K. Cchiba, The Identification of Rice Fields Using Multi-temporal ERS-1 C-band SAR Data. *International Journal of Remote Sensing*, 1997, 18(14): 2967- 2984.
- [2]K. Okamoto, and H. K. Ashima, Estimation of Rice-land Planted Area in the Tropical Zone Using a Combination of Optical and Microwave Satellite Sensor Data. *International Journal of Remote Sensing*, 1999, 20(5): 1045-1048.
- [3]B. F. Wu, and H. Y. Liu, The Operational Methods for Rice Area Estimation Using Remote Sensing. *Journal of Remote Sensing*, 1997, 1(1): 58-63.
- [4]H. L. Fang, A Discussion On Two Strategies Applied To Estimate Rice Planting Area Of An Administrative Division Using Remote Sensing Technique. *Acta Geographica Sinica*, 1998, 65(1): 58-65.

- [5]S. D. Liao, and Q. F. Liao, Rice Mapping in Large Area Using Radarsat SNB-SAR Data. *Tropical Geography*, 2001, 21(4): 346-349.

- [6]Q. T. Wang, X. G. Lin, and Z. J. Wang, et al. Extraction of Winter Wheat Planting Area by Object-oriented Classification Method. *Science of Surveying and Mapping*, 2008, 33(2): 143-146.

- [7]F. Zhang, B. F. Wu, and H. P. Huang, et al. Study of Ploughed Field Information Extraction in Rice Area of Thailand. *Journal of Natural Resources*, 2003, 18(6): 766-772.

- [8]Y. L. Chen, W. H. Mo, J. F. Mo, J. H. WANG, and S. Q. Zhong, Object-oriented Classification for the Extraction of Rice Planting Area in South. *Remote Sensing Technology and Application*, 2011, 26(2): 163-168.

- [9]X. Gu, Y. Pan, X. He, and J. Wang, Estimation of Maize Planting Area through the Fusion of Multi-source Images. *IFIP Advances in Information and Communication Technology*, 2012, 369.

- [10]J. W. Dong, and X. Ming, et al. Tracking the dynamics of paddy rice planting area in 1986–2010 through time series Landsat images and phenology-based algorithms. *Remote Sensing of Environment*, 2015.

- [11]Z. Y. Sun, X. F. Wang, H. Yamamoto, J. Q. Zhang, H. Tani, G. S. Zhong, and S. Yin, Extraction of rice-planting area and identification of chilling damage by remote sensing technology: a case study of the emerging rice production region in high latitude. *Paddy and Water Environment*, 2017, (15): 181-191.

- [12]L. Xun, P. Wang, and L. Li, et al. Identifying crop planting areas using Fourier-transformed feature of time series MODIS leaf area index and sparse-representation-based classification in the North China Plain. *International journal of remote sensing*, 2019, 40(5-6): 2034-2052.

Comparison of Reduction of Ilmenite Concentrate with Hydrogen and Carbon Monoxide

Xinguo Si, Ermin Zhao

HBIS Group Tangsteel Company, Tangshan, 063020, Hebei, China

Abstract: Reduction of ilmenite concentrate containing 45.24% TiO_2 and 32.62% total Fe was studied by hydrogen and carbon monoxide gas with gas flow rate of 100ml min^{-1} at 1150°C . Weight loss and metallization rate enhanced with prolonging of reaction time. The phase transformation, chemical composition, microstructure and morphology of reduced samples were investigated by using X-ray diffraction, scanning electron microscopy. Metallization rate of reduction products could reach to above 86% by reduction of hydrogen with 80min and carbon monoxide with 300min. Phase transformation of products are similar on the condition of different reduction gas. Hematite phase is reduced prior to ilmenite phase. Final samples contain metallic iron and M_3O_5 solid solution mainly. Metallic iron phases appear on outer margins of samples firstly, then they diffuse to interior gradually and present in the whole particles irregularly. Metallic iron phases are mainly present as tiny vermicule in hydrogen, however, as major particles in carbon monoxide. Reduction reaction of ilmenite concentrate from Fe^{3+} to Fe^{2+} should be controlled by diffusion below 900°C with hydrogen and carbon monoxide. At the temperature range from 950°C to 1200°C , the diffusion process is all also the rate-controlling step with Fe^{2+} to Fe, which activation energy is 59.088kJ mol^{-1} and 73.429kJ mol^{-1} respectively and one of hydrogen reduction is less 14.341kJ mol^{-1} .

Keywords: Ilmenite concentrate; Reduction; Hydrogen; Carbon monoxide; Metallization rate

1. INTRODUCTION

Titanium oxides can be not only prepared for metal titanium by chlorination process and metallothermic reduction directly but also widely used in paper, plastics and pigment industries with increasing rapidly [1,2]. However, rutile mineral is decreasing worldwide because it is exploited largely in the present, so low-grade minerals as ilmenite concentrate are being given attention. But it is necessary to be refined to obtain high-titanium material owing to the high content of impurities with especially iron oxides [3-8].

Table 1 Chemical compositions of ilmenite concentrate, wt-%

Total Fe	TiO_2	Fe_2O_3	FeO	MgO	CaO	MnO	Al_2O_3	SiO_2
32.62	45.24	24.17	20.19	6.6	1.19	0.74	1.08	3.73

Over the past several decades, many studies have been conducted on the reduction of ilmenite concentrate. Pesl and Eric investigated carbothermic reduction of $\text{Fe}_2\text{O}_3\text{-TiO}_2\text{-MxOy}$ oxide mixtures from 1500°C to 1700°C , which indicated that under strong reducing conditions iron oxide was almost completely reduced and under weak reducing conditions a fully molten slag was stable as iron was only partially reduced [4]; Solid state reduction of a natural ilmenite was studied with graphite under argon between 1250°C and 1350°C by Kucukkaragoz and Eric, it could be known that reduction of ilmenite consisted of two stages: reduction of Fe^{3+} to Fe^{2+} to Fe0 and Ti^{4+} to Ti^{3+} and formation of Fe3C until 50% reduction level, and reduction of Ti^{3+} to Ti^{2+} and eventually formation of TiO_{1-x} after 50% level [5]; Pourabdoli et al. studied smelting of ilmenite concentrate by Electro-Slag Crucible Melting process to produce TiO_2 -rich as primary product and pig iron as by-product, at optimum conditions, TiO_2 content in slag and the iron recovery are 70% and 84% respectively [6]; reduction of ilmenite by hydrogen or carbon monoxide was studied by Merk et al. or Sun et al., in which the reduction rate increased with increasing temperature and the reduction proceeded through the stages of Fe^{3+} to Fe^{2+} and Fe^{2+} to Fe0 [7,8].

Hydrogen and carbon monoxide as gas mixture or waste gas are provided or discharged widely in the industry. For instance, coke oven gas, blast furnace gas and converter waste gas and so on in steel and iron industry [9,10]. Valuable energy as reduction gas or fuel is utilized deficiently and wasted partly. According to the above, we plan to use the waste gas to reduce ilmenite concentrate to acquire high-titanium material. Contents in the paper are one of the basic researches in the whole plans.

The aim of the present investigation is to establish the difference between reduction of ilmenite concentrate by hydrogen and carbon monoxide and experimentally determine the possible stages of reactions taking place and the nature of phase transition in reactive process.

2. EXPERIMENTAL DETAILS

2.1 Material and Gas

Ilmenite concentrate as raw material is provided by

Panzhihua iron and steel research institute, Pangang

group. Chemical compositions are listed in Table 1. In the experiment, 69.879 μm of ilmenite concentrate average particle diameter was used. High pure hydrogen, carbon monoxide and argon, which purity is in excess of 99.99%, are used as reducing gas and shielding gas.

2.2 Reduction Equipment and Procedure

The experiments were conducted with a reactor of quartz in a horizontal SiC furnace fitted with an S type thermocouple, which was controlled by the Lindberg UP150 temperature programmed control instrument. The reactor had a total length of 1500mm and an inner diameter of 28mm. The length of isothermal section was 20 mm, the temperature has an accuracy of $\pm 3^\circ\text{C}$. The experiments were conducted with a gas flow of 100ml min⁻¹ of hydrogen and carbon monoxide. A schematic layout of the laboratory setup is presented in Figure 1.

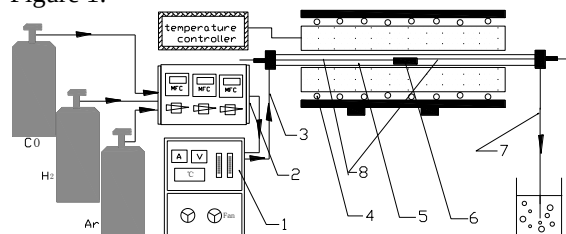


Figure 1 Schematic layout of the laboratory setup
1-gas purification system; 2-gas flow controller; 3-gas inlet pipe; 4-SiC rod; 5-quartz tube; 6-alumina boat; 7-gas outlet pipe; 8-metal wire

Firstly, the specimens were put in the alumina boat in Figure 1, and then the alumina boat with 2000mg ilmenite concentrate was placed on the left side of quartz tube, simultaneously, argon was purged to provide an inert atmosphere in the reaction zone; Secondly, the boat was pulled into isothermal section and kept for a certain time when temperature reached 1150 $^\circ\text{C}$ at the heating rate of 5 $^\circ\text{C}$ min⁻¹; Finally, the boat was withdrawn to the beginning side, then temperature started to decrease till the room temperature and specimens were prepared for subsequent test and analysis.

2.3 Analytical Work

The phases were identified and examined by XRD (X-Ray Diffraction) analyzer and using OM (Optical Microscope). Microphotographs of the specimens were taken by an image analyzer. The electron images of the particles were taken by SEM (Scanning Electron Microscopy).

3. RESULTS AND DISCUSSION

A typical result is illustrated in graphical form in Figure 1. The weight loss was assumed to be due to deoxidation of sample by reaction gas during a reduction experiment. Weight loss was calculated using Eq. (1):

$$\text{Weight loss (\%)} = \frac{m_0 - m_t}{m_0} \times 100 \quad (1)$$

where m_0 and m_t are the weight of sample before and after reaction at time t respectively.

And in the paper, Fe is regard as subject investigated

of metallization rate. Therefore, metallization rate may be represented by

$$\text{Metallization rate (\%)} = \frac{m_{Fe} - m_{Fe_t}}{m_{Fe}} \times 100 \quad (2)$$

where m_{Fe} is the total weight of Fe element in ilmenite concentrate before reaction and m_{Fe_t} is the weight of metallic iron in product. m_{Fe_t} is measured by applying chemical titration analyses.

3.1 Effect of Reaction Time on Weight Loss and Metallization Rate

Plots of weight loss and metallization rate of ilmenite concentrate by hydrogen and carbon monoxide as a function of reaction time are shown in Figure 2 (a) and Figure 2 (b).

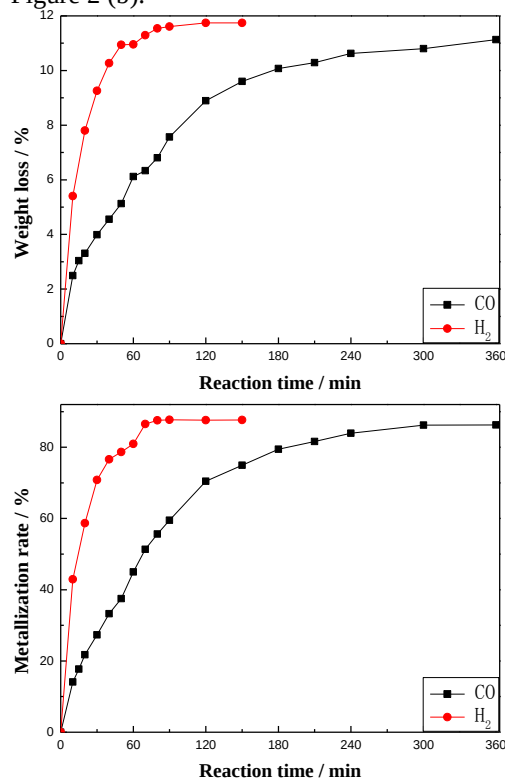


Figure 2 Effects of time on weight loss and metallization rate with hydrogen and carbon monoxide at 1150 $^\circ\text{C}$

From Figure 2, it can be seen that weight loss and metallization rate increase sharply at the beginning step and slowly afterwards with increasing reaction time at 1150 $^\circ\text{C}$. Metallization rates, reach to 87.6% and 86.2%, level off after reaction time extent is in excess of 80min for hydrogen and 300min for carbon monoxide. Here indicates that reaction rate and reducing capacity proceeds more rapidly by hydrogen than carbon monoxide. According to comparison of reaction time in Figure 2, reaction time, during which metallization rate reaches constant, is 4 times approximately with carbon monoxide than with hydrogen.

3.2 Phase Characteristics of Reduction Products

Phase compositions of the reduction products were characterized by XRD, and shown in Figs.3 (A~B), all peaks of samples match well with the standard XRD

pattern for each phase.

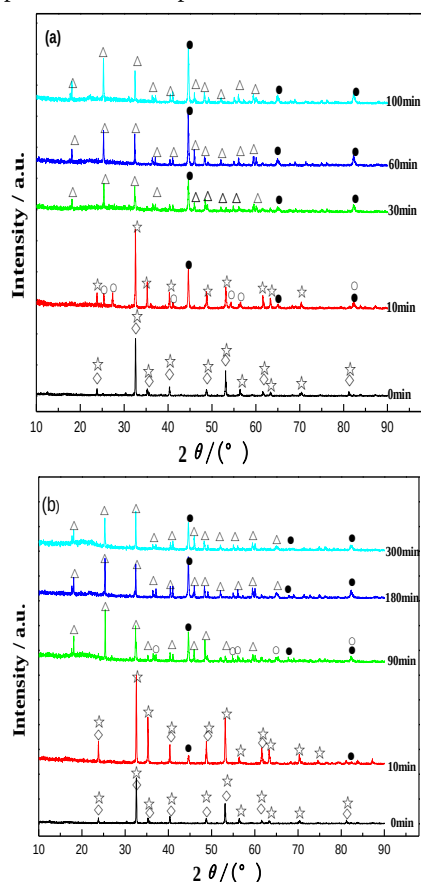


Figure 3 XRD patterns of the reduction products by carbon monoxide and hydrogen at 1150 °C for different time

(a): sample reduced by hydrogen; (b): sample reduced by carbon monoxide

☆—FeTiO₃; ●—Fe; ○—TiO₂; △—M₃O₅; ◇—Fe₂O₃

Figure 3 shows XRD patterns of samples reduced with carbon monoxide and hydrogen respectively for different reduction time at 1150 °C. Changeable trend of the diffraction peaks of reduction products, which are reduced by hydrogen, is same as ones with carbon monoxide in Figure 3. Ilmenite concentrates contain mainly Fe₂O₃ and FeTiO₃ phases, and the others are less. The diffraction peaks of Fe₂O₃ vanish and ones of FeTiO₃ weaken, simultaneously, Fe and TiO₂ diffraction peaks appear and are gradually broadened with the increase of reduction time. Then FeTiO₃ disappear but TiO₂ decreases further and the M₃O₅ solid solution emerges and strengthens sharply, so that the final reduction products compose of metallic iron and M₃O₅ solid solution. And M₃O₅ solid solution phase in the products, in which most of M are Mg, Ti and less Fe, is remarkably complicated. The sharp differences of phase transformation attribute to reaction time, and disappearance of primary phase and appearance of new phase are more hysteretic by reduction with carbon monoxide than hydrogen. (c) (d) (a) (b) 10μm 20μm

3.3 Microstructure Analysis

To study and compare the difference of characteristics of hydrogen and carbon monoxide reduction, the microstructure of samples has been analyzed by using SEM and OM and shown in Figs. (4-6).

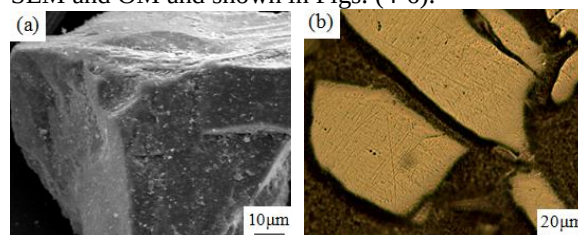


Figure 4 Image (SEM and OM) of raw ilmenite concentrate

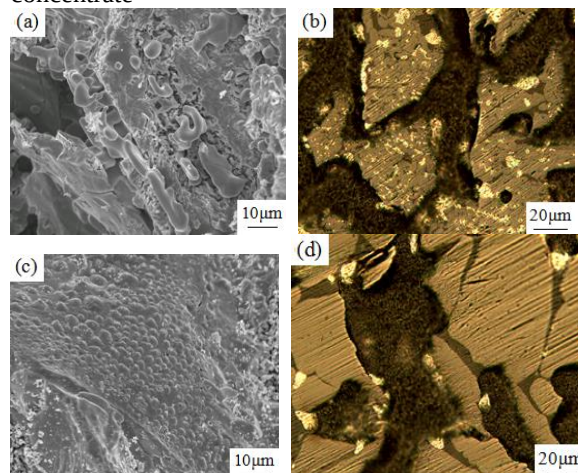


Figure 5 Images (SEM and OM) ilmenite reduced with different reduction gas at 1150 °C for 10min

a, b: sample reduced by hydrogen; c, d: sample reduced by carbon monoxide.

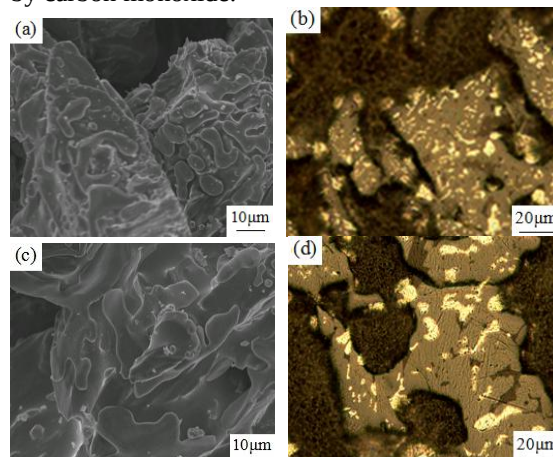


Figure 6 Images (SEM and OM) ilmenite reduced with different reduction gas at 1150 °C for different time
a, b: sample reduced by hydrogen for 100min; c, d: sample reduced by carbon monoxide for 300min

Figs. 4(a-b) show that the particles of ilmenite concentrates are compact and irregular on outer margins, which is disadvantageous to diffusion of reduction gas with hydrogen or carbon monoxide into inside and breaking away from interface of reduction products with H₂O or CO₂. Therefore, reduction of

ilmenite concentrates occurs on outer margins and in the holes or cracks of samples firstly, so that metallic iron phases start to present in carbon monoxide at 1150 °C for 10min, as shown in Figs.5 (c-d). The particles become looser with pores (Figure 5 (a)) in hydrogen than in carbon monoxide and metallic iron phases also appear in the interiors of reduction products (Figure 5 (b)) because hydrogen atoms have small size and high diffusivity. With the increase of reduction time, inner holes of products disappear gradually and final structures become dense, as shown in Figs.6 (a, c), this is because M_3O_5 solid solution produces in reduction process. Metallic iron phases are mainly present as tiny vermicule in hydrogen Figs.6 (c), however, as major particles in carbon monoxide Figs.6 (d).

4. REDUCTION MECHANISM

To analyze the reduction mechanism, define weight percent (%) and the reduction degree (%), as shown in formula (1) and (2).

$$\text{Weight percent } w (\%) = \frac{m_t}{m_0} \times 100 \quad (1)$$

$$\text{Reduction degree } x (\%) = \frac{m_0 - m_t}{\Delta m} \times 100 \quad (2)$$

Where, m_0 and m_t are the weight of sample before and after reduction for time t , respectively; Δm is the total potential mass loss in the whole reduction process. According to the solid-state kinetics [3], the equation (3) is controlled by the diffusion; the equation (4) is controlled by the chemical reaction at the interface.

$$G_1(x) = 1 - 2/3x - (1-x)^{2/3} = kt \quad (3)$$

$$G_2(x) = 1 - (1-x)^{1/3} = kt \quad (4)$$

Where, k is rate constant. We could consider the relationship between $G(x)$ and T when the heating rate remains unchanged in no isothermal system.

The activation energy E is calculated by equation (5) for non-isothermal reduction reaction.

$$\log_{10} \left\{ \frac{1-(1-x)^{1-n}}{T^2(1-n)} \right\} = \log_{10} \frac{AR}{xE} \left[1 - \frac{2RT}{E} \right] - \frac{E}{2.3RT} \quad (5)$$

Where, T is thermodynamic temperature, K; A is constant; $n = 0, 1/2, 2/3$.

Thus a plot of either $\log_{10} \left\{ \frac{1-(1-x)^{1-n}}{T^2(1-n)} \right\}$ against $\frac{1}{T}$ or where $n = 1$, $\log_{10} \left\{ \frac{-\log_{10}(1-x)}{T^2} \right\}$ against $\frac{1}{T}$ should result in a straight line of slope $-\frac{E}{2.3R}$ for the correct value of n , since it may be shown that for most values of E and for the temperature range over which reactions generally occur the expression $\log_{10} \frac{AR}{xE} \left[1 - \frac{2RT}{E} \right]$ is constant [11].

On the basis of the above formulas and equations, we studied the reaction model and kinetic parameters from thermogravimetric data in the hydrogen and carbon monoxide reduction.

4.1 Reduction from Fe^{3+} to Fe^{2+}

Experiments were performed in the temperatures ranges from 300°C to 1200°C by thermogravimetric analysis with the heating rate of 2.5 °C min⁻¹. Plots of

the weight percent and the reduction degree by 50%CO and 50%CO₂ as a function of temperature were shown in Figure 7. The weight percent of sample decreases with the increase of temperature in the above experimental condition, but the reduction degree increases. Final samples were analyzed by XRD, and the results were described in Figure 8.

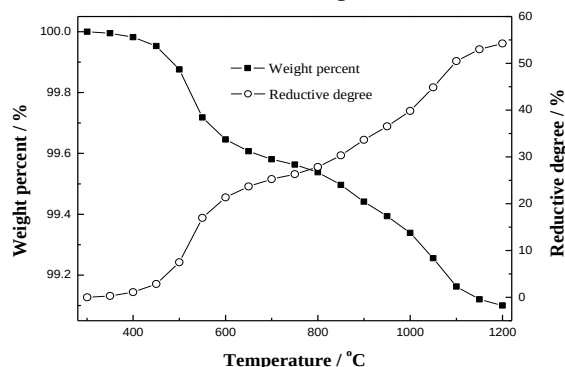


Figure 7 Change of weight percent and reduction degree of reduction products in the process of $Fe^{3+} \rightarrow Fe^{2+}$ conversion on isothermal reaction

Figure 8 shows XRD patterns of final samples reduced with 50% carbon monoxide and 50% carbon dioxide from 300°C to 1200°C. The Fe_2O_3 diffraction peaks of reduction products appear and metallic iron phases do not occur, other peaks are the same as ones of ilmenite concentrates in Figure 3. Therefore, it can be inferred that the reduction reaction occurs with transformation of Fe^{3+} to Fe^{2+} and without other reduction.

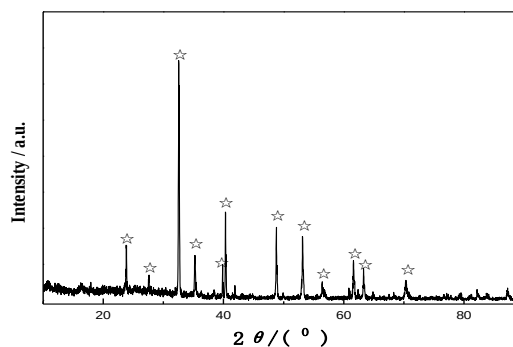


Figure 8 XRD result of reduction product reduced by the proportion of carbon monoxide and carbon dioxide with 1:1

☆— $FeTiO_3$; ●— Fe ; ○— TiO_2 ; ◎— Ti_xO_y ; △— M_3O_5
The kinetic model may be easily determined by using the relationship between $G(x)$ and t from equations 3-4 and considering the change of temperature with time, the results were listed in Figure 9. It can be seen that the better linear relation only appears below 900°C and is controlled by equation 3. The above analysis proves that the reductive reaction from Fe^{3+} to Fe^{2+} should be controlled by diffusion below 900°C and both diffusion and chemical reaction could be rate-controlling step on other conditions.

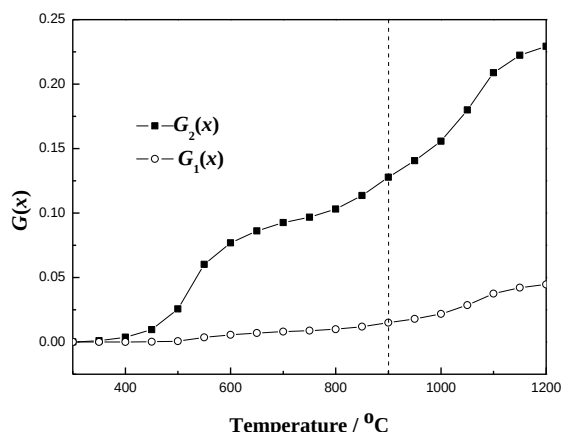


Figure 9 Relationship between $G(x)$ and reduction temperature

$G_1(x)$ and $G_2(x)$ represent for integral functions expression of reaction controlled by diffusion and interface chemical reaction respectively

4.2 Reduction from Fe^{2+} to Fe

The samples as the above reduction products were reduced by hydrogen and carbon monoxide in the temperature range from 300°C to 1200°C respectively, weight percent and reduction degree of which were shown in Figure 10. The curve changes of both are similar as the ones in Figure 8, but it has significant difference in concrete values and experiments are finished by reduction of different gas specially. It is obvious that the reducing capacity of hydrogen is stronger than carbon monoxide. Combining with the phase analysis of final reduction products, it can be proved that Fe^{2+} is reduced to Fe in the reduction step.

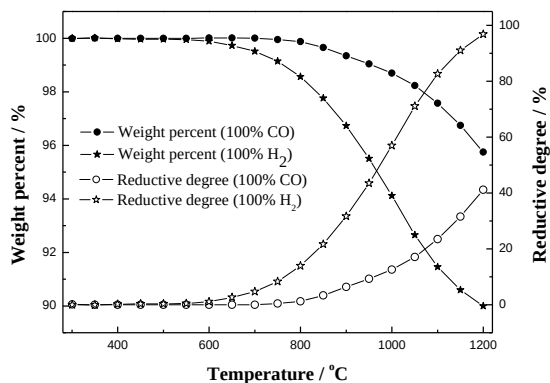


Figure 10 Change of weight percent and reduction degree of reduction products in the process of $\text{Fe}^{2+} \rightarrow \text{Fe}$ conversion on isothermal reaction

Combining equations (3), (4) and the data in Figure 10, we get the relationships of $G(x)$ with reduction temperature from 300°C to 1200°C as illustrated in Figure 11 shows the experimental results of $G_1(x)$ have only better linear dependence with reduction temperature above 950°C and it is adverse besides. This indicates that there is a higher chemical reaction rate and the diffusion is the rate-controlling step at the temperature ranges from 950°C to 1200°C, diffusion and chemical reaction both should play a part in the reduction reaction and the mixed controlling is the one

below 950°C.

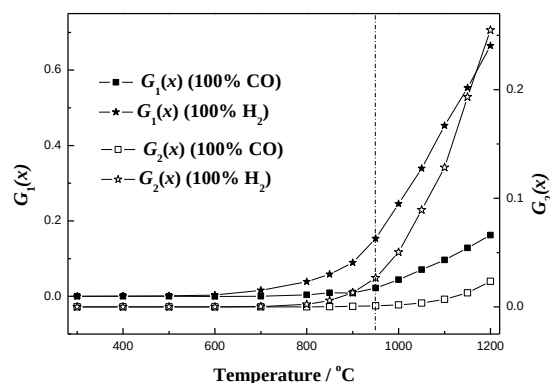


Figure 11 Relationship between $G(x)$ and reduction temperature

$G_1(x)$ and $G_2(x)$ represent for integral functions expression of reaction controlled by diffusion and interface chemical reaction respectively

The equation (5) was used to calculate the activation energies of reduction reaction by hydrogen and carbon monoxide respectively above 950°C. The results in Figure 12 allowed the calculation of the activation energies, and it could be seen that the results best fit a 2/3 order. The fitting equations between Y and $1/T$ may be expressed by equations (6) and (7), therefore the calculated activation energy of the reduction from Fe^{2+} to Fe becomes 59.088 kJ mol⁻¹ and 73.429 kJ mol⁻¹ by hydrogen and carbon monoxide respectively. The energy by hydrogen reduction is less 14.341 kJ mol⁻¹ than by carbon monoxide, therefore, the relationships between metallization rate and reduction time were shown in Figure 12 so that there was a wide 4 times gap about reduction time by using different gases reduction.

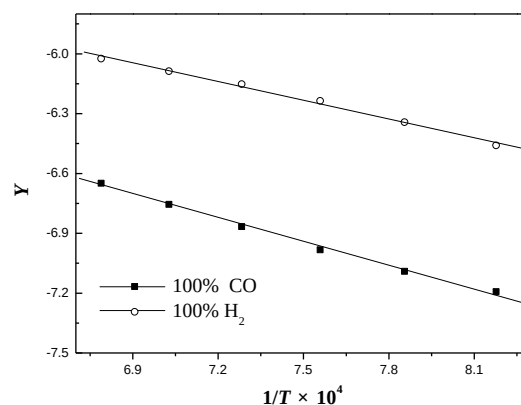


Figure 12 Relationship between Y and $\frac{1}{T} \times 10^4$

$$Y = \log_{10} \left\{ \frac{1-(1-x)^{1-n}}{T^2(1-n)} \right\} \text{ for } n = 2/3$$

$$Y = -0.309x - 3.998 \quad (R=0.998) \quad (6)$$

$$Y = -0.384x - 3.982 \quad (R=0.998) \quad (7)$$

5. CONCLUSIONS

The reduction processes of ilmenite concentrate using hydrogen and carbon monoxide as the reducing gas were investigated by analyzing metallization rate, mineral compositions and microstructure change of reduction products at 1150 °C and the kinetic

mechanism at the temperature range from 300 °C to 1200 °C. It is concluded as follows:

Metallization rates of reduction products could reach to 86% by reduction with each of hydrogen and carbon monoxide at 1150 °C. But reduction time is 4 times by using carbon monoxide than hydrogen as reduction gas. Phase transformation is similar in the process of hydrogen and carbon monoxide reduction. Hematite phase is reduced prior to ilmenite phase with both reduction gas. Final samples contain metallic iron and M_3O_5 solid solution.

Metallic iron phases appear on outer margins and in the holes or cracks of samples firstly, then they diffuse to interior gradually and present in the whole particles irregularly. Metallic iron phases are mainly present as tiny vermicular in hydrogen, however, as major particles in carbon monoxide.

Reduction reaction from Fe^{3+} to Fe^{2+} should be controlled by diffusion below 900°C with hydrogen and carbon monoxide. At the temperature range from 950 °C to 1200 °C, the diffusion process is all also the rate-controlling step with Fe^{2+} to Fe, which activation energy is 59.088 kJ mol⁻¹ and 73.429kJ mol⁻¹ respectively and one of hydrogen reduction is small.

REFERENCES

- [1]Rahul K.K., Harshad G., Deepa S., Kartic C.K., and Raman S.S., Room temperature synthesis of titanium dioxide nanoparticles of different phases in water in oil microemulsion, *Colloids Surf., A*, 2010, 369: 75.
- [2]Li Y.J., and George P.D., Precipitation of nanosized titanium dioxide from aqueous titanium chloride solutions by neutralization with MgO, *Hydrometallurgy*, 2008, 90: 26.
- [3]Wang Y.M., and Yuan Z.Y., Reduction kinetics of the reaction between a natural ilmenite and carbon, *Int. J. Miner. Process*, 2006, 81: 133.
- [4]Pesi J., and Eric R.H., High temperature carbothermic reduction of Fe_2O_3 - TiO_2 - M_xO_y oxide mixtures, *Miner. Eng.*, 2002, 15: 971.
- [5]Kucukkaragoz C.S., and Eric R.H., Solid state reduction of a natural ilmenite, *Miner. Eng.*, 2006, 19:334.
- [6]Pouraboli M., Raygan S.R., Abdizadeh H., and Hanaei K., Production of high titania slag by Electro-Slag Crucible Melting process, *Int. J. Miner. Process*, 2006, 78: 175.
- [7]Merk R., and Pickles C.A., Reduction of ilmenite by carbon monoxide, *Can. Metall. Q.*, 1988, 27: 179.
- [8]Sun K., Takahashi R., and Yagi J.I., Reduction kinetics of cement-bonded natural ilmenite pellets with hydrogen, *ISIJ Int.*, 1992, 32(4): 496.
- [9]Oleg O., and Zhang G.Q., Energy and exergy analyses of direct ironsmelting processes, *Energy*, 2005, 30: 2772.
- [10]Sun S., Jin H.G., Gao L., and Han W., Study on a multifunctional energy system producing coking heat, methanol and electricity, *Fuel*, 2010, 89: 1353.
- [11]Coats A.W., and Redfern J.P., Kinetic parameters from thermo gravimetric data, *Nature*, 1964, 201(1): 68.

A New Belief Interval-Valued Soft Set Theoretic Approach to Decision Making Problems

Xiaomin Wang, Yang Liu, Piyu Li, Shengnan Cao, Lichao Zhang

School of Mathematics and Statistics, Northeastern University at Qinhuangdao, Qinhuangdao, 066004, Shandong, China

Abstract: In this paper, new symmetrical notions of soft belief value and soft belief degree are proposed, which are on the basis of belief interval-valued soft set as an improved approach to make decisions. Comparing with previous approaches, the improved approach is easier to calculate and understand when solving same decision problems and obtaining the same correct results. Another advantage is that can compare horizontally and vertically among different parameters and different objects. Furthermore, the paper proposes a rule of parameter reduction developed in accordance with the new concepts and numerical examples employed as evidence of the reduction. Finally, it puts forward a decision method for group decision-making according to soft belief value and soft belief degree and an example to it.

Keywords: Belief interval-valued soft set; Soft belief value; Soft belief degree; Parameter reduction; Group decision-making

1. INTRODUCTION

Molodstov [1] introduced soft set as an instrument to solve uncertainty problems in 1999. Then, Maji et al. [2,3] put forward diverse operations on it and studied decision theory. They also proposed the fuzzy soft set such that they used a unique number to indicate the subordinate degree of the object to each parameter. Furthermore, Maji [2] and Yang et al. [4] considered using interval to present the subordinate degree of the object to each parameter, and they separately proposed interval-valued fuzzy soft sets and intuitionistic fuzzy soft sets. In the following years, Dey et al. [5] and Feng et al. [6] studied soft sets in various directions. Recently, many related concepts of soft set and decision making [7-14] have been considered to solve different kinds of uncertainty problems. As the result of the development of soft set theory, Vijayabalajin et al. [15] proposed belief interval-valued soft set (BIVSS) and introduced soft belief power and soft recommend value to make multi-attribute decisions. Moreover, group decision making was combined with some concepts like interval-value and fuzzy via Xu et al. [16] and Zhou et al. [17]. Muhammad et al. [18] put forward some group decision making algorithms on the basis of hesitant N-soft sets. In the context, we will propose another new method to make decisions on BIVSS and

an algorithm according to new concepts to make group decisions on the basis of two or more BIVSSs.

Parameter reduction has been discussed in previous studies [19,20]. Maji et al. [3] took into account the foremost level reduction soft set with the aid of rough set method. Yet, Chen et al. [21] reminded about the mistakes of the previous reduction and proposed another concept of parameter reduction, which was similar to the one for the rough set. Kong et al. [22-24] proposed normal parameter reduction of the soft set and corresponding algorithm. They also studied the normal parameter reduction soft set in different contexts, which is a great contribution of soft set reduction. Afterwards, Ma et al. [25] considered four reduction algorithms about interval-valued fuzzy soft sets. They analyzed and compared the four algorithms of parameter reduction.

Dempster [26] and Shafer [27] introduced Dempster-Shafer theory (DST) as a new effective tool to study uncertainty problems. Hence, Sambuc et al. [28] put forward ϕ -flow function to express DST, and Zadeh [29] developed an equivalent notion named interval valued fuzzy sets. Intuitionistic fuzzy sets are relevant to other undetermined models, which was studied by Deschrijver et al. [30]. Xiao [31] generalized DST to fuzzy soft set and made significant contribution to medical diagnosis problem.

For the intuitionistic fuzzy set, Hong et al. [32] considered a modified interval representation $[\mu(x_i), 1 - v(x_i)]$ substituting $\langle \mu(x_i), v(x_i) \rangle$. According to [19], an approach of solving DST with intuitionistic fuzzy was put forward by Dymova et al. [33], then some operations were defined by them. Dymova et al. [34] introduced the relationship between Atanassov Intuitionistic Fuzzy set(A-IFS) [35-38] and DST. They defined the basic assignment function. Vijayabalaji et al. [15] generalized the idea of the belief interval-value set developed from DST and soft set to present the belief interval valued soft set (BIVSS) and related operations and then proposed the soft belief power and soft recommend value on BIVSS as approaches to deal with multi-attribute decision making problems.

In the above literature, the approaches to address the belief interval-valued decision making problems are complicated and difficult. Furthermore,

the parameter reduction of BIVSS has not been introduced. To solve these problems, we performed the following research. In Section 2, the fundamental notions with regard to the intuitionistic fuzzy set, intuitionistic fuzzy soft set, and belief interval-valued soft set are discussed. Section 3 puts forward new concepts named the soft belief value and soft belief degree based on BIVSS and the corresponding algorithm to solve decision making problems, which refers to the problems of investment and complementary and alternative medicine (CAM) mentioned in the paper. Then, we compare our approach with that of Vijayabalaji et al. [15] to solve multi-attribute decision making problems, which indicates that our approach is easier to calculate and understand. Different objects and different parameters also can be compared horizontally and vertically by our approach. In Section 4, we present an algorithm for parameter reduction of BIVSS according to new concepts such as the soft belief value and soft belief degree. Some examples are also provided to illustrate the algorithm. In Section 5, a decision method for group decision making such as medical diagnosis by utilizing the soft belief value and soft belief degree and an example for explaining them are put forward. Finally, the concluding section discusses the results and states further research directions and limitations.

2. PRELIMINARIES

In this section, Suppose $U = \{l_1, l_2, \dots, l_n\}$ is a finite universe set, $E = \{s_1, s_2, \dots, s_m\}$ is the set of parameters and $S \subseteq E$.

2.1. Intuitionistic Fuzzy Sets

Definition 1. ([35]). An intuitionistic fuzzy set A can be represented as.

$$A = \{(l_i, \mu_A(l_i), \nu_A(l_i)) | l_i \in U\}$$

subject to $0 \leq \mu_A(l_i) + \nu_A(l_i) \leq 1$ for every $l_i \in U$. $\pi_A(l_i) = 1 - (\mu_A(l_i) + \nu_A(l_i))$ is called the hesitation degree of $l_i \in U$. Hong et al. [32] introduced $[\mu_A(l_i), 1 - \nu_A(l_i)]$ representing the intuitionistic fuzzy set A to substitute the previous representation. There is an advantage that the representation $[\mu_A(l_i), 1 - \nu_A(l_i)]$ express a normal interval because the right boundary is bigger than the left boundary. The basic concepts of the intuitionistic fuzzy set in accordance with DST can be redefined. Dymova and Sevastjanov (2010) [15] proposed the triplet $\pi_A(l_i) = 1 - (\mu_A(l_i) + \nu_A(l_i))$ to represent the basic assignment function. That is $Bel_A(l_i) = \mu_A(l_i)$ and $Pl_A(l_i) = \mu_A(l_i) + \pi_A(l_i) = 1 - \nu_A(l_i)$.

Definition 2. ([33]). An intuitionistic fuzzy set A can be represented as.

$$A = \{(l_i, BL_A(l_i)) | l_i \in U\}$$

where $BL_A(l_i) = [Bel_A(l_i), Pl_A(l_i)]$ represents the belief interval and $Bel_A(l_i) = \mu_A(l_i)$ and $Pl_A(l_i) = 1 - \nu_A(l_i)$ represent the degrees of belief and plausibility.

2.2. Intuitionistic Fuzzy Soft Set

Definition 3. ([1]). A mapping $F: S \rightarrow P(U)$, indicated

by (F, S) , is a soft set on U , and $P(U)$ represents the power set of U .

Definition 4. ([39]). A mapping $G: S \rightarrow P(U)$ indicated by (G, S) is a fuzzy soft set on U , and $P(U)$ represents the set of all fuzzy sets over U .

Definition 5. ([2]). A mapping $I: S \rightarrow \mathcal{P}(U)$, indicated by (I, S) is a intuitionistic fuzzy soft set on U , and $\mathcal{P}(U)$ represents the set of all intuitionistic fuzzy sets over U .

2.3. Belief Interval-Valued Soft Set

Definition 6. ([15]). $\mathbb{P}(U)$ is a set of all belief interval-valued subsets of U . A mapping $Y: S \rightarrow \mathbb{P}(U)$ is named a belief interval-valued soft set and indicated as (Y, S) on U , represented as

$$Y(s_j) = \{(l_i, Bl_{Y(s_j)}(l_i)) | l_i \in U\},$$

where $Bl_{Y(s_j)}(l_i) = [Bel_{Y(s_j)}(l_i), Pl_{Y(s_j)}(l_i)]$, $\forall s_j \in S$.

Example 1. Let $U = \{l_1, l_2, l_3, l_4, l_5\}$ be a set of five candidates for a job and $E = \{s_1, s_2, s_3, s_4, s_5\}$ be a set of demanding capacities, where $s_j (j = 1, 2, 3, 4, 5)$ represent "experience", "computer knowledge", "skilled foreign language", "creativity", and "managerial skills", respectively. Let $S = \{s_1, s_2, s_3\} \subseteq E$.

According to Definition 3, a soft set is expressed as

$$(F, S) = \{(s_1, \{l_1, l_2, l_4\}), (s_2, \{l_1, l_3, l_4\}), (s_3, \{l_2, l_3, l_4\})\}$$

By Definition 4, a fuzzy soft set is expressed as

$$(G, S) = \{(s_1, \{\frac{l_1}{0.7}, \frac{l_2}{0.8}, \frac{l_3}{0.7}\}), (s_2, \{\frac{l_1}{0.9}, \frac{l_2}{0.6}, \frac{l_4}{0.5}\}), (s_3, \{\frac{l_1}{0.8}, \frac{l_2}{0.7}, \frac{l_3}{0.6}\})\}$$

From Definition 5, an intuitionistic fuzzy soft set is expressed as

$$(I, S) = \{(s_1, \{\frac{l_1}{\langle 0.20, 0.60 \rangle}, \frac{l_2}{\langle 0.60, 0.30 \rangle}, \frac{l_4}{\langle 0.50, 0.30 \rangle}\}), (s_2, \{\frac{l_1}{\langle 0.70, 0.20 \rangle}, \frac{l_3}{\langle 0.20, 0.70 \rangle}, \frac{l_4}{\langle 0.30, 0.60 \rangle}\}), (s_3, \{\frac{l_2}{\langle 0.80, 0.10 \rangle}, \frac{l_3}{\langle 0.40, 0.50 \rangle}, \frac{l_4}{\langle 0.50, 0.40 \rangle}\})\}$$

By Definition 6, a belief interval-valued soft set can be expressed as

$$(Y, S) = \{(s_1, \{\frac{l_1}{\langle 0.20, 0.40 \rangle}, \frac{l_2}{\langle 0.60, 0.70 \rangle}, \frac{l_4}{\langle 0.50, 0.70 \rangle}\}), (s_2, \{\frac{l_1}{\langle 0.70, 0.80 \rangle}, \frac{l_3}{\langle 0.20, 0.30 \rangle}, \frac{l_4}{\langle 0.30, 0.40 \rangle}\}), (s_3, \{\frac{l_2}{\langle 0.80, 0.90 \rangle}, \frac{l_3}{\langle 0.40, 0.50 \rangle}, \frac{l_4}{\langle 0.50, 0.60 \rangle}\})\}$$

3. SOFT BELIEF VALUE AND SOFT BELIEF DEGREE

Assume $U = \{l_1, l_2, \dots, l_n\}$ is the set of objects and $E = \{s_1, s_2, \dots, s_m\}$ is the set of parameters. According to Dymova and Sevastjanov [33], the belief interval is defined as $BL_A(l_i) = [Bel_A(l_i), Pl_A(l_i)]$, where $Bel_A(l_i) = \mu_A(l_i)$ and $Pl_A(l_i) = 1 - \nu_A(l_i)$ are the degrees of belief and plausibility, respectively. Vijayabalaji and Ramesh [15] also considered the case $\mu_A(l_i) = \nu_A(l_i)$, then redefine $Bel_A(l_i) = \mu_A(l_i)$ and $Pl_A(l_i) = 1 - (\nu_A(l_i))^2$. We initiate some new concepts to measure the belief degree of one object to attributes which is different from Vijayabalaji and Ramesh [15] below.

Definition 7. The soft belief value of $l_i (i = 1, 2, \dots, n)$

for $s_j (j = 1, 2, \dots, m)$ on BIVSS (Y, S) is defined by

$$SBV_{Y(s_j)}(l_i) = Bel_{Y(s_j)}(l_i) + \frac{Bel_{Y(s_j)}(l_i)}{Bel_{Y(s_j)}(l_i) + \sqrt{1 - Pl_{Y(s_j)}(l_i)}} \times (Pl_{Y(s_j)}(l_i) - Bel_{Y(s_j)}(l_i))$$

The soft belief degree of $l_i (i = 1, 2, \dots, n)$ on BIVSS (Y, S) is

$$SBD_Y(l_i) = \frac{1}{n} \sum_{j=1}^m SBV_{Y(s_j)}(l_i)$$

Where $(Pl_{Y(s_j)}(l_i) - Bel_{Y(s_j)}(l_i))$ represents the hesitation degree, $\frac{Bel_{Y(s_j)}(l_i)}{Bel_{Y(s_j)}(l_i) + \sqrt{1 - Pl_{Y(s_j)}(l_i)}} \times$

$(Pl_{Y(s_j)}(l_i) - Bel_{Y(s_j)}(l_i))$ represents the ratio of the belief value to the hesitation degree. Symmetrically, the non-plausibility part in the hesitation degree

$\frac{\sqrt{1 - Pl_{Y(s_j)}(l_i)}}{Bel_{Y(s_j)}(l_i) + \sqrt{1 - Pl_{Y(s_j)}(l_i)}} \times (Pl_{Y(s_j)}(l_i) - Bel_{Y(s_j)}(l_i))$ can be determined. $SBD_Y(l_i)$ is the general estimate of each object l_i for the all considered parameters.

Example 2. Let $U = \{l_1, l_2, l_3\}$ be the universe set and $S = \{s_1, s_2, s_3\}$ be the set of parameters, BIVSS (Y, S) can be expressed as,

$$(Y, S) = \left\{ \left(s_1, \left\{ \frac{l_1}{\langle 0.30, 0.60 \rangle}, \frac{l_2}{\langle 0.40, 0.50 \rangle}, \frac{l_3}{\langle 0.50, 0.50 \rangle} \right\} \right), \left(s_2, \left\{ \frac{l_1}{\langle 0.60, 0.80 \rangle}, \frac{l_2}{\langle 0.60, 0.60 \rangle}, \frac{l_3}{\langle 0.50, 0.70 \rangle} \right\} \right), \left(s_3, \left\{ \frac{l_1}{\langle 0.10, 0.50 \rangle}, \frac{l_2}{\langle 0.40, 0.80 \rangle}, \frac{l_3}{\langle 0.40, 0.90 \rangle} \right\} \right) \right\}$$

Furthermore:

$$\begin{aligned} SBV_{Y(s_1)}(l_i) &= Bel_{Y(s_1)}(l_i) + \frac{Bel_{Y(s_1)}(l_i)}{Bel_{Y(s_1)}(l_i) + \sqrt{1 - Pl_{Y(s_1)}(l_i)}} \times (Pl_{Y(s_1)}(l_i) - Bel_{Y(s_1)}(l_i)) \\ &= 0.30 + \frac{0.30}{0.30 + \sqrt{0.4}} \times (0.60 - 0.30) \approx 0.3965 \end{aligned}$$

Therefore, $SBV_{Y(s_1)}(l_2) = 0.4361$, $SBV_{Y(s_1)}(l_3) = 0.5000$, $SBV_{Y(s_2)}(l_1) = 0.7146$, $SBV_{Y(s_2)}(l_2) = 0.6000$, $SBV_{Y(s_2)}(l_3) = 0.5954$, $SBV_{Y(s_3)}(l_1) = 0.1496$, $SBV_{Y(s_3)}(l_2) = 0.5889$, $SBV_{Y(s_3)}(l_3) = 0.6793$.

For the arbitrary parameter, a decision can be made, such as s_1 , $SBV_{Y(s_1)}(l_1) \leq SBV_{Y(s_1)}(l_2) \leq SBV_{Y(s_1)}(l_3)$, so l_3 is the optimal choice, for the parameter s_2 , $SBV_{Y(s_2)}(l_3) \leq SBV_{Y(s_2)}(l_2) \leq SBV_{Y(s_2)}(l_1)$, so l_1 is the optimal choice, for the parameter s_3 , $SBV_{Y(s_3)}(l_1) \leq SBV_{Y(s_3)}(l_2) \leq SBV_{Y(s_3)}(l_3)$, so l_3 is the optimal choice. Considering all parameters synthetically, $SBD_Y(l_1) = 0.4202$, $SBD_Y(l_2) = 0.5417$, $SBD_Y(l_3) = 0.5916$, so $SBD_Y(l_1) \leq SBD_Y(l_2) \leq SBD_Y(l_3)$, so l_3 is the best choice.

We propose an algorithm to make decisions as applications of the new concepts.

Algorithm 1: Decision making on BIVSS

BEGIN

1. Input BIVSS of (Y, S) .

2. Calculate the soft belief value of $l_i (1 \leq i \leq n)$ for $s_j (1 \leq j \leq m)$ and the soft belief degree of $l_i (1 \leq i \leq n)$.

3. Sort the options $l_i (1 \leq i \leq n)$ according to the soft belief degree of $l_i (1 \leq i \leq n)$.

END

The following is an example of utilizing the Algorithm 1.

Example 3. An investment company wants to invest in a project. Let $U = \{l_1, l_2, l_3, l_4, l_5\}$ be the set of five alternatives, where $l_i (i = 1, 2, 3, 4, 5)$ describe “a pharmaceutical company”, “a building materials company”, “a software company”, “a clothing company”, “an electrical appliance company”, respectively. The company evaluates the companies with respect to four aspects, which are: $S = \{s_1, s_2, s_3, s_4\}$. $s_j (j = 1, 2, 3, 4)$ describing “the investment risk”, “the possible benefits”, “the public influence”, and “the environmental effect”, respectively. There is a decision maker who considers the parameters above to evaluate the five candidates. The properties of the five candidates are indicated by BIVSS (Y, S) .

Step 1. Input BIVSS matrix $A = [(Y, S)]_{m \times n}$.

$$[(Y, S)] = \begin{bmatrix} [0.30, 0.60] & [0.40, 0.70] & [0.40, 0.80] & [1.00, 1.00] & [0.70, 0.80] \\ [0.20, 0.30] & [0.50, 0.70] & [0.80, 0.90] & [0.70, 0.80] & [0.50, 0.50] \\ [0.40, 0.50] & [0.60, 0.80] & [0.80, 1.00] & [0.70, 0.90] & [0.70, 0.80] \\ [0.50, 0.50] & [0.70, 0.80] & [0.80, 0.90] & [0.50, 0.70] & [0.50, 0.70] \end{bmatrix}$$

Step 2. Calculate the soft belief value of $l_i (i = 1, 2, 3, 4, 5)$ for $s_j (j = 1, 2, 3, 4)$ and the soft belief degree of $l_i (i = 1, 2, 3, 4, 5)$ indicated by S in Table 1.

Table 1. Soft belief degree of l_i in Example 3

	l_1	l_2	l_3	l_4	l_5
s_1	0.3965	0.5266	0.5889	1.0000	0.7610
s_2	0.2193	0.5954	0.8717	0.7610	0.5000
s_3	0.4361	0.7146	1.0000	0.8378	0.7610
s_4	0.5000	0.7610	0.8717	0.5954	0.5954
$SBD_Y(l_i)$	0.3880	0.6494	0.8331	0.7986	0.6544

Step 3. Sort all the options $l_i (i = 1, 2, 3, 4, 5)$ according to the soft belief degree of $l_i (i = 1, 2, 3, 4, 5)$. Select the greatest soft belief degree of $l_k (k \in \{1, 2, 3, 4, 5\})$ as the optimal choice, so $l_3 > l_4 > l_5 > l_2 > l_1$, the optimal choice is l_3 .

Vijaya Balaji and Ramesh [15] proposed two approaches to make multi-attribute decision on BIVSS and obtain the sequence of the options. We compare our approach with the one of Vijaya Balaji and Ramesh [15].

Example 4. Consider that $U = \{l_1, l_2, l_3, l_4, l_5, l_6\}$ is the set of sufferers, $E = \{N, P, H\}$ is the set of CAM therapies; $N = \{n_1, n_2, n_3, n_4, n_5, n_6\}$ denotes natural treatment items, where n_1 = no side effect, n_2 = non-toxic, n_3 = apply natural ingredients, n_4 = strengthen

immune system, n_5 = cure the body on its own, and n_6 = enhance natural capacity; $P = \{p_1, p_2, p_3\}$ is priority of participation in health therapies projects, where p_1 = equal companions, p_2 = patients should be active, and p_3 = patients decide by themselves; $H = \{h_1, h_2, h_3, h_4\}$ is orientation toward overall health projects, where h_1 = coordinating your body, heart and

soul, h_2 = concentrate on people' total happiness, h_3 = the body possesses a basic instinct, and h_4 = employ contemporary science and technique.

Step 1. Input belief interval-valued soft sets decision matrices $M_k = (Y_k, E_k) (k = 1, 2, 3)$, where $E_1 = N$, $E_2 = P$, and $E_3 = H$.

$$M_1 = \begin{bmatrix} [0.30, 0.70] & [0.40, 0.80] & [0.40, 0.70] & [0.50, 0.90] & [0.20, 0.60] & [0.20, 0.70] \\ [0.40, 0.70] & [0.40, 0.80] & [0.50, 0.80] & [0.40, 0.90] & [0.30, 0.70] & [0.50, 0.80] \\ [0.20, 0.50] & [0.30, 0.70] & [0.40, 0.80] & [0.60, 1.00] & [0.50, 0.70] & [0.40, 0.60] \\ [0.20, 0.60] & [0.30, 0.60] & [0.50, 0.90] & [0.60, 0.90] & [0.40, 0.50] & [0.30, 0.60] \\ [0.40, 0.60] & [0.40, 0.80] & [0.50, 0.80] & [0.50, 0.90] & [0.20, 0.50] & [0.30, 0.50] \\ [0.20, 0.50] & [0.40, 0.90] & [0.60, 0.80] & [0.70, 0.90] & [0.10, 0.50] & [0.20, 0.50] \end{bmatrix}$$

$$M_2 = \begin{bmatrix} [0.40, 0.70] & [0.30, 0.60] & [0.50, 0.70] & [0.20, 0.60] & [0.30, 0.50] & [0.40, 0.70] \\ [0.20, 0.50] & [0.40, 0.80] & [0.40, 0.60] & [0.50, 0.90] & [0.40, 0.70] & [0.30, 0.60] \\ [0.30, 0.60] & [0.40, 0.70] & [0.30, 0.60] & [0.60, 1.00] & [0.20, 0.50] & [0.30, 0.60] \end{bmatrix}$$

$$M_3 = \begin{bmatrix} [0.20, 0.50] & [0.10, 0.40] & [0.40, 0.70] & [0.50, 0.80] & [0.30, 0.60] & [0.20, 0.50] \\ [0.30, 0.70] & [0.50, 0.80] & [0.40, 0.50] & [0.60, 0.90] & [0.30, 0.70] & [0.40, 0.70] \\ [0.40, 0.60] & [0.40, 0.70] & [0.20, 0.60] & [0.40, 0.70] & [0.20, 0.40] & [0.50, 0.80] \\ [0.30, 0.60] & [0.70, 1.00] & [0.50, 0.70] & [0.30, 0.80] & [0.10, 0.50] & [0.40, 0.90] \end{bmatrix}$$

Step 2. Calculate the soft belief value of l_i for s_j and soft belief degree of l_i . Its tabular representation is expressed in Tables 2-4.

Table 2. Soft belief degree of l_i on (Y_1, E_1)

	l_1	l_2	l_3	l_4	l_5	l_6
n_1	0.4416	0.5889	0.5266	0.7450	0.2721	0.3337
n_2	0.5267	0.5889	0.6584	0.6793	0.4416	0.6584
n_3	0.2662	0.4416	0.5889	1.0000	0.5954	0.4775
n_4	0.2962	0.3965	0.7450	0.7965	0.4361	0.3965
n_5	0.4775	0.5889	0.6584	0.7450	0.2661	0.3596
n_6	0.2661	0.6793	0.7146	0.8378	0.1496	0.2661
$SBD_Y(l_i)$	0.3791	0.5474	0.6487	0.8006	0.3602	0.4153

Table 3. Soft belief degree of l_i on (Y_2, E_2)

	l_1	l_2	l_3	l_4	l_5	l_6
p_1	0.5266	0.3965	0.5954	0.2961	0.3596	0.5266
p_2	0.2661	0.5889	0.4775	0.7450	0.5266	0.3965
p_3	0.3965	0.5266	0.3965	1.0000	0.2661	0.3596
$SBD_Y(l_i)$	0.3964	0.5040	0.4898	0.6804	0.3841	0.4276

Table 4. Soft belief degree of l_i on (Y_3, E_3)

	l_1	l_2	l_3	l_4	l_5	l_6
h_1	0.2661	0.1343	0.5266	0.6584	0.3965	0.2661
h_2	0.4416	0.6584	0.4361	0.7965	0.4416	0.5266
h_3	0.4775	0.5266	0.2961	0.5266	0.2410	0.6584
h_4	0.3965	1.0000	0.5954	0.5007	0.1496	0.6793
$SBD_Y(l_i)$	0.3964	0.5798	0.4636	0.6206	0.3072	0.5326

Step 3. Utilize soft belief degree of l_i of each class parameters to aggregate alternative values

$SBD_M(l_i)$,
 $SBD_M(l_1) = SBD_N(l_1) + SBD_P(l_1) + SBD_H(l_1) \approx 1.170872$, so similarly, $SBD_M(l_2) \approx 1.631141$, $SBD_M(l_3) \approx 1.602036$, $SBD_M(l_4) \approx 2.101524$, $SBD_M(l_5) \approx 1.05144$, $SBD_M(l_6) \approx 1.375477$. Then, the ranking of the alternatives is shown as following.

$SBD_M(l_5) < SBD_M(l_1) < SBD_M(l_6) < SBD_M(l_3) < SBD_M(l_2) < SBD_M(l_4)$, hence $l_5 < l_1 < l_6 < l_3 < l_2 < l_4$, the best choice is l_4 (max).

The comparison of our approach and the one of Vijayabalaji and Ramesh [15] is given in Table 5.

Table 5. Contrast between the two methods

Method sequence	Best choice(s)
Vijayabalaji and Ramesh (2019)	$l_4 < l_2 < l_3 < l_6 < l_1 < l_5 < l_4$
our approach(max)	$l_5 < l_1 < l_6 < l_3 < l_2 < l_4 < l_4$

Compared with the approach of S. Vijayabalaji and A. Ramesh [15], we can clearly see that our approach is easier to calculate and understand. Furthermore, the approach can be used to compare both horizontally and vertically among different parameters and different objects. The decision choices can be made based on an arbitrary parameter.

4. PARAMETER REDUCTION OF BELIEF INTERVAL-VALUED SOFT SET

Let $U = \{l_1, l_2, \dots, l_n\}$ be the set of objects, $E = \{s_1, s_2, \dots, s_m\}$ be the set of parameters and $S \subseteq E$. Based on the BIVSS (Y, S) , we introduce related definitions about the constant sequence of choices and the algorithm of parameter reduction of BIVSS.

Definition 8. An indistinguishable relationship $INR(S)$ is

$$INR(S) = \{(l_i, l_j) \in U \times U : SBD_Y(l_i) = SBD_Y(l_j)\}$$

The decision partition is

$$R_S = \{(l'_1, l'_2, \dots, l'_i)_{SBD_Y(l'_1)}, (l'_{i+1}, \dots, l'_j)_{SBD_Y(l'_2)}, \dots, (l'_k, \dots, l'_n)_{SBD_Y(l'_p)}\}$$

where for subclass $\{l'_v, l'_{v+1}, \dots, l'_{v+w}\}_{SBD_Y(l'_i)}$,

$$SBD_Y(l'_v) = SBD_Y(l'_{v+1}) = \dots = SBD_Y(l'_{v+w})$$

recorded as $SBD_Y(i)$, may as well set up $SBD_Y(1) \geq SBD_Y(2) \geq \dots \geq SBD_Y(p)$. Generally speaking, objects in U are sorted in accordance with $SBD_Y(i)$.

Definition 9. If B is independent (B is the minimum subset of E that maintains sequence of decision

choices constant) and $R_B = R_E$, B is a belief interval-valued soft set parameter reduction (BIVSSPR) of E .

We propose an algorithm that deletes superfluous parameters while maintaining the sequence constant. Example 5 is an application of Algorithm 2.

Algorithm 2: Parameter reduction on BIVSS

BEGIN

1. Input BIVSS of (Y, S) .

2. Calculate the soft belief value of $l_i (1 \leq i \leq n)$ for $s_j (1 \leq j \leq m)$ and the soft belief degree of $l_i (1 \leq i \leq n)$.

3. Check B if $R_B = R_E$ and B is independent.

Then B is a BIVSSPR.

END

The following is an example utilizing algorithm for the parameter reduction of the belief interval-valued soft set.

Example 5. Let $U = \{l_1, l_2, l_3, l_4\}$ be a set of four candidates who want to get the post that a company wants to fill. $S = \{s_1, s_2, s_3, s_4, s_5, s_6, s_7, s_8\}$ be a set of candidates, where $s_j (j = 1, 2, 3, 4, 5, 6, 7, 8)$ represents “young age”, “experience”, “higher education”, “computer knowledge”, “creativity”, “training”, “managerial skills”, and “skilled in a foreign language”, respectively. The features of four candidates are indicated by BIVSS (Y, S) .

There is a decision maker who considers the parameters above to evaluate the four candidates.

Step 1. Input BIVSS of (Y, S) . The BIVSS matrix is as follows:

$$[(Y, S)] = \begin{bmatrix} [0.50, 0.70] & [0.10, 0.30] & [0.20, 0.40] & [0.60, 0.80] \\ [0.20, 0.50] & [0.50, 0.80] & [0.10, 0.40] & [0.40, 0.60] \\ [0.80, 1.00] & [0.70, 0.90] & [0.60, 0.80] & [0.30, 0.50] \\ [0.70, 0.90] & [0.30, 0.50] & [0.20, 0.40] & [0.50, 0.70] \\ [0.30, 0.60] & [0.60, 0.70] & [0.50, 0.80] & [0.80, 1.00] \\ [0.10, 0.30] & [0.70, 0.70] & [0.80, 0.90] & [0.60, 0.80] \\ [0.40, 0.50] & [0.60, 0.80] & [0.90, 1.00] & [0.70, 0.90] \\ [0.50, 0.70] & [0.60, 0.90] & [0.80, 0.90] & [0.60, 0.70] \end{bmatrix}$$

Step 2. Calculate soft belief value of $l_i (1 \leq i \leq 4)$ for $s_j (1 \leq j \leq 8)$ and the soft belief degree of $l_i (1 \leq i \leq 4)$ according to BIVSS in Table 6.

Table 6. Soft belief degree of l_i in Example 5

	l_1	l_2	l_3	l_4
s_1	0.5954	0.1214	0.2410	0.7146
s_2	0.2662	0.6584	0.1343	0.4775
s_3	1.0000	0.8378	0.7146	0.3596
s_4	0.8378	0.3596	0.2410	0.5954
s_5	0.3965	0.6523	0.6584	1.0000
s_6	0.1214	0.7000	0.8717	0.7146
s_7	0.4361	0.7146	1.0000	0.8378
s_8	0.5954	0.7965	0.8717	0.6523
$SBD_Y(l_i)$	0.5311	0.6051	0.5916	0.6690

In Example 4, $E = \{N, P, H\}$ is the set of CAM therapies, according to the approach of parameter reduction above, $\{n_1, n_2, p_1, h_2\}$ (not all) is the parameter reduction.

5. GROUP DECISION-MAKING AND

APPLICATION ON BIVSS

In the preceding section, we make decision via the newly proposed concepts based on only one BIVSS. Then we performed a group decision-making (GDM) based on two or more BIVSSs. This section introduces the group decision making as a procedure in which some experts apply their knowledge to judge optimal alternative. In the following, we propose weight method that gives each expert a weight depending on the importance of the expert based on two or more BIVSSs.

Definition 10. Let $(Y_1, S), (Y_2, S), \dots, (Y_p, S)$ be BIVSSs over U . Let $U = \{l_1, l_2, \dots, l_n\}$, $S = \{s_1, s_2, \dots, s_m\}$. $SBD_{Y_j}(l_i)$ is the soft belief degree of $l_i (i=1, 2, \dots, n)$ over the j^{th} BIVSS ($j = 1, 2, \dots, p$), $0 \leq w_j \leq 1$, such that $\sum_{j=1}^p w_j = 1$, and the weight score for p BIVSSs is defined by

$$S_w(l_i) = \sum_{j=1}^p \left(w_j \times SBD_{Y_j}(l_i) \right) (i = 1, 2, \dots, n)$$

$S_w(l_i)$ is the weight score of the i^{th} object calculated by the weights of all experts.

In the current context, we design an algorithm as follows to calculate the final group decision.

Algorithm 3: Group decision-making based on BIVSSs

BEGIN

1. Input BIVSS of $(Y_1, S), (Y_2, S), \dots, (Y_p, S)$.

2. Calculate the soft belief degree of $l_i (i = 1, 2, \dots, k)$ for each BIVSS, respectively.

3. Give different BIVSSs different weights such that $\sum_{j=1}^p w_j = 1$ ($0 \leq w_j \leq 1$).

4. Compute weight score $S_w(l_i) = \sum_{j=1}^p \left(w_j \times SBD_{Y_j}(l_i) \right)$.

5. Sort the options $l_i (i = 1, 2, \dots, k)$ in accordance with $S_w(l_i)$.

END

The following is an example of utilizing Algorithm 3.

Example 6. Dengue virus is an acute insect-borne infectious disease, which can not only involve blood, nerve, circulation and other systems, but also cause damage to liver function, and severe cases can endanger life. It is hard for doctors to diagnose if a patient is suffering from the Dengue fever. Under these circumstances, we apply the group decision-making of BIVSS by the weight score to check and diagnose Dengue fever. Let $U = \{l_1, l_2, l_3, l_4\}$ be the set of four patients and let $S = \{s_1, s_2, s_3, s_4\}$ be the set of four symptoms for Dengue fever, where s_1 = intense joint and muscle ache, s_2 = severe headache, s_3 = hyperpyrexia, and s_4 = erythra. There are three experts to check the patients to give the three BIVSSs (Y_1, S) , (Y_2, S) , (Y_3, S) represented by the following matrixes. Step 1. Input BIVSSs of (Y_1, S) , (Y_2, S) , and (Y_3, S) ,

$$\begin{aligned}
[(Y_1, S)] &= \begin{bmatrix} [0.40, 0.70] & [0.30, 0.80] & [0.60, 0.70] & [0.70, 1.00] \\ [0.20, 0.40] & [0.60, 0.70] & [0.50, 0.70] & [0.70, 0.90] \\ [0.40, 0.60] & [0.50, 0.80] & [0.80, 0.90] & [0.60, 0.90] \\ [0.50, 0.70] & [0.70, 0.90] & [0.80, 0.90] & [0.60, 0.70] \end{bmatrix} \\
[(Y_2, S)] &= \begin{bmatrix} [0.40, 0.60] & [0.40, 0.70] & [0.40, 0.80] & [1.00, 1.00] \\ [0.20, 0.30] & [0.80, 0.90] & [0.80, 0.90] & [0.50, 0.80] \\ [0.30, 0.50] & [0.60, 0.80] & [0.80, 1.00] & [0.70, 0.90] \\ [0.80, 0.90] & [0.70, 0.80] & [0.60, 0.90] & [0.50, 0.70] \end{bmatrix} \\
[(Y_3, S)] &= \begin{bmatrix} [0.30, 0.60] & [0.60, 0.70] & [0.50, 0.80] & [0.80, 1.00] \\ [0.10, 0.30] & [0.70, 0.70] & [0.80, 0.90] & [0.60, 0.80] \\ [0.40, 0.50] & [0.60, 0.80] & [0.90, 1.00] & [0.70, 0.90] \\ [0.50, 0.70] & [0.60, 0.90] & [0.80, 0.90] & [0.60, 0.70] \end{bmatrix}
\end{aligned}$$

Step 2. Calculate soft belief degree of $l_i (i = 1, 2, 3, 4)$ for each BIVSS, respectively. We can obtain the soft belief value and soft belief degree that we described in previous sections in Tables 7-9.

Table 7. Soft belief degree of l_i in Example 6

	l_1	l_2	l_3	l_4
s_1	0.5266	0.5007	0.6523	1.0000
s_2	0.2410	0.6523	0.5954	0.8378
s_3	0.4775	0.6584	0.8717	0.7965
s_4	0.5954	0.8378	0.8717	0.6523
$SBD_{Y_1}(l_i)$	0.4601	0.6623	0.7478	0.8216

Table 8. Soft belief degree of l_i in Example 6

	l_1	l_2	l_3	l_4
s_1	0.4775	0.5266	0.5889	1.0000
s_2	0.2193	0.8717	0.8717	0.6584
s_3	0.3596	0.7146	1.0000	0.8378
s_4	0.8717	0.7610	0.7965	0.5954
$SBD_{Y_2}(l_i)$	0.4820	0.7185	0.8143	0.7729

Table 9. Soft belief degree of l_i in Example 6

	l_1	l_2	l_3	l_4
s_1	0.3965	0.6523	0.6584	1.0000
s_2	0.1214	0.7000	0.8717	0.7146
s_3	0.4361	0.7146	1.0000	0.8378
s_4	0.5954	0.7965	0.8717	0.6523
$SBD_{Y_3}(l_i)$	0.3874	0.7159	0.8505	0.8012

Step 3. Give different BIVSSs different weights such that $\sum_{j=1}^3 w_j = 1 (0 \leq w_j \leq 1)$. Suppose the weights $w_1 = 0.3$, $w_2 = 0.5$, $w_3 = 0.2$ are assigned to the three doctors.

Table 10. Weight score of l_i in Example 6

	l_1	l_2	l_3	l_4
$SBD_{Y_1}(l_i) \cdot w_1$	0.1380	0.1987	0.2243	0.2465
$SBD_{Y_2}(l_i) \cdot w_2$	0.2410	0.3592	0.4071	0.3865
$SBD_{Y_3}(l_i) \cdot w_3$	0.0775	0.1432	0.1701	0.1602
$S_w(l_i)$	0.4565	0.7011	0.8015	0.7932

Step 4. Compute weight score $S_w(l_i) = \sum_{j=1}^3 (w_j \times SBD_{Y_j}(l_i)) (i = 1, 2, 3, 4)$. $S_w(l_1) = 0.3 \times SBD_{Y_1}(l_1) + 0.5 \times SBD_{Y_2}(l_1) + 0.2 \times SBD_{Y_3}(l_1)$, $S_w(l_2) = 0.3 \times SBD_{Y_1}(l_2) + 0.5 \times SBD_{Y_2}(l_2) + 0.2 \times SBD_{Y_3}(l_2)$, $S_w(l_3) = 0.3 \times SBD_{Y_1}(l_3) + 0.5 \times SBD_{Y_2}(l_3) + 0.2 \times SBD_{Y_3}(l_3)$, The weight scores can be as expressed in Table 10.

Step 5. Sort the options $l_i (i = 1, 2, 3, 4)$ in accordance with $S_w(l_i)$. We can obtain the decision $l_3 > l_4 > l_2 > l_1$ in Table 10.

6. CONCLUSIONS

We introduced the soft belief value and the soft belief degree on BIVSS as a more available and simpler

approach to solve decision making problems. For investment issues and recruitment issues, we calculated the soft belief degree, which only involved the ratio of the belief and plausibility, and obtained the best choice by sorting the soft belief degree of different objects. Compared with the previous approach to solving the CAM issue, our approach was easier to calculate and understand, while obtaining the same correct result. Furthermore, our approach could be used to compare both horizontally and vertically among different parameters and different objects. The decision choices could be made based on an arbitrary parameter. Thus, parameter reduction, which is different from traditional soft set reduction, could be proposed. It considered the minimal subset of parameters that kept the sequence of decision choices constant. Some examples such as recruitment issues and CAM problems were used to illustrate the method of parameter reduction. We also presented a weight score method of group decision making problems and a corresponding algorithm in accordance with the soft belief degree. For instance, medical diagnosis, which includes multiple experts, was one of the group decisions making problems. It explained the weight score method, and we could see that it was easy to obtain the final diagnostic results.

The limitation was that the parameter reduction was complicated when there were too many parameters. Thus, we will continue to study the parameter reduction on BIVSS. For the new method of decision making, each interval was finally processed into a decimal number, so the robustness and the sensitivity were better than previous methods. For the parameter reduction, the robustness was better.

REFERENCES

- [1] Molodtsov, D. Soft set theory first results. Comput. Math. Appl., 1999, 37, 19-31.
- [2] Maji, P.K. More on intuitionistic fuzzy soft sets. In Proceedings of the Rough Sets, Fuzzy Sets, Data Mining and Granular Computing, Delhi, India, 2009, 5908: 231-240.
- [3] Maji, P.K.; Roy, A.R.; Biswas, R. An application of soft sets in a decision-making problem. Comput. Math. Appl., 2002, 44: 1077-1083.
- [4] Yang, X.; Lin, T.Y.; Yang, J.; Li, Y.; Yu, D. Combination of interval-valued fuzzy set and soft set. Comput. Math. Appl., 2009, 58: 521-527.
- [5] Dey, A.; Pal, M. Generalised multi-fuzzy soft set and its application in decision making. Pac. Sci. Rev. Nat. Sci. Eng., 2015, 17: 23-28.
- [6] Feng, Q.; Zhou, Y. Soft discernibility matrix and its applications in decision making. Appl. Soft Comput. J., 2014, 24: 749-756.
- [7] Nguyen, H. A new interval-valued knowledge measure for interval-valued intuitionistic fuzzy sets and application in decision making. Expert Syst. Appl., 2016, 56: 143-155.
- [8] Jiang, Y.; Liu, H.; Tang, Y.; Chen, Q. Semantic

- decision-making using ontology-based soft sets. *J. Comput. Appl. Math.*, 2011, 53: 1140-1149.
- [9]Zhang, Z. A rough set approach to intuitionistic fuzzy soft set-based decision making. *Appl. Math. Model.*, 2012, 36: 4605-4633.
- [10]Liu, X.; Yang, W. A new multi-period linguistic aggregation operator and its application to financial product selection. In *Proceedings of the International Conference on Graphic and Image Processing, ICGIP*, Hong Kong, China, 2013, 8768.
- [11]Xue, B.; Wang, L.; Qin, K. An interval-valued fuzzy soft set based triple I method. In *Proceedings of the 2017 12th International Conference on Intelligent Systems and Knowledge Engineering*, 2017, 2018: 1-7.
- [12]Khan, M.; Kumam, J.P.; Liu, P.D.; Kumam, W.; Ashraf, S. A Novel Approach to Generalized Intuitionistic Fuzzy Soft Sets and Its Application in Decision. *Support Syst. Math.*, 2019, 7: 1-21.
- [13]Muhammad, R.; Naim, C.; Iqra, Z.; Muhammad, A. N-soft topology and its applications to multi-criteria group decision making. *J. Intell. Fuzzy Syst.* 2019, 36, 6521-6536.
- [14]Yang, J.; Yao, Y. Semantics of soft sets and three-way decision with soft sets. *Syst. Eng. Theory Pract.* 2020, 194, 105538.
- [15]Vijayabalajin, S.; Ramesh, A. Belief interval-valued soft set. *Expert Syst. Appl.* 2019, 119, 262-271.
- [16]Xu, Z.; Chen, J. Approach to Group Decision Making Based on Interval-Valued Intuitionistic Judgment Matrices. *Syst. Eng. Theory Pract.* 2007, 27, 126-133.
- [17]Zhou, Y.; Zhu, J.; Zhou, L.; Chen, H.; Zheng, T. A new approach to fuzzy group decision making with trapezoidal fuzzy preference relations by using compatibility measure. *Neural Comput. Appl.* 2018, 29: 1187-1203.
- [18]Akram, M.; Adeel, A.; Alcantud, J.C.R. Group decision making methods based on hesitant N-soft sets. *Expert Syst. Appl.*, 2019, 115, 95-105.
- [19]Sani, D.; Tutut, H.; Akmar, I.M.; Haruna, C.; Adamu, I.A.; Akram, M.Z. A Review on Soft Set-Based Parameter Reduction and Decision Making. *IEEE Access* 2017, 5, 4671-4689.
- [20]Zhan, J.; Alcantud, J.C.R. A survey of parameter reduction of soft sets and corresponding algorithms. *Artif. Intell. Rev.* 2019, 52, 1839-1872.
- [21]Chen, D.; Tsang, E.C.C.; Yeung, D.S.; Wang, X. The parameterization reduction of soft sets and its application. *Comput. Math. Appl.* 2005, 49, 757-763.
- [22]Kong, Z.; Gao, L.Q.; Wang, L.F.; Li, S. The normal parameter reduction of soft sets and its algorithm. *Comput. Math. Appl.* 2008, 56, 3029-3037.
- [23]Kong, Z.; Jia, W.H.; Zhang, G.D.; Wang, L.F. Normal parameter reduction in soft set based on particle swarm optimization algorithm. *Expert Syst. Appl.* 2015, 39, 4808-4820.
- [24]Kong, Z.; Wang, L.; Wu, Z. Application of fuzzy soft set-in decision-making problems based on grey theory. *Math. Comput. Model.* 2011, 236, 1521-1530.
- [25]Ma, X.; Qin, H.; Sulaiman, N.; Herawan, T.; Abawajy, J. The parameter reduction of the interval-valued fuzzy soft sets and its related algorithms. *IEEE Trans. Fuzzy Syst.* 2014, 22, 57-71.
- [26]Shafer, G. *A Mathematical Theory of Evidence*. Princeton University Press: Princeton, NJ, USA, 1976.
- [27]Sambuc, R.; Fonctions φ , F. Application l'Aide au Diagnostic en Pathologie Thyroïdienne. Ph.D. Thesis, University of Marseille, Marseille, France, 1975.
- [28]Zadeh, L.A. The concept of a linguistic variable and its application to approximate reasoning-I. *Inf. Sci.* 1975, 8, 199-249.
- [29]Deschrijver, G.; Kerre, E.E. On the position of intuitionistic fuzzy set theory in the framework of theories modelling imprecision. *Inf. Sci.* 2007, 177, 1860-1866.
- [30]Xiao, F. A hybrid fuzzy soft sets decision making method in medical diagnosis. *IEEE Access* 2018, 6, 25300-25312.
- [31]Hong, D.H.; Choi, C.H. Multicriteria fuzzy decision making problems based on vague set theory. *Fuzzy Sets Syst.* 2000, 114:103-113.
- [32]Dymova, L.; Sevastjanov, P. An interpretation of intuitionistic fuzzy sets in terms of evidence theory: Decision making aspect. *Knowl. Based Syst.* 2010, 23, 772-782.
- [33]Dymova, L.; Sevastjanov, P. The operations on intuitionistic fuzzy values in the framework of [34]Dempster-Shafer theory. *Knowl. Based Syst.* 2012, 35:132-143.
- [35]Atanassov, K. Intuitionistic fuzzy sets. *Fuzzy Sets Syst.* 1986, 20:87-96.
- [36]Dimitris, K.I.; Nikos, P.; Evangelos, K.; Ioannis, K. Intuitionistic fuzzy clustering with applications in computer vision. *Lect. Notes Comput. Sci.* 2008, 5259:764-774.
- [37]Wu, W.; Song, W.; Jiang, N.; Cao, W.; Wang, S.; Liu, J. The Research of Evidence Dynamic Reliability Evaluation Based on Intuitionistic Fuzzy Sets. In *Proceedings of the 2018 5th Asia-Pacific World Congress on Computer Science and Engineering, APWC on CSE*, Momi Bay, Fiji, 2018:132-141.
- [38]Song, Y.; Fu, Q.; Wang, Y.F.; Wang, X. Divergence-based cross entropy and uncertainty measures of Atanassov's intuitionistic fuzzy sets with their application in decision making. *Appl. Soft Comput. J.*, 2019, 84:1-15.
- [39]Roy, A.R.; Maji, P.K. A fuzzy soft set theoretic approach to decision making problems. *J. Comput. Appl. Math.* 2007, 203:412-418.

Research on Quality Management of New Energy Vehicle Development Process

Wenbo Cai^{1,*}, Yue Zhao²

¹ Changchun Automobile Industry Institute, Changchun, Jilin, China

² Changchun New Industries Optoelectronics Technology Co. Ltd., Changchun, Jilin, China

Abstract: With the rapid development of China's economy, people's living standards have been greatly improved in both urban and rural areas. In recent years, almost every household in our country has bought a car as a travel tool. More and more people are buying cars, which will have a very serious impact on our living environment, because most of our cars are still using ordinary fuel, which not only consumes fast, but also causes serious pollution to our living environment. So, we need to develop a new energy vehicle to ensure the quality and not to pollute the environment. Next, we will study the quality management of the development process of new energy vehicles.

Keywords: New energy vehicle; Development process; Quality management research

1. INTRODUCTION

The new energy we want to study is to replace the traditional power fuel with a new power that will not pollute the environment. For example, there are many electric vehicles, fuel cell cars and hybrid cars. New energy vehicles can not only save fuel, but also provide security for our living environment. What we want to study is the development process of electric vehicles. Next, we will study the quality management of the development process of new energy vehicles.

2. QUALITY MANAGEMENT STATUS OF NEW ENERGY VEHICLE DEVELOPMENT PROCESS

We all know that now our country pays great attention to environmental problems, because in recent years, the air pollution in our country has become more and more serious. First of all, PM2.5 is also quite serious to our air pollution. Now basically every family has cars. For some traditional cars, fuel is still used to provide power, which will aggravate the air pollution in our living environment. In order to protect our ecological environment, we will develop some new energy vehicles to reduce the burden of air in our lives.

Of course, we also found that in recent years, we can see some new energy vehicles on the road. At present, the new energy vehicles in China are still in the initial stage. We need to carry out further research. I will strengthen the quality management in the development process. For the new energy vehicles, there may be many enterprises still carrying out R & D, batch by batch for trial, strictly control the quality management problems, the quality in the development

process is a very important problem, if the quality is relatively good, there will be more candidates to choose to buy new energy vehicles, if the quality is not good, it will lead to the failure of new energy vehicles. So, for the quality management in the development process of new energy vehicles, researchers need to pay attention to it. For the quality management in the development process of new energy vehicles, it determines whether they can go to the market and face the world [1-4]. For quality problems, we need to pay attention to product planning, product design, and product development. These three aspects are indispensable. Before the development, we need to investigate some users who buy cars, and then summarize the data to see if anyone will choose new energy vehicles. We need to promote the customers who need to buy cars. When designing energy vehicles, we also need to pay attention to the appearance and quality of energy vehicles. In fact, the most important thing is the user experience.

3. QUALITY MANAGEMENT IN THE DEVELOPMENT PROCESS OF NEW ENERGY VEHICLES

3.1 Product Planning Stage

For the quality management problems in the development process of new energy vehicles, we first discuss and analyze them from the product planning stage. We all know that no matter what project we are doing, we should make preparations first and carry out a series of advanced planning. The product planning scheme for new energy vehicles includes the product operation stage and the start-up stage. These two aspects determine whether new energy vehicles can go to the market and go to the whole country. We also need to investigate the demanders of new energy vehicles and analyze the preferences of more users. We need to plan products according to the preferences of users, and we also need to meet the price requirements of customers. In a word, we need to be well prepared before the development of new energy vehicles. To cope with various situations, we need to evaluate the quality of products and achieve the goals. Finally, we should price the products according to the price requirements of the customers, meet the various needs of the customers and try our best to satisfy the customers. The new energy we want to study is to replace the traditional power fuel with a new power that will not pollute the environment. In order to

protect our ecological environment, we will develop some new energy vehicles to reduce the burden of air in our lives. Of course, we also found that in recent years, we can see some new energy vehicles on the road.

3.2 Conceptual Design Stage

In terms of the design of new energy vehicles, we need to check the safety standards of new energy vehicles. Safety is the top priority, because we always need to ensure the personal safety of customers and minimize the potential safety hazards. New energy vehicles generally use fuel electric pools, which can not only save fuel, but also protect our ecological environment. Before the development of new energy vehicles, we should make sufficient preparations. To deal with various situations, we need to evaluate the quality of products and achieve the goals. In fact, the best way to protect the environment is to take the bus or subway. We should try to use fewer private cars, so as to reduce air pollution. Develop some new energy vehicles to reduce the burden of air in our lives. We also need to price the products according to the price requirements of customers. We need to meet all kinds of customers' needs and try our best to satisfy customers. For the conceptual design stage, we need to carry out strict inspection on all indicators to meet the national standards.

3.3 Engineering Design Stage

We also need to design the new energy vehicle project. We need to put forward a series of plans. The successful completion of a project requires a group of conscientious and meticulous managers. For safety issues, if even the staff responsible for engineering safety management are not interested, who is responsible for the safety of customer personnel? There is even corruption in the interior of some projects. The managers are greedy for comfort, and only carry out simple safety education for the design staff, or even do not carry out safety education for them. Everything that starts in 2020 seems to tell us to respect and cherish life. Adequate safety education is the primary premise to ensure construction safety. Safety education can play the role of prevention in advance and prevention of all kinds of safety accidents. Managers should not have any fluke mentality, and do not neglect safety education. Once such an event occurs, it is not only the progress of the project, but also the lives that are affected. Therefore, in the design stage of automobile engineering, it is necessary to strictly follow the relevant construction

and operation standards to ensure the personal safety of workers and create more high-quality automobiles for customers.

4. CONCLUSION

In recent years, our country has been committed to solving traffic safety problems. At the same time, we should also pay attention to the safety problems in the research process of quality management in the development process of new energy vehicles. The research on quality management in the development process of new energy vehicles is the basis of traffic development. Only by unblocking the development of new energy vehicles can social and economic development be promoted. From ancient times to now, traffic has controlled the lifeblood of national development, and safety issues should be paid attention to at all times, and the safety of the development of new energy vehicles should not be ignored. Only by fully ensuring the personal and property safety of designers can we make the implementation of the design project go on smoothly and make the national development continue to run on the fast lane.

ACKNOWLEDGEMENT

This research is the result of the "Jilin Provincial Vocational and Technical College Education and Steering Committee Teaching Project", the project name is "Development of New Energy Vehicle Technology Teaching Resources Based on College Students' Innovation and Entrepreneurship Achievements", project approval number is CXCYHZW2019035.

REFERENCES

- [1]Li Dayuan, "Research on the development of China's new energy automobile industry in the context of low carbon," *Economic development*, 2019(2): 72-75.
- [2]Wang Haifeng, Tian Xueping, "Analysis of the development status and Countermeasures of China's new energy vehicles," *Guide to technology enrichment*, 2019 (21): 193-193.
- [3]Liu Lanjian, Chen Shuangbo, "New energy vehicle technology innovation policy research based on multi circuit competition," *Scientific management research*, 2018 (5): 41-45.
- [4]Zhang Guiqun, Zhang Xin, "Path dependence of new energy automobile industry development and its solution," *Industrial technology and economy*, 2019 (2): 75-80.

Discussion on the Development Direction of Computer Management Information System

Xiaobo Chen

Shandong College of Electronic Technology, Jinan, 250000, China

Abstract: Computer technology plays an important role in the development of contemporary society, especially in promoting economic development, which is widely used in our actual life. Because of its special importance, computer technology has become one of the compulsory subjects for college students. Computer is simple to start with, but it is also a more complex technology if we study it deeply. Computer management information system is related to the operation of the whole computer, so to strengthen the development of computer technology, we must start from the root. This paper focuses on the development direction of computer management information system.

Keywords: Computer management; Information system; Development direction

1. INTRODUCTION

With the reform and innovation of high and new technology in our country, the economy of our country has been upgraded to a higher level, and all kinds of enterprises have been developed rapidly, which has also resulted in the phenomenon of fierce competition among peers. Under the condition of ensuring the quality standard, enterprises also think about how to speed up production, improve production efficiency, improve the competitive advantage of enterprises, and stand out from the crowd, which needs to Now the high and new technology is applied to the management of enterprises to create advanced industries with advanced methods. At present, the most widely used enterprise is computer management information system. Because of the convenience of technology, the enterprises that widely use this technology can improve their production efficiency, greatly reduce the input of human cost, and then promote the sustainable and stable development of enterprise economy [1-5]. The universal use of computer technology is an inevitable phenomenon in the development of China's production enterprises. Contemporary enterprises should keep up with the pace of the times, pay attention to the development and application of technology, speed up the economic operation of enterprises, and contribute to the national economic development.

2. ANALYSIS OF COMPUTER MANAGEMENT SYSTEM

People, equipment and methods are the three major parts of computer management system. Its main

function is to collect, store, disseminate and exchange the internal information of the enterprise. This technology can timely transmit effective information to the relevant staff of the enterprise for processing, can timely save and analyze important information, and regularly maintain the enterprise system. Reasonable use of computer management system can make the internal management of enterprises scientific, improve the management level, improve the production efficiency and the overall operation of enterprises, which will enhance the technological and management advantages of enterprises in the market competition. However, there is no limit to the application of technology. The universality of computer management system in the operation of enterprises also brings obvious effects to enterprises by using the same technology. They use some advanced technology, combined with the integrity of the system to play its advantages, so that it can build a play space with infinite extension. Because of the rapid development of computer technology, it also provides certain technical conditions for the upgrading of computer management system, which can better integrate into the development of society. The management scale of an enterprise is relatively large compared with other industries, and the biggest feature of the computer management system is its integration. It collects huge data and carries out sorting, collection and transmission, which provides an important data reference for the decision-making of an enterprise, speeds up the efficiency of decision-making, and improves the scientific of enterprise management.

3. ECONOMIC ANALYSIS OF COMPUTER MANAGEMENT SYSTEM

In order to adapt to the production and management operation of modern enterprises, people can widely apply computer management technology to the management of enterprises, which is to improve the economic benefits of enterprises. The advantages of the computer management system are mainly reflected in two aspects. One is to manage and collect the information of the enterprise many years ago systematically according to the computer management system. In the case of data management, you can quickly find, compare and integrate the analysis questions Problem, and solve the problem in time and quickly, so that the solution of the problem has pertinence, which can reduce the probability of enterprise information processing errors, to a certain

extent, can reduce the risk of enterprise operation. Second, for enterprises, customers' needs are always the first. Through management technology, customers' needs can be timely retrieved to meet their needs for information. At the same time, for an enterprise, it can better store the competitive information of its peers, which is conducive to the long-term development of the enterprise. Third, in the management and operation of large-scale enterprises, the management of personnel is also a more complex thing. At this time, we can make full use of computer management system to supervise and manage the work of staff. Fourth, in the production and operation of enterprises, it is very important to master the latest market research reports and information, and the information management system can quickly receive and convey the information of the outside world, and build a convenient platform for people to communicate with the outside world.

4. CURRENT SITUATION OF COMPUTER MANAGEMENT TECHNOLOGY

At present, the computer management technology commonly used in our country is a management system developed by internal personnel, and the gap between it and some developed countries such as Europe and the United States is still very large, because the development conditions in our country are relatively complex, and the core development technology is not mastered, resulting in the development process, slow speed and big obstacles. And for domestic enterprises, there is the same stroke, that is, there is no independent software management system inside the enterprise, and the technology used by common enterprises still relies on foreign technology, which is mainly due to the insufficient strength of enterprise development and investment. If the enterprise can solve these two problems well, it may be more powerful for the development of the enterprise. In terms of the computer management system used, because the development of its technology has been hindered by various factors, so at present, it can only be widely used and some small information exchanges and dissemination, for those more complex work, the computer management information system cannot be well solved, and for the current operation status of the enterprise, its information management is in Diversification and complexity, so with the rapid development of society and the cruel social elimination system, the computer management system obviously cannot meet the huge needs of enterprises, and there is an important problem in the computer management system, which is too single technology and lack of diversity. As far as the enterprise is concerned, the limitation of technology will hinder the information exchange between the departments of the company. It is difficult for the computer management system to provide effective help when dealing with simple and complex information. And most of the systems are not

technology, even if there are a few systems can be carried out, but he cannot deal with the complex and difficult information very well. Therefore, there is a great demand for remote control technology of management system. If we cannot solve this problem in time, it is difficult to provide technical help for enterprises.

5. DEVELOPMENT DIRECTION OF COMPUTER MANAGEMENT SYSTEM

The development of computer technology in the contemporary era is very rapid. At the beginning, it was used in military computing. However, because the development of science and technology at that time was not as rapid as it is now, the volume of computer at that time was relatively large and the speed of computing was relatively slow, but it was the latest technology at that time. With the spread and exchange of information technology, computer technology has also changed with people's needs. From the huge volume to the portable notebook computers, etc., from a small number of people to the popularity of the present, it is a general manifestation of China's computer technology progress. As a necessity of people's life, computer technology plays an important role in every aspect of life. Especially the development of computer management system, which is widely used in enterprises, is an important measure for enterprises to improve management means and economic benefits. However, there are still some defects in computer management technology in China, which requires technical work Personnel should improve the shortcomings of computer management technology, actively learn from and learn from the advanced technology of other countries, strive to create core technology as soon as possible and gradually get rid of the dependence on foreign technology, so as to make the enterprise management of our country more efficient, more convenient and diversified, and make outstanding contributions to improve the economic efficiency of our country.

6. CONCLUSION

At present, computer information management technology is widely used in enterprises, which plays a key role in enterprise management and promotes the improvement of enterprise production efficiency. However, with the complexity and diversification of enterprise information, if we want to improve the level of higher level, we need to further study computer management technology. However, because of the strong comprehensiveness of computer management technology, which involves a wide range of knowledge and complexity, it requires our researchers to study harder and contribute to the economic development of national enterprises Give your own strength.

REFERENCES

- [1]G. Liu, and N. Zeng, Research on development direction and implementation technology of

management information system. Journal of Beijing Printing Institute, 2019, 25 (07): 156-158.

[2]P. Li, Analysis of development status and direction of computer management information system. China management information, 2018, 19 (15): 159-160.

[3]C. Chen. On the development direction of computer management information system. China management information, 2018, 18 (21): 177-178.

[4]Q. J. and Zhu, Research on the development direction of computer management information system. Enterprise technology development, 2017, 34 (06): 67 + 71.

[5]C. Li, S. S. Bai, and L. Hong, On the development direction of computer management information system. Computer disc software and application, 2017, 16 (18): 135-136.

Application of 3D Animation Technology in Virtual Reality Project

Le Qiu

ZIBO Vocational Institute, Zibo 255314, China

Abstract: This paper describes the current 3D animation technology and virtual reality project, focusing on the analysis of the actual application of the project, including modeling, action capture and adjustment stage. In the early stage of production, we will achieve high authenticity for reference.

Keywords: 3D animation technology; Virtual reality project; Modeling

1. INTRODUCTION

3D animation technology can achieve more accurate reality simulation, in many fields can see its figure. And in the process of practical application, because of the realization of digitalization, not easy to be affected. At present, the virtual reality project gets more attention, and applies 3D animation technology to improve the simulation degree of virtual scene and promote its development.

2. 3D ANIMATION TECHNOLOGY AND VIRTUAL REALITY PROJECT

2.1 3D Animation Technology

At this stage, the technology has been nearing maturity, and the development of computer programs has also promoted its wider application, of which the role in film and television animation is particularly significant. On the one hand, the technology is more practical and has a strong economy. On the other hand, when shooting a difficult picture, the technician can use the computer program to insert the desired scene, in order to get better animation effect, help to control the project operating costs. On the whole, the technology is animated by computer programs and presented through various media. Specifically, the technology is not affected by the external environment and is being developed in the context of continuous technological progress.

2.2 Virtual Reality Project

To realize the virtual reality project, we need to use the computer's related programs, the above 3D animation technology and professional sensors and other equipment, so that the masses to achieve an immersive experience. During the practical practice, the virtual reality project realizes the virtual and realistic interaction with the help of computer, network, animation and other technical equipment. In addition, this activity has a variety of perception functions, so that the public can feel the virtual world, improve the user's sense of experience. Typically, the data of the real movement is transmitted into the system by sensor, and digitally processed in a virtual

animation, which helps to immerse itself completely in the context of the computer's settings [1].

3. APPLICATION OF 3D ANIMATION TECHNOLOGY IN VIRTUAL REALITY PROJECT

3.1 Modeling

The most basic link in virtual reality projects is modeling, in which the people involved use 3D animation technology to create characters and scenes to ensure the integrity of the virtual world. In the actual design stage, on the one hand, the relevant personnel need to integrate the relevant information related to the design concept, such as the buildings, mountains and waters contained in the virtual world, as a reference, improve the realism of the virtual world, to achieve a high level of simulation. On the other hand, during the formal modeling period, it is necessary to preserve the motion process of each part, which is beneficial to the relevant personnel to observe their motion trajectory and characteristics. During the construction of virtual model, the relevant personnel are based on the realistic scene, which not only improves the work efficiency, but also realizes the consistency of the virtual model and reality. Collect physical data with professional scanning instruments to ensure a reasonable degree of virtual model.

3.2 Motion Capture

In the construction of virtual reality project, some scene characters cannot be obtained by conventional shooting, for which the use of 3D animation technology to achieve the state of motion capture. After further processing, obtain the design of the required information, optimize the state of motion, and produce a full range of stereoscopic scenes. With professional instruments, you can see the relevant information in the virtual world visually to bring the sense of distance between virtual and realistic [2]. For example, in the three-dimensional animated film "Which Demon Child Descends", it will use action capture to achieve a good image of the characters in the virtual project, so that the movement of the characters smoother. Good application can also be obtained in other areas, in the medical aspect can play a greater role in the installation of temperature sensing equipment, health care workers through observation of electronic monitors to understand the patient's situation, for infectious disease isolation wards, can reduce the frequency of access, effectively reduce the workload of staff, reduce the chance of infection. In addition, this kind of sensor can also be

used in daily life, through the mobility of the situation, such as effective dynamic monitoring, reduce the pressure on the family.

3.3 Adjustment

The application of 3D animation technology in virtual reality project, the relevant personnel should not only master the operation of specific computer programs, but also need to be fully applied through motion capture collected data, in order to enhance the authenticity of the virtual environment. During the actual operation, it is necessary to adjust the data information, to realize the effective processing through computer technology, and to modify the virtual world of design by insertion and overlay. After many mediations, to maximize the consistency of virtual data and real data, to ensure that the produced works meet the design needs.

4. CONCLUSION

In virtual reality projects, 3D animation technology plays an important role, and relevant designers

constantly optimize and adjust the production process and production effect in the process of practice. In addition, we should absorb more advanced design technology and scene design concept, strengthen communication and cooperation in various fields, achieve good integration effect, and provide more real virtual experience for the masses.

REFERENCES

- [1]Information Technology; Researchers from University of Science and Technology of China Report Details of New Studies and Findings in the Area of Information Technology (RAS: A Data-Driven Rigidity-Aware Skinning Model for 3D Facial Animation). Computers, Networks & Communications, 2019, (67): 90.
- [2]Application Research of Automatic Generation Technology for 3D Animation Based on UE4 Engine in Marine Animation. Journal of Coastal Research, 2019, (22): 10.

Book Management of Applied Chemistry Major in the Background of New Engineering

Chuanbo Dai*, Hua Wang
Jiaying University, Meizhou, 514015, China

Abstract: The development and popularization of the "New Engineering" model in the new period is very important for China's educational reform and economic development, and improving the library management of applied chemistry major sins in colleges and universities can enhance students' professional level and innovation ability. By outlining the importance of applying chemistry professional book management in the context of new engineering, this paper explores the way of book management, and then enables colleges and universities to continuously deliver high-quality "new engineering" talents with strong innovation and high level of practice to the society.

Keywords: New engineering; Applied chemistry; Book management

1. INTRODUCTION

Applied chemistry major is a subject formed by penetration and fusion of modern chemistry and other fields, which belongs to the applied subject series in the field of technology and chemical engineering, which focuses on cultivating students' application level of knowledge and solving problems in social life and knowledge application. Under the background of the new engineering, the demand for high-quality engineering talents is increasing, so strengthening the library management of applied chemistry major is very important to improve the quality of engineering students.

2. THE IMPORTANCE OF BOOK MANAGEMENT IN APPLIED CHEMISTRY IN THE CONTEXT OF NEW ENGINEERING

The specialty of Applied Chemistry belongs to the specialty with short development time, and there are few kinds of related books. Although there are many excellent teaching materials for chemistry major in Colleges and universities, the number of books and teaching materials suitable for the new engineering background is insufficient, which is difficult to meet the needs of national quality education, so it brings challenges to the cultivation of application-oriented talents in schools. For example, 40% of the knowledge of inorganic chemistry courses overlaps with structural chemistry and physical chemistry, which limits the scope of the teaching of school chemistry, making it unable to meet the teaching needs of the new engineering era. At the same time, the contents of books are tedious, unable to highlight the key points, so they are not suitable for carrying

out multi-level and multi-standard engineering personnel training. Therefore, relying on the background of new engineering, it is very important to strengthen the book management of Applied Chemistry Specialty, so that the teaching material setting not only meets the basis of science, but also reflects the technical knowledge of engineering, integrates the theory of new engineering with the book management, and highlights the pertinence, integration and diversity of the books of Applied Chemistry Specialty.

3. THE WAY OF APPLYING THE LIBRARY MANAGEMENT OF CHEMISTRY MAJOR IN THE CONTEXT OF THE NEW ENGINEERING DEPARTMENT

3.1 Establish a Clear Guiding Ideology for Book Management

In the process of applied chemistry professional book management, we need to follow the following principles: breaking down barriers, pushing new information, expanding knowledge, selecting content, scientific caution, contact with reality, easy to self-study, strengthen application. Because professional books are the carrier of students learning new technologies and new science, professional basic book management should focus on improving everyone's subject quality and professional ability. At the same time, in the book preparation, we should combine the production, life, natural phenomenon and other examples, image, intuitive description of the scientific theorems and basic concepts, and then help students to learn the theoretical knowledge and actual production integration, to meet the "new engineering" model of talent training objectives.

3.2 Book Management Should Focus on "Application"

Applied Chemistry is a new major in colleges and universities, and the Professional Teaching Materials Committee, through analysis and research on the use of professional teaching materials, strengthens the setting and management of professional books, and has published "Higher Organic Chemistry" and "Experimental Methods for Applied Inorganic Chemistry"[1, 2]. In the era of new engineering, the teaching material management organization focuses on the "application" part when it innovates the basic books of applied chemistry. For example, Advanced Organic Chemistry is an expanded book on basic organic chemistry, which contains knowledge of the application areas of organic reactions that students are

more familiar with. In the "Organic Synthesis" section, lead students to learn the design of organic synthesis routes, collect relevant fine chemical products as a case, and strengthen our understanding of applied chemistry knowledge. In the book "Modern Application Inorganic Chemistry" contains a variety of theoretical knowledge of the explanation and application process, focusing on the production of applications of relevant examples. Therefore, highlighting the application of chemistry professional basic books "application" is the focus of book management, before the book set up the writing team needs to carry out seminars, combined with new engineering concepts, with the use of application examples to enhance the practical and innovative students' professional learning.

3.3 Writing and Setting up Application Materials Books in Conjunction with the Online Education Platform

Under the "new engineering" mode, the basic quality and professional development of the students majoring in Applied Chemistry are required to be improved. Innovation online platform + module teaching system, combined with modern technology to build related discipline education system, innovation and entrepreneurship system. For example, according to the online education platform of our school, a school's Applied Chemistry Specialty conducts research on regional talent demand and post quality standards, compiles a series of applied teaching materials such as comprehensive training of Applied Chemistry professional skills, which is combined with flipped classroom, micro class, MOOC class, etc., so as to cultivate students' professional ability and engineering professional level, and integrates the concept of "new engineering" into response in the training plan for chemical talents [2].

3.4 Setting Series of Applied Chemistry Books

First, improve the systematization and scientization of books. When setting up a series of books, applied chemistry majors need to refer to the knowledge of physics and mathematics, and infiltrate them with chemistry disciplines, so as to lay a foundation for students to learn physics and chemistry courses in the future. At the same time, reference to organic chemistry, analytical chemistry, and inorganic chemistry related books to reduce the repetitive content of new books and old books. Secondly, in terms of book content setting, we should explain the nature of chemical phenomena from micro and macro fields, improve students' understanding of chemical principles, and then promote the cohesion of chemical

books for the curriculum. In addition, the set-up of the series of teaching materials should reflect the theoretical thought of "new engineering", cultivate the students' logical thinking and innovation ability, scientifically arrange the book content, match with typical examples, summarize the teaching content in combination with the actual production and life, and meet the students' learning needs of applied chemistry knowledge. Third, strengthen the management of books and drawings. Taking the chemical engineering drawing of Applied Chemistry as an example, it is closely related to mechanical drawing. Therefore, in the process of book management, it is necessary to not only lay emphasis on the basic knowledge of mechanical drawing and chemical drawing, but also integrate the characteristics of Applied Chemistry Specialty, cultivate the students' ability to solve the shape problem of machine parts, and cultivate the engineering operation ability and quality of everyone relying on the concept of "new engineering".

4. CONCLUSION

Under the background of new engineering, the book management of Applied Chemistry Specialty needs to be carried out step by step. In the compilation of professional books, the new engineering elements and Applied Chemistry professional knowledge should be integrated in combination with the actual situation of production and scientific research in the new era. Strengthen the management of electronic information, multimedia and network of books, expand the contents of books, extend the space for students to learn chemical knowledge, cultivate their innovative consciousness, and make them become talents to meet the needs of "new engineering".

ACKNOWLEDGEMENTS

The Construction and Practice of the Talent-cultivation Mode of Applied Chemistry Specialty under the Background of Engineering Education Accreditation (Teaching Reform Project of Higher Education in Guangdong Province, China).

REFERENCES

- [1]Y. S. Dong, Y. L. Tu, and K. W. Wang, A General Strategy for Macrotheranostic Prodrug Activation: Synergy between the Acidic Tumor Microenvironment and Bioorthogonal Chemistry. *Angewandte Chemie International Edition*, 2020, 59(18).
- [2]T. Holme, Using the chemistry of pharmaceuticals to introduce sustainable chemistry and systems thinking in general chemistry. Elsevier B.V., 2020, 16.

Research on the Teaching Strategy of Chemical Engineering Principle Experiment under the Concept of New Engineering

Lili Geng, Bailin Sun, Xiaoning Shen

Institute of applied chemistry, Hebei North University, Zhangjiakou, 075000, China

Abstract: The concept of "new engineering" requires that local colleges and universities should take the initiative to meet the development needs of new economy and new industry, and cultivate compound "new engineering" talents with strong engineering practice ability, strong innovation ability and certain competitiveness. Chemical engineering principle experiment is one of the important basic courses of chemical engineering, pharmaceutical engineering and other engineering majors. This paper takes the teaching of chemical engineering principle experiment course of Applied Chemistry Major in our university as an example to reform and innovate its teaching mode, and discusses how to improve students' awareness of new engineering, deepen the reform, and cultivate compound applied talents through experimental teaching.

Keywords: New engineering; Teaching strategy; Compound talents

1. INTRODUCTION

The rapid development of the new economy has put forward a severe test to the talent cultivation of engineering specialty. The new engineering concept requires local universities to actively face the development needs of the new economy and new industry, and cultivate the compound "new engineering" talents with strong engineering practice ability, innovation ability and certain competitiveness. The so-called "new engineering" is to give top priority to the cultivation of talents based on morality, take crossing and integration, inheritance and innovation, coordination and sharing as the basic way [1-4], and cultivate talents with comprehensive abilities such as the ability to apply the knowledge learned to solve practical engineering problems, engineering design, innovation, creation and entrepreneurship.

Chemical engineering principle experiment belongs to the category of engineering experiment, which is the basic course of chemical engineering and pharmaceutical engineering specialty. It is an important link to combine the theory and practice of chemical engineering principle, and an important auxiliary and supplement to the theory course. The experimental course of chemical engineering principle can cultivate the ability of students to use

the knowledge they have learned to solve practical engineering problems in chemical unit operation. With the development of the construction of new engineering and the orientation of the school, improving the students' awareness of "new engineering" is the guarantee for the implementation of the overall teaching effect of the chemical engineering principle experiment course, and the need for local colleges and universities to cultivate high-quality applied talents for the local economic construction and industrial development.

2. CURRENT TEACHING SITUATION AND PROBLEMS

Chemical engineering principle experiment is an engineering experiment course, which is used to enhance students' awareness of "new engineering", cultivate students' ability of comprehensive analysis and problem-solving, establish engineering viewpoint, so as to open up ideas in production and development research work, bypass by analogy, flexibly use, continuously develop and apply new technologies, new processes, new products and new equipment, reduce raw materials and equipment in production process Energy consumption, improve economic efficiency and better meet social needs. However, in the process of teaching for many years, it is found that students have the following problems in learning chemical engineering principle experiment class:

First of all, students do not pay enough attention to the experimental class. For a long time, the experiment course of chemical engineering principle has been regarded as an accessory of the theory course. Students despise it in thought and can't devote themselves to the experiment study. Then there will be students' experiment operation coping, data processing and experiment report writing. In addition, 36 class hours of teaching plan are relatively insufficient, which can only compress the experiment with a long experimental process in a short time, resulting in the low quality of the experiment or in order to do a good job in the experiment procrastination phenomenon.

Secondly, the experimental instruments are not perfect. At present, there are only six single sets of experimental equipment, namely heat transfer, absorption, Bernoulli equation instrument, distillation tower, rotary distillation and Renault device. Students

can only carry out experiments in groups of six or seven people in each group. There will be only one or two hands-on operations in individual groups, while the rest of the students will wait and see, which will lead to the decrease of students' enthusiasm and actual teaching effect.

Thirdly, it is restricted by the traditional experimental teaching ideas and methods. Some students only want to take credits or scholarships for experimental study. They are not very active and interested in learning. They only want to complete the teaching process and carry out experiments. Their awareness of "new engineering" cannot be improved, which is far from the goal of training practical talents with certain engineering practice ability and innovation ability.

3. TEACHING REFORM MEASURES

According to the current development situation of national higher engineering education and the general goal of talent cultivation in our university, the research group has discussed the reform trend of teaching content and teaching method of chemical engineering principle experiment. In order to enhance the effect of experimental teaching, improve students' awareness of new engineering and further promote the training process of applied talents, the research group of our university has reformed the teaching of chemical engineering principle experiment education. Some measures have been taken.

3.1 Develop New Teaching Plan and Syllabus

By studying the concept of "new engineering" and the training objectives of our school, the research group discussed, formulated new teaching plans and syllabus, and adjusted the experimental hours to 48 hours, so as to ensure the time of students' hands-on exercises, and revised the corresponding experimental contents, so as to make it conform to the new economy and new industry, which requires a compound type with strong engineering practice ability, strong innovation ability and certain competitiveness. Training requirements of "new engineering" talents.

3.2 Improve Experimental Teaching Equipment

In order to increase the opportunity of students' hands-on operation and better complete the experimental content, our school has increased the experimental instruments to achieve the parallel teaching of two identical experimental equipment, and the number of students in groups has been reduced to 2-3 in each group, so as to ensure that each student can operate by himself. At the same time, the laboratory has added common chemical production equipment, such as plate and frame filtration, centrifugal pump, extraction tower, chemical instrument and reaction kettle. On the basis of chemical principle experiment, it has added chemical practical training course, which can carry out small chemical production process. Students can not only set up learning through material selection, engineering design, material and heat calculation, but

also discuss and solve problems encountered in production process. The students' engineering view has also trained their practical and innovative ability, laying a foundation for their graduation to engage in relevant chemical related work.

3.3 Application of Simulation Teaching

With the development of virtual simulation technology and the new requirements of "new engineering" for innovation ability, chemical laboratory integrates resources on the existing basis, and adds five 3D virtual simulation experiment resources, such as sulfuric acid production process, ethylene oxide production and ethyl acetate production, in the simulation teaching experiment platform of our school. 3D virtual simulation experiment has a vivid, lifelike and three-dimensional form of expression, which can make the dangerous practical operation process through vivid animation demonstration, can make the boring and abstract theoretical knowledge in the theoretical teaching become vivid and easy to understand, increase the interest of students, teachers can combine the actual teaching needs, maximize the advantages of virtual resources, and improve the teaching effect. At the same time, let the students experience the feeling of being in the environment of safety and environmental protection, realize the interactive experiment teaching, stimulate the students' interest of independent experiment and the interest of exploring the mystery of chemical process to the greatest extent.

3.4 Build a Reasonable Assessment Plan

Before each experiment, students are arranged to preview and ask questions, and a preview experiment report with their own ideas is written. After the experiment, the teacher evaluates the students' operation, and finally reflects the students' experimental operation level in the form of a score and comment. The writing of the experimental report should be standardized, and reflect what has been gained in the experiment, where there are mistakes, whether there are constructive opinions, and their own feelings about the experiment. This is not only conducive to stimulate their interest in learning, improve their enthusiasm for learning, but also improve their ability to solve problems.

4. CONCLUSION

Through the reform and exploration of chemical engineering principle experiment teaching, the learning effect of chemical engineering principle experiment in our school has been improved, and students' learning interest, hands-on operation ability, engineering problem solving ability and innovative design ability have been improved to a certain extent. As a local undergraduate university, with the overall goal of cultivating high-quality applied talents with noble morality, solid foundation, innovative spirit and practical ability, our university will continue to actively invest in the construction of "new engineering" and education reform, and cultivate new

engineering and technical talents for local economic construction and new industry demand.

ACKNOWLEDGEMENT

Education reform project of Hebei North University (GJ2019081), Industry-academy cooperation and cooperative education of the Ministry of Education (201802066130).

REFERENCES

- [1]J. Zhou, Q. J. Liu, and Q. Zhang, Reform and construction of practical teaching mode in the context of new engineering. *Experimental technology and management*, 2018, 35 (3): 165-168.
- [2]P. Lan, T. Xie, and L. Zhong, et al. Reform of

experimental teaching of principles of chemical engineering in Colleges and universities. *Journal of Guangxi University for Nationalities: Natural Science Edition*, 2010 (3): 97-100.

- [3]Q. H. Zhao, W. Y. Bai, and H. Q. Tan, et al. Teaching reform and practice of chemical engineering principle experiment. *Guangzhou chemical industry*, 2012, 40 (6): 146-147.

- [4]Z. B. Zhang, Y. H. Liu, and Z. B. Xie, et al. Discussion on the teaching system of chemical virtual simulation experiment in Local Universities under the background of "new engineering" construction. *Education modernization*, 2019, 55: 97-98.

Research on the Rural Tourism Targeted Poverty Alleviation Model from the Perspective of Agricultural Tourism Integration

Xiaoyu Cao

Library of Hunan Agricultural University, Changsha, 410128, China

Abstract: The precision poverty alleviation of rural tourism is based on an open, blood-forming form of poverty alleviation formed under the reform and development of tourism industry. It plays a vital role in promoting the common development of rural areas, agriculture and farmers. Based on the summary and summary of the existing experience, this paper makes a brief analysis of the strategy of constructing the precision poverty alleviation model of rural tourism from the perspective of the integration of agricultural brigades, and makes clear the necessity and importance of concept reform, government guidance, feature drive, joint promotion, etc. for reference.

Keywords: Integration of agricultural brigades; Rural tourism; Precision poverty alleviation

1. INTRODUCTION

The guiding opinions on promoting the revitalization of rural industry clearly points out that the foundation of Rural Revitalization lies in "industrial prosperity". In order to solve the "three rural issues", we should be good at relying on rural resources, taking the integration of rural industries as the path, combining industry integration, poverty alleviation, urban and rural integration, building a modern agricultural industry system and forming a new development pattern. Therefore, it is necessary to speed up the construction of rural tourism targeted poverty alleviation model, and give full play to the advantages of tourism, agriculture, rural areas and farmers in the implementation of Rural Revitalization Strategy.

2. STRENGTHEN THE REFORM OF IDEAS AND ESTABLISH THE CORRECT THINKING OF RURAL TOURISM PRECISION AND POVERTY ALLEVIATION

In the process of constructing the precision poverty alleviation model of rural tourism, we should accurately grasp the concept of precision poverty alleviation in rural tourism, establish correct construction and development thinking, solve the problems between the development of rural tourism and the development of agriculture in rural areas, and enhance the precision, authenticity, rationality and effectiveness of precision and poverty alleviation in rural tourism. Rural tourism precision poverty alleviation expensive in the word "precision", its core

concept is "precision poverty alleviation" and "industrial integration". This requires us to be able to put such thinking and ideas into practice in the process of poverty alleviation. For example:

First, accurately identify rural tourism poverty-relief objects. That is, we need to know in depth the situation of regional construction and development, complete the construction of archives in poor counties, poor towns, poor townships, poor villages and so on, and clarify the causes of poverty and the extent of poverty.

Second, the precise formulation of rural tourism poverty alleviation measures. That is, on the basis of a comprehensive grasp of rural poverty, tap the potential of rural tourism development, with the principle of local conditions, people-oriented principles as a guide, targeted, targeted formulation of poverty alleviation measures and programs, such as "planting help", "farming help", "technical help", "creative help", "to the village with people", "with people with villages", "villages with goods", "villages with villages" and so on.

Third, accurate supervision of rural tourism poverty alleviation effect. That is, with the participation of various forces, strengthen the tracking and control of precision poverty alleviation survey, understand the degree of assistance of rural tourism poverty alleviation, poverty alleviation progress, poverty alleviation difficulties, improve demand, etc., so as to enhance the success rate and efficiency of precision poverty alleviation in rural tourism.

Fourth, diversified integration to promote the process of precision poverty alleviation of rural tourism. That is, under the integration of agriculture and tourism, promote the integration of education, health care, culture, social security, etc., and promote the integration of tourism elites, intellectuals, ordinary farmers, technical experts, etc [1]. Make precision poverty alleviation more coordinated, integrated and systematic.

3. FOCUS ON GOVERNMENT-LED SCIENTIFIC MECHANISM TO CULTIVATE PRECISION POVERTY ALLEVIATION IN RURAL TOURISM

In the precision poverty alleviation of rural tourism, the government, as the main responsibility body, should make full use of its own advantages and strong

lying in rural tourism to guide and promote the work of precision poverty alleviation. In this process, we should clarify the responsibilities, obligations and powers of various departments in the work of precision poverty alleviation in rural tourism, and determine the work objectives, work priorities, difficulties and working methods of each department. For example, the municipal government will precisely formulate the targets of the precision poverty alleviation work for rural tourism and complete the strategic deployment, the poverty alleviation department will precisely formulate poverty alleviation standards, carry out the identification of poor villages and poor households, the implementation of poverty alleviation programs, the supervision of the poverty alleviation process, the evaluation of the effectiveness of poverty alleviation, etc., and the financial departments shall provide financial support for the precision poverty alleviation work of rural tourism to ensure reasonable and safe use of funds [2]. Second, we should do a good job in the overall planning of rural tourism precision poverty alleviation, improve the dynamic control system. For example, organizational professionals make detailed development plans based on the development advantages of regional tourism, relying on dynamic control systems to achieve comprehensive supervision and management of poverty-relief targets, poverty-relief projects, poverty-relief content, poverty - relief measures and so on.

4. INCREASE THE CHARACTERISTIC DRIVE, BUILD THE RURAL TOURISM PRECISION POVERTY-RELIEF BRAND SYSTEM

If poor areas are to rely on tourism to achieve the goal of poverty alleviation, they need to ensure that the rural tourism projects developed are competitive in the market. Therefore, each village should be based on its own actual conditions, including position, natural landscape, folk customs, ecological environment, historical buildings and other excavation with its own characteristics of tourism resources, to shape a good rural tourism brand image, so as to increase the attractiveness and influence of tourism projects. For example, relying on the advantages of agricultural production, to create "agricultural landscape", agricultural production and tourism organic combination, to achieve the "one field multi-use" purposes, relying on the advantages of natural landscape, to create "leisure and entertainment and health" rural tourism projects, farmers, rural areas, tourism and other organic combination, to achieve the coordinated development of agricultural tourism purposes.

5. ENCOURAGE JOINT PROMOTION TO ENHANCE THE CAPACITY OF RURAL TOURISM TO PRECISION AND PRO-POOR DEVELOPMENT

The integration of agricultural brigades not only focuses on industrial integration, but also emphasizes

the integration of other resources. In order to improve the quality and efficiency of resource integration and utilization, but relying on government guidance cannot be achieved, need to be supported by farmers, enterprises, rural cooperatives and other forces to carry out and complete. In this regard, in the construction of the precision poverty alleviation model of rural tourism, villagers should be encouraged to actively participate in transforming them from ordinary farmers to tourism practitioners, tour operators and producers of tourism products.

6. CONCLUSION

In a word, rural tourism targeted poverty alleviation, as a new form of poverty alleviation, is a systematic, comprehensive and long-term development project, which needs to be guided by correct concepts and supported by regional resource characteristics. It needs to obtain development and innovation under the guidance of the government and the support of rural cooperatives, enterprises, farmers and other forces. Therefore, from the perspective of rural tourism integration, the construction of rural tourism targeted poverty alleviation model should pay attention to concept reform, government guidance, characteristic driving and joint promotion, so as to better serve the development of agriculture, rural areas and Rural Revitalization.

ACKNOWLEDGEMENTS

Research project: Scientific research project of Hunan Agriculture University "Research on the service mode of University Library for the cultivation of innovative and entrepreneurial talents", Project number: 2018056; Research project: Scientific research project of CALIS. National Agricultural Literature Information Center "On the promotion model of farming reading culture in Hunan Province under the background of Rural Revitalization", Project number: 2019022; Research project: Scientific research project of CALIS National Agricultural. Literature Information Center "Research on the practice of scientific data literacy education in University Library under the background of double first class", Project number: 2019023.

REFERENCES

- [1]H. L. Hu, Research on Precision Poverty Alleviation of Rural Tourism Based on the Perspective of Integration of Agriculture and Tourism-Taking Dazhu County, Dazhou as an example, reservoir area of large and medium-sized reservoirs and resettlement areas. *Rural Economy and Technology*, 2019, 30(17): 102-103.
- [2]Y. P. Wu, P. Y. Chen, and J. Zhou, Study on the mechanism of tourism precision poverty alleviation in minority villages-and on the mechanism of "integration of agriculture and tourism" in Guizhou ethnic villages tourism precision poverty alleviation. *Journal of Guizhou Normal University*, 2016, 32(05): 57-61.

How to Adapt College Physical Education to the Development of the Network Age

Xin Fang

Tongren University, Tongren, 554300, China

Abstract: This paper will give a detailed introduction to the current situation of college physical education in the network era, and put forward four development strategies for college physical education in the network era by using high-tech products, using network teaching, changing teaching concepts and updating teaching equipment. The development of the network age has greatly changed the current educational model, in order to improve the development of college physical education, teachers need to follow the trend, improve the teaching methods, and then really improve the teaching effect of college physical education.

Keywords: College Physical Education; Network Age; Teaching Concept

1. INTRODUCTION

Many industries have changed greatly due to the development of the network, and their advanced technology concepts have also affected the university physical education [1-2]. At present, there are some problems in college physical education, in order to solve the current predicament, physical education teachers should improve their professional quality and network technology, through multimedia technology to promote the reform of physical education, change the concept of physical education, and then improve their physical education level.

2. THE CURRENT SITUATION OF COLLEGE PHYSICAL EDUCATION IN THE NETWORK ERA

With the advent of the network era, college physical education is facing many challenges, on the one hand, because of the traditional physical education is more rigid, teachers and students less interaction, coupled with some physical education needs to use limbs, some students due to poor coordination, will greatly affect physical education learning, reduce their interest in physical education subjects. At the same time, because of the different personality of college students, a unified teaching method will stifle the personality of some students, and their educational and teaching philosophy is difficult to achieve.

On the other hand, the new teaching concept pays more and more attention to the interaction between teachers and students, but the traditional teaching method is still teacher-oriented, lack of interaction, and teachers because of the limitations of various conditions, such as their own quality, objective conditions, it is difficult to take care of each student,

which will affect the student's sense of participation in sports subjects. In addition, old teaching equipment or textbooks are extremely difficult to meet the basic needs of current students, even if some universities install new equipment, but the update time is slow, it is still extremely difficult to enhance the interest of college students.

3. THE DEVELOPMENT STRATEGY OF COLLEGE PHYSICAL EDUCATION IN THE NETWORK AGE

3.1 Use of High-tech Products

The era of micro-learning has greatly affected the work of university education and teaching, with the popularization of network technology, the society has produced a variety of high-tech products, and even a variety of mobile devices. Physical education teachers can strengthen physical education in today's universities by using high-tech products. For example, in designing a specific sports action, teachers can record it in a network video, using mobile devices to enable students to better grasp the action essentials, thereby improving their own physical education. At the same time, university teachers can also use a variety of ways to carry out virtual teaching, improve the extension of education and teaching.

3.2 Using Online Teaching

Based on the short time of the classroom, micro-learning can make teachers more flexible teaching activities, in the daily network platform, teachers can publish relevant learning tasks or action tips, students can learn anytime and anywhere sports knowledge, whether it is theory, or practical action, through two-way communication and communication, teachers can be more targeted to carry out physical education teaching, students' understanding is more in-depth. At the same time, the biggest characteristics of the network age are diverse forms, traditional physical education, if students want to obtain sports knowledge or related essentials, its approach is less, but network teaching can make up for this defect, college students learn more diverse ways, such as students can learn through network teaching a certain sports movement or related knowledge, the time to acquire knowledge will be faster, the cost will be reduced, help to enhance their interest in sports.

3.3 Transforming the Teaching Philosophy

The traditional teaching methods and concepts are mostly teachers as the main body, whether it is professional courses, or outdoor-based physical education classes, with less interaction with students,

this way will stifle students' interest and creativity, therefore, in order to improve the level of physical education of college students, college physical education teachers should change the teaching concept, students as the main body of teaching, not only in the outdoor, in the network classroom to increase the frequency of interaction with students, so that they more active learning physical education courses. In the course of teaching, teachers need to make students realize the importance of lifelong physical education, guide them to change their initiative and improve the teaching atmosphere, so as to really improve the effectiveness and level of physical education in universities.

For example, in Hubei Province, a physical education teacher in a physical education college in accordance with the requirements of the network era, change their own teaching philosophy, in the network classroom, it is in the form of discussion to carry out physical education-related activities, in the enhancement of interaction with students at the same time, more familiar with and understand the students on the relevant physical education knowledge or action of the situation, and thus greatly changed the students' interest in physical education curriculum, improve the physical education level of most college students.

3.4 Updating Teaching Equipment

On the one hand, under the joint action of quality education and network age, universities should purchase a variety of advanced equipment to meet the needs of current education, after the purchase of network equipment, professional and technical personnel need to update in real time, so that it can better adapt to the needs of teaching. Physical education teachers should also improve their overall quality, not only to learn to use a variety of scientific and technological equipment, but also through physical education, to teach students to learn physical education methods, so that they can more fully understand physical education, and physical education into life.

On the other hand, teaching equipment does not include network communication, also includes more appliances, based on sports activities of outdoor properties, in the outdoor practical teaching, students should also master the use of a variety of appliances, enhance their practical ability [2]. To make it more comprehensive development in physical education. At the same time, the teaching effect of college physical education teachers has been significantly improved.

For example, a physical education teacher in a physical education college in Guangxi Province, on the one hand, uses advanced teaching equipment to impart relevant sports expertise, which visually affects students' understanding of physical education, on the other hand, the teacher actively learns the use of fitness equipment, and in the outdoor classroom will use methods to teach students, improve students' professional level and physical quality, and promote their all-round development.

4. CONCLUSION

To sum up, with the rapid development of the Internet era, college physical education also needs to conform to the trend of teaching mode reform. The goal of physical education should be to cultivate students' habit of lifelong learning. When teachers introduce multimedia technology into the classroom, they should also update the teaching concept in time. Enhance the interest of college students in sports, and then affect their sports concept, and really improve their sports level.

REFERENCES

- [1]X. J. Hu, Analysis of University Physical Education Teaching Strategies in the Context of Information Technology. *Contemporary Sports Technology*, 2019, 9(15): 82-84.
- [2]R. J. Li, How College Physical Education Teaching Adapt to the Development of Network Age. *Contemporary Educational Practice and Teaching Research*, 2018, (01): 31.

Progress Management System of Large Building Based on BIM Technology

ZhongLong Jing

Art College, Zhengzhou Railway Vocational and Technical College, Zhengzhou, 450000, China

Abstract: This paper first analyzes the application advantages of BIM technology-based large-scale building schedule management system, and then introduces the design of BIM technology-based large-scale building schedule management system, including system design concept, establishment of 3D model, WBS function creation, and preparation of schedule plan, hoping to provide effective reference for relevant people.

Keywords: BIM technology; Large buildings; Progress management

1. INTRODUCTION

The birth of BIM Technology provides technical support for the innovation and development of the construction industry, which can effectively restore the original appearance of 3D design. Through the construction of management model covering all kinds of construction information, promote the coordination and communication between participants, improve their original organizational structure and cooperation mode, improve the overall production efficiency of the construction industry, and bring greater value benefits to all participants.

2. ADVANTAGES OF BIM BASED SCHEDULE MANAGEMENT FOR LARGE-SCALE BUILDINGS

Large scale construction projects are more complex, which have higher coordination requirements for each participating team. Traditional methods have been unable to meet the development needs of large-scale construction projects, and strengthening the coordination among various participants has become the focus of construction enterprises. The birth of BIM Technology provides technical support and basic platform for the collaborative communication between different participating teams. The site is highly professional, and the construction team with rich experience can use this platform to implement smooth communication with the participants after finding problems, and the participants should also make reasonable adjustment according to their actual development situation. The progress management system based on BIM Technology can show the progress plan in the form of movie and transmit it to the management and construction layers, so that the participants at different levels can master the project progress [1, 2].

3. DESIGN OF LARGE-SCALE CONSTRUCTION SCHEDULE MANAGEMENT SYSTEM BASED

ON BIM TECHNOLOGY

3.1 System Design Ideas

The construction schedule is a static content, which cannot be changed with the development of engineering construction. Engineering construction is a dynamic change process. The change of construction scheme, design and schedule will change the application plan of machine equipment, building materials and human resources. In order to further control the project risk, we can combine BIM Technology to create 4D project management system, introduce the information of site, resources and progress, and then carry out overall control and fine management of the whole construction process from a macro perspective.

Construction schedule management system mainly includes application layer, foundation layer, platform layer and model layer. The basic layer is the main source of relevant data information in the data layer, including schedule management software, 3D modeling software and enterprise quota. Quota and software in data source can provide various engineering information and technical support. Data layer covers all kinds of parameter information needed to create 3D model, including various component materials, dimensions, etc. Therefore, it is necessary to build WBS standard template and construction schedule, reasonably select construction cost, construction resources and all kinds of data and information required by construction site. In the model layer, the relevant data information in the data layer is introduced into the practical application cases, and the relevant data can integrate the management information such as 3D geometric information, 3D building model, cost, site, progress, resources, etc., create the construction process model, promote the full integration of the two model information, and finally form the BIM information model, which covers the diversified building information. The platform layer links BIM progress management platform, management system platform and most visible platforms. WBS is the core and links two application platforms. Based on the multi-dimensional visualization platform, the whole three-dimensional building model is browsed. BIM construction progress platform is based on BIM progress management system, which can manage construction progress and construction simulation, and then manage construction site, construction cost and construction resources.

3.2 Building a 3D Model

The three-dimensional model is not only the solid model of various construction objects, but also the static description of the whole project. Relevant models can be established by combining achicad, Autodesk Revit building and other professional modeling software. According to the hierarchical analysis, the relevant components cover all kinds of attributes and information required in the project life cycle. For example, the component is regarded as a solid unit building object space location, geometric size, component solid space and other information. Relevant information is mainly stored in the graphic database, which can store, manage and maintain BIM data information, browse, analyze and query 3D geometric model, construction progress, construction materials and other information, as well as modify, increase, decrease, query and copy 3D model through hands-on operation.

By construction segment and floor division, components can be defined as structural groups, and the construction sequence in different structure groups can be different, so different maps, textures, and colors can be used to describe this. For example, the reinforced coagulation structure group covers the concrete pouring, maintenance, template support, rebar strapping and hand frame and other processes. Different operation properties and inter-operation relationships can be set in order to have construction properties.

3.3 WBS Role Creation

WBS is primarily a work decomposition structure that breaks down large building projects into manageable breakdowns and projects to facilitate the discovery of the various elements required within the scope of the project. The creation of progress management system based on BIM technology cannot be separated from WBS technology, but also the core of the whole system.

Within the progress management system under BIM technology, WBS can facilitate the smooth exchange of data information between different functional modules. The specific function is as follows: First, the interface can be used in the system to read the three-dimensional model and external information in WBS, and promote the progress management system to achieve effective information exchange. For example, WBS can be used in the system to receive information on the application status and construction status of sites, labor, machinery and material resources in the designated construction area. The second is the effective link between Microsoft Project-related progress management software and WBS to optimize the progress management interface. The third is the use of WBS to achieve BIM

technology-based visual dynamic management, covering site setup, resource management, construction simulation and progress management functions. In addition, combined with WBS data to implement analytical processing, can promote functional expansion, optimize construction and cost analysis [2].

Establish WBS, that is, implement decomposition treatment for construction objects, become several components convenient for management and small-scale, and create process task node in WBS as each sub node in WBS construction section. For each node of WBS, corresponding codes will be automatically assigned, and time attributes will be collected for each node in combination with the progress management system. WBS process node also needs to classify the specific construction tasks, but only after the progress management is refined to WBS process node, can the precision and accuracy of the progress management in the construction be improved.

3.4 Preparation of a Schedule

In the current management work, the schedule is mainly divided into different construction sections by using the flow construction method and Microsoft project software combined with the workload and work surface differences. Then the actual content of each construction section is decomposed, and the schedule is prepared according to the corresponding construction process and logical relationship. At the end of the planning work, the information association of cost, site, resource and WBS structure is extracted to form a construction model which can change with time. Finally, WBS can promote the information association between construction schedule and 3D building model.

4. CONCLUSION

To sum up, the construction schedule management system based on BIM Technology is of great significance for the development of construction enterprises, and also has high research value, which can successfully solve various problems in project management, and relevant research results have great application prospects, which can promote the further development of the construction industry.

REFERENCES

- [1]M. A. Eirgash, Earned Value Analysis for Construction Projects Using Project Management Scheduling Engine. American Journal of Civil Engineering, 2019, 7(5).
- [2]P. Pramen, Shrestha, K. K. Shrestha, and H. B. Zeleke, Probability of change orders and the effect on cost and schedule for new public-school buildings. Emerald Publishing Limited, 2019, 26(6).

Problems and Countermeasures of Water Fertilizer Integration Technology in Practical Application

Jingli Li

Department of Electrical Engineering, Yellow River Conservancy Technical Institute, Kaifeng, 475004, China

Abstract: In the background of the development of agricultural machinery automation, in order to improve the efficiency of agricultural production, water fertilizer integration technology is beneficial to agricultural production capacity and economic growth, so the technology has been widely used. However, it was soon discovered that there were still many problems in the application of water fertilizer integration technology, which limited the function of the technology and could bring about a series of negative effects, so it must be improved. In this paper, the application of water fertilizer integration technology will be analyzed in the light of the general case, and the relevant countermeasures will be put forward.

Keywords: Water fertilizer; Integration technology; Problems and countermeasures

1. INTRODUCTION

In modern agricultural activities, the application value of water fertilizer integration technology is unquestionable, but according to the general case to compare, it can be seen that some agricultural areas in the use of this technology has encountered difficulties, mainly reflected in the limited application of technology, technology promotion difficulties and large costs. In view of these manifestations, this paper will analyze their causes and influences, and solve problems through countermeasures, which has the practical significance of promoting the development of agricultural technology.

2. MAJOR PROBLEMS IN THE APPLICATION OF WATER FERTILIZER INTEGRATION TECHNOLOGY

2.1 Lack of Technical Awareness

The main service object of water fertilizer integration technology is farmers, so the behavior of farmers using this technology determines the function of technology, but in fact, many farmers' cognition of water fertilizer integration technology is not enough, resulting in their technical application behavior is not correct, limiting the effectiveness of technology. This kind of problem performance will cause serious waste of resources, but also affect agricultural production capacity, such as a farmer in the use of water fertilizer integrated technology, it is believed that the technology as an advanced technology will automatically limit the

amount of irrigation, so the opening of the relevant facilities did not close, but in real time the technology is a semi-automatic technology, and will not be based on irrigation capacity to self-control, resulting in a large number of water fertilizer resources, energy waste, while water fertilizer resources irrigation is affecting crop growth, explain that this problem will reduce agricultural production capacity [1].

2.2 Technical Acceptance Is Not High

In some agricultural areas, most farmers are still willing to use traditional irrigation models to engage in agriculture, water fertilizer integration technology and a series of advanced technology is not high acceptance. There are two reasons for this problem: the local government departments have not publicized the integrated technology of water fertilizer, resulting in farmers not aware of such technologies, or even do not know the existence of such technologies, thus, do not blindly use such technologies;

2.3 Adverse Maintenance of Technical Equipment

The use of water fertilizer integration techniques requires irrigation equipment to support them, most of which are located in soil near farmland and require long-term operation. Under this condition, equipment after a long period of operation will inevitably failure, aging problems, resulting in the technology in a short period of time lost the original energy efficiency, and in the eyes of farmers this phenomenon is a typical "input and expenditure is not proportional" phenomenon. However, the cause of this phenomenon lies in the technical equipment maintenance work is not conducive, that is, farmers in the use of water fertilizer integration technology will not take the initiative to maintain the equipment, there is no local person to carry out maintenance, so the equipment will be long-term out of high-speed loss of state, resulting in the above phenomenon, limiting the application of water fertilizer integration technology in agriculture [2].

3. COUNTERMEASURES TO SOLVE THE PROBLEM OF THE APPLICATION OF WATER FERTILIZER INTEGRATION TECHNOLOGY

In view of the above water fertilizer integrated technology application of the problems, the following will put forward the relevant countermeasures, aimed at solving the problem, to ensure the effectiveness of technology application.

3.1 Technical Training

Theoretically, the use of water fertilizer integrated technology for agricultural production is conducive to agricultural activities, and there will be no negative impact, but to implement this, we must ensure the proper application of technology, so for farmers on the water fertilizer integration technology is not well-known, resulting in the problem of improper operation of technology, it is recommended that the relevant local departments to carry out technical training work, aimed at strengthening farmers' technical awareness, master the correct application of technology. First of all, taking into account the difficulty of training, in the training should screen some farmers to receive training, so that when the trained farmers have the correct cognition, and through the water fertilizer integration technology to benefit, can drive other farmers to use water fertilizer integration technology, and with the help of trained farmers to strengthen awareness. Secondly, in the training content, as far as possible, the technical principles, operational behavior should be streamlined, in order to facilitate farmers' understanding, at the same time carry out a series of practical activities, so that farmers better to familiar with the integrated technology of water fertilizer, to ensure that the technical efficacy is fully played.

3.2 Policy Optimization

In fact, through the above (3.1 technical training work) content can be improved farmers' technical acceptance, but relying solely on training to improve this is not complete enough, so other ways are needed to strengthen. In this regard, this paper suggests that the local government in the technology introduction policy optimization, to give farmers more economic support, so that farmers are willing to try technology, to eliminate farmers in the introduction of technology on the economic worries, at the same time, the relevant departments should also strengthen publicity efforts, so that technology can be more quickly integrated into agricultural production, and completely enhance the technical acceptance of farmers.

3.3 Forming a Technical Steering Group

Around the water fertilizer integrated technical equipment maintenance work, the relevant departments should set up a technical guidance group, which is mainly responsible for the local water fertilizer integrated technical equipment system for regular maintenance, while long-term basic

maintenance methods to the farmers, so that not only can extend the service life of technical equipment, to ensure the direct relationship between farmers' input and expenditure, but also to enhance the level of farmers to maintain the technical level, solve a series of problems in the integrated technology application of water fertilizer, which can reduce the burden of team members. However, it is worth noting that the maintenance methods taught by the group to farmers are some relatively simple methods, indicating that farmers face complex problems are still unable to deal with, so the relevant departments cannot be in the farmers have mastered the basic maintenance methods to withdraw the steering group, the group should be asked to continue to help farmers to deal with complex problems.

4. CONCLUSION

To sum up, water and fertilizer integration technology has outstanding energy efficiency performance in modern agricultural production. However, due to the influence of various problems, the practical role of this technology has not been fully played. Moreover, it is difficult to popularize the technology, which also brings great cost, so it is necessary to improve the problem. This paper puts forward the relevant problems and countermeasures, through which we can solve the problems, promote the popularization of technology and give full play to the effect of technology.

ACKNOWLEDGEMENTS

Kaifeng science and technology research project: Research on Key Technologies of water and fertilizer intelligent control in precision agriculture, No.: 1902004.

REFERENCES

- [1]J. Li, T. Hong, and R. Feng, et al. Development of automatic control device for integrated water and fertilization drip irrigation of citrus orchard. Transactions of the Chinese Society of Agricultural Engineering, 2012, 28(10): 91-97.
- [2]A. J. Van, and R. Carrette, A practical application of integrated urban pollution modelling in Flanders (Belgium): the catchment of Tielt. Water Science & Technology A Journal of the International Association on Water Pollution Research, 2002, 45(3): 125.

Research on The Location and Capacity of Distributed Power Supply in Microgrid

Shengkai Li

Huainan Union University, Huainan 232000, Anhui, China

Abstract: This paper focuses on the static voltage index of microgrid system, and analyzes the location and capacity of microgrid distributed generation in detail. In the actual research process, by optimizing the layout of distributed power supply and considering the improvement of network loss, the stability of static voltage can be improved, which lays a foundation for the future research work.

Keywords: Microgrid; Distributed power supply; Location and configuration

1. INTRODUCTION

In the process of location and capacity of distributed power supply in microgrid, it is necessary to grasp the principle of the selection of DG installation location, integrate the network loss improvement and static voltage stability improvement index, optimize the DG location configuration model, and adapt it to the needs of the location and capacity research of the distributed power supply of microgrid.

2. STATIC VOLTAGE INDEX OF MICROGRID SYSTEM

The factors affecting the voltage stability of the microgrid system are diverse, among which the most influential is the peak load phenomenon, which leads to the instability of the bus line inside the system. To this end, in the process of DG planning to understand the load level, calculate the static voltage stabilization voltage, the integration of the line's impedance, branch current, end bus active power and reactive power, start and end bus voltage, it is set to $R + jX, I, P_j, Q_j, U_i, U_j$.

At this point, it is concluded $I = \frac{U_i - U_j}{R_{ij} + jX_{ij}}, S = P_j - jQ_j = U_j I$. After the simplicity can be obtained at this time static voltage stability indicator is $L = \frac{4}{U_i^4} [(P_j X_{ij} - Q_j R_{ij})^2 + (P_j R_{ij} + Q_j X_{ij}) U_i^2]$. At this point the indicator is less than or equal to 1. Corresponding to the static voltage stability indicator, there is a weak branch, which is more prone to voltage collapse. When the indicator is 0, it will be in a critical state of collapse.

3. LOCATION AND CAPACITY ANALYSIS OF DISTRIBUTED POWER SUPPLY IN MICROGRID

3.1 DG Installation Location Selection Principle

During the analysis of DG installation site selection principle, it is necessary to adhere to the principle of adjusting measures to local conditions in combination with the actual situation of natural resources and geographical location. In the process of determining the voltage level, when the distributed power supply is

not connected, the feeder nodes near the end should be observed, and it is found that the voltage position shows a downward trend. In order to improve the voltage value of microgrid system, put DG into it and keep it in the state of active absorption, we should adhere to the principle of dispersion in the process of laying DG, and confirm the voltage of the selected series parallel branch and the way to connect DG [1]. The system voltage is positively correlated with the location of DG near the feeder, and the system voltage increases with the proximity of DG and feeder. When testing the voltage of the nearby system, it is found that the impact is greater (as shown in Table 1).

Table 1 DG installation series branch, parallel branch preferred principle

DG installation location selection principle	Main content
Series branch	Select the voltage level below 0.975pu when accessing the DG and plug in at the end
Parallel branch	Access to nodes with voltage levels below 0.975pu

3.2 Net Loss Improvement Indicators

In the process of calculating the network loss index, it is necessary to analyze the changes before DG access and after DG access, in which the factors affecting the size of the microgrid active network loss are diverse. In this link, we need to take full account of the support resistance of the microgrid system and the node voltage. When the voltage level of the microgrid is gradually reduced, the network loss is large, which is mainly due to the flow in the feedline of the tide. In the process of planning the network loss improvement index, it is necessary to understand the system active network loss before and after the DG installation, and set the active net loss of the pre-installation system as $P_{DGFront}$. Set the active net loss of the installed system to $P_{DGbehind}$. By indicator $I = \frac{P_{DGFront}}{P_{DGbehind}}$ analysis, through the change of the indicator to carry out the overall evaluation of the DG access effect [2].

3.3 Static Voltage Stability Improvement Indicators

In the process of analyzing the stability improvement index of static electrical industry, it is necessary to grasp the stability margin of the static voltage in the system, so as to ensure the integrity of the static voltage stability improvement index. In the process of analyzing the improvement index, it is consistent with the network loss improvement index to some extent,

and the static voltage stability of the system before and after accessing DG is still needed to analyze the static voltage stability, at which time the static voltage before the system is connected to the DG is set to $P_{DGFront}$, the static voltage after access to the DG is set to $P_{DGbehind}$, and follow the indicators $I = \frac{P_{DGFront}}{P_{DGbehind}}$ Analysis.

3.4 Optimization Model of DG Location and Volume

In the setting of DG site size model, the scheme included is diverse, there are more factors affecting the loss of active network and static voltage stability, the operating state of the microgrid system is understood in real time, and the DG access position and capacity are measured in all aspects. To this end, in order to reduce the impact on active network loss and static voltage stability, it is necessary to confirm the access capacity of the DG, and analyze from the perspective of the stability of the microgrid system, and set the static voltage stability improvement index to L_i , Net loss improvement indicator set to I_i , Select two weight coefficients of different proportions, respectively K_1 , K_2 . Build a model on this basis $\max T = \max(K_1 I_i + K_2 L_i)$. Among them, there are three main schemes of the model, the first scheme, when the weight coefficient takes values K_1 , K_2 , the value is 1 and 0, the active net loss of the scheme is shown. The second scheme, when the weight coefficient K_1 , K_2 , and the

value is 0, 1, the static voltage stability is displayed as the best. The third scheme, when the weight factor K_1 , K_2 , the value is 0.5, 0.5, at this time the active network loss and static voltage stability are the best.

4. CONCLUSION

Micro grid distributed power has the characteristics of high efficiency and environmental protection, which can reduce the line loss of distribution point in time in the process of practical application. Through the application of distributed generation and optimization of distributed generation optimization planning model, the optimal configuration of distributed generation can be realized, which is helpful to reduce the network loss of microgrid.

ACKNOWLEDGEMENTS

KJ2019A1005 Natural Science Research Projects of colleges and universities In Anhui Province.

REFERENCES

- [1] Xu Longbiao. A Study on the Coordinated Control Strategy of Active Load and Distributed Power in Micro-network Operation, Shenyang University of Technology, 2019.
- [2] Fan Xiangran. A Study on the Location and Capacity of Distributed Power Supply in High-speed DC Microgrid, Harbin University of Technology, 2018.

On the Educational Path of Integrating Red Culture into College Students' Socialist Core Values

Jihui Liu

Department of Scientific Research, Baise University, Baise 533000, Guangxi, China

Abstract: Under the new situation, red culture belongs to a kind of high-quality educational resources, and it is also an advanced spiritual response in the historical period. The integration of red resources into the socialist core values of college students can not only create valuable creation resources for our country, but also guide students to establish a correct outlook on life, the world and values. Therefore, it is necessary to find the conformity between red cultural resources and socialist core values according to the value orientation of college students. According to the fit point, we should make a scientific education path to further promote the red culture and inherit the revolutionary spirit. Guide students to set up the goal of moral education, practice the core values of socialism, and realize the common "Chinese dream".
Keywords: Red Culture; College Students; Core Values

1. INTRODUCTION

After the "Chinese dream" on the road of rejuvenation is presented to everyone's vision, the establishment of socialist core values not only needs to bear in mind the history, inherit the history, but also needs to develop and innovate, and cultivate a higher patriotic national spirit and the spirit of the times. The cultivation of these spirits needs red cultural resources to stimulate. Red culture is not only the culture of history, but also the culture of the times. It carries the revolutionary traditional spirit, belongs to the precious wealth of the Chinese nation's great rejuvenation of the Chinese dream, and is also the inexhaustible driving force of youth.

College students belong to the main body of the development of the times, but also the development trend of values, affecting the future extension of society. However, in terms of the current form, under the influence of western ideological and political education, many college students' ideological values have developed towards the direction of diversification and interest pattern differentiation [1]. Red culture is an important part of the excellent culture of the Chinese nation and the main source of socialist core values. Only by making full use of red culture, can college students perceive the hardships of revolution, enhance their sense of political identity and cognition, consciously form good behavior habits, establish correct outlook on life and values, and

finally put all these into practice to promote the socialist core values. Therefore, in the process of integrating red culture, how can we make a scientific education path of College Students' socialist core values based on the actual situation? It has become the focus that needs to be explored under the current situation.

With the continuous extension of the spirit of the 19th National Congress, red culture has become a hot topic all over the country. How to integrate red culture into the socialist core values of college students and grasp the fit between the two has become the focus of analysis in the current situation. At this time, we need to explore the compatibility of red cultural resources and socialist core values. Understand the connotation of red cultural resources, and analyze the contents and methods of cultivating socialist core values contained in red cultural resources.

2. THE EDUCATION PATH OF RED CULTURE INTO COLLEGE STUDENTS' SOCIALIST CORE VALUES

2.1 Teachers Need to Strengthen the Research of Red Culture Theory

From the current situation, with the social development and the continuous improvement of national education, the advantage of "teacher is researcher" is higher and higher. Theory is not only the important embodiment of persuading people, but also the main basis of guiding practice. Therefore, to strengthen the research of the theory of red culture is the main force to realize the application of the socialist core values in practice. First of all, we need to enhance teachers' theoretical literacy and professional knowledge. Teachers belong to the disseminator of knowledge and the teacher of advanced red culture. Only by improving the comprehensive level of teachers, can we integrate ideas and meet the development path of modernization. Secondly, we need to constantly improve the construction of red culture system. On the basis of seeking truth from facts, we need to combine theory with practice, improve innovation, enhance inspiration and meet the needs of the times. Finally, we need to integrate the red culture into the curriculum, penetrate the subject education, combine with our own actual situation, rely on the network new media, and extend the communication channels of red resources into the socialist core values. For

example, Ye Ting, who refused the Kuomintang's inducements and wrote the prison song, and Liu Hulan, 15, who resolutely resisted Japan to the end in order to win the Chinese nation's victory [2-4]. All of them are dedicated to the interests of the country, and perform their own standards. These heroic deeds are models of cultivating core values of college students.

2.2 Strengthen the Combination of Red Culture and Red Holy Land Practice

To a certain extent, red culture can change the pursuit of value, but also can produce greater spiritual power. Combine the red resources with the spirit of the times of college students, so as to better inherit and carry forward the original spirit. How to combine the big classroom with the life practice, how to extend to the rich angle of the classroom, how to extend to the direction of network on the basis of "the second classroom", has become the focus of current research [3]. Therefore, first, we can carry out the propaganda of red culture for college students. It can be the way of historical reappearance, or the way of story, the process of formation. In this way, we can skillfully integrate red culture into the education of socialist core values on the basis of diversification. In addition, in the propaganda and education, we can combine the actual needs, according to the current hot spots, to implement the cultivation of interest. Second, colleges and universities can organize college students to combine theory and practice, to some red cultural revolution bases, or historical museums and other scenic spots, to experience rich revolutionary stories and more red cultural spirit. Red culture carries a strong sense of patriotism and collectivism. Under the positive guidance, it is like a fresh textbook, which transmits positive energy. It can not only promote college students' firm belief, but also enhance their sense of history. For example, students can be guided to understand Qiu Shaoyun, Ren Changxia and other revolutionary deeds, and understand revolutionary beliefs.

2.3 Strengthen System Guarantee and Ensure the Implementation of Red Culture in Socialist Core Values

From the current situation, in order to ensure the effective implementation of College Students' core values, it is necessary to establish an integration mechanism on the basis of theory and practice. We should combine the rule of law with the rule of virtue, clarify the division of responsibilities, and ensure efficient implementation. Build the "Trinity" model, give play to the leading role of the government, the

main role of colleges and universities, and the main role of students [4]. We should refine the red cultural resources, promote the "entry" of red cultural resources into teaching materials, innovate teaching contents and methods, and let the red cultural resources "enter the classroom". Arouse the enthusiasm of the students and promote the red cultural resources into the mind. Therefore, the integration of red culture into college students' socialist core values needs to combine the needs of the times, stimulate students' enthusiasm and improve their consciousness, perspective of the current living environment, learning situation, so as to get the psychological washing, spiritual influence.

3. CONCLUSION

With the progress of society, red culture still creates great social value with the power of eternal youth. The integration of red cultural resources into the core values education of college students can not only excavate and find elements in line with the development of the times, but also inherit the revolutionary spirit, inherit the arduous struggle, and carry forward the tradition of nationality and patriotism. Guide students to establish a correct world outlook and values, combine theory with practice, deepen the process, and enhance awareness. To undertake the historical task of rejuvenating the country through youth and strengthening the country through youth, so as to realize the common "Chinese dream".

REFERENCES

- [1] Xu Gongxian, Wen Yanhong. The value of campus red culture in Ideological and Political Education. Journal of Zhejiang University of Technology (SOCIAL SCIENCES), 2019 (02).
- [2] Liu Liping. Research on the integration of red culture into Ideological and political education in Colleges and Universities under the background of the new era -- Taking Jiangxi Province as an example. Quality education in the West, 2019 (06).
- [3] Jiang Jiacheng. The role and practice of red culture education in the ideological and political education of college students in the new era. Quality education in the West, 2019 (05).
- [4] Guo Lihuan. The application of red culture in Ideological and political education in Colleges and Universities -- Taking Nanyang Normal University as an example. Journal of Yan'an vocational and technical college, 2018 (04).

Heavy Metal Contamination and Removal Strategy in Solar Grade Silicon Wafer Processing

Yan'e Niu, Ning Li, Jingjing Guo

Yulin Vocational and Technical College, Yulin 719000, Shaanxi, China

Abstract: In order to improve the removal effect of heavy metal impurities in the processing of solar grade silicon wafers, this paper uses graphite furnace atomic absorption method to detect and analyze the heavy metal content on the surface of silicon wafers, and verifies the alkaline cleaning technology, which can effectively remove the heavy metal impurities such as Cu and Fe in silicon wafers. The results show that by adding surfactant, the pollution of heavy metal impurities on the surface of silicon wafer can be effectively reduced, especially the content of copper and iron is within the controllable threshold.

Keywords: Solar grade silicon wafer; Heavy metal impurity pollution; Removal

1. INTRODUCTION

Since the 1950s, with the large-scale outbreak of the global oil crisis, it has greatly affected the overall economic level of the world. As a limited resource, oil reserves have been reduced after continuous exploitation, so the difficulty of oil development is also increasing. Under the background that the international energy consumption is still dominated by oil, the effective solution to the energy crisis is to reduce the consumption from improving the efficiency of the use of oil resources, and constantly develop new energy and new process material technology [1]. Therefore, the solar grade silicon chip came into being under the background of energy crisis. Solar energy has the characteristics of green, clean, economic and no development limit. In recent years, the solar energy industry has achieved great development [2]. However, solar cells have high requirements for the surface quality of solar grade silicon wafers, not only for the strict size requirements, but also for the surface heavy metal content as an important quality index. Therefore, it is required to adopt effective surface heavy metal impurity removal process after cutting solar grade silicon wafer to avoid heavy metal pollution of solar cells [3]. At present, the commonly used solar grade silicon chip removal technology includes RCA technology and the improved removal technology, such as plasma removal, mega sonic removal, laser dry cleaning, centrifugal jet removal [4]. Therefore, this paper takes solar grade silicon wafer as the research object to explore the removal and control of heavy metal impurities such as copper and iron in its

processing.

2. POLLUTION SOURCES AND HAZARDS OF HEAVY METAL IMPURITIES IN SOLAR GRADE SILICON WAFER PROCESSING

2.1 Source

Polycrystalline silicon raw material is made of monocrystalline silicon rod by direct drawing method. After square cutting, rolling grinding and brush processes, the square rod with qualified appearance size can be cut by wire. After growing Czochralski single crystal with quartz crucible and other consumables, a small amount of graphite carbon felt volatilized at high temperature, which polluted the single crystal. In the process of using mortar or steel wire to cut silicon wafer, mortar and worn steel wire surface will also become the key source of heavy metal contamination on the surface of solar grade silicon wafer [5]. The details are as follows:

- (1) Due to the influence of manufacturing technology in the processing of solar grade silicon wafers, the pollution of polycrystalline raw materials results in the presence of heavy metal impurities;
- (2) The process of Czochralski silicon single crystal includes six steps: loading, chemical processing, necking, shoulder laying, equal diameter and ending;
- (3) Heavy metal pollution is caused by the process environment and the applied process equipment and tools in the processing of solar grade silicon wafers, including wire cutting, cleaning process.
- (4) The chemical reagents used in the processing will also cause heavy metal pollution on the surface of solar grade silicon wafer.
- (5) In the preparation stage of solar grade silicon wafer, almost any step cannot be separated from high-purity water. High-purity water is required to be used for spraying every time the medicine tank is cleaned. In the process of processing silicon wafer with such frequent pure water contact, the quality of pure water or other aqueous solutions will cause heavy metal pollution.

2.2 Hazards

The principle of solar grade silicon chip is to use the p-n junction on the surface of silicon chip to form photoelectric effect, which is a relatively standard semiconductor component at present, and a few carrier components. Therefore, the semiconductor composite theory is also true for solar grade silicon wafers, and the expression formula for generating

resistivity is as follows [6]: $\rho=1/\sigma=1/[(n\mu_n+p\mu_p)e]$

When n-type silicon is used to make solar grade silicon wafer, even at normal room temperature, the high concentration of inversion impurities in silicon wafer has also excited ionization, resulting in high apparent resistivity, which has a serious impact on the photoelectric effect. The heavy metal impurities in silicon include gold, silver, copper, iron, nickel, manganese, cobalt, mercury and other metal impurities. Generally, the capture cross section of these impurity elements in silicon for a few carriers will exceed 2-3 orders of magnitude of normal doped boron and phosphorus elements [7]. Therefore, the existence of heavy metal impurities will have an important impact on the effective life of minority carrier. For example, when impurities are on the surface and interface of the battery, the surface life will be reduced. Metal impurities reduce the surface, body and effective life of a small number of carriers on the silicon wafer, and ultimately reduce the short-circuit current density and open circuit voltage of the solar silicon wafer, which greatly reduces the photoelectric conversion efficiency of the battery. When the solar grade silicon chip module is made and exposed to the sun for a long time, all kinds of heavy metal impurities will gradually diffuse to the p-n junction surface, increasing the leakage current on the surface of the battery, reducing the minority carrier life, reducing the photoelectric conversion efficiency and power generation of the silicon solar cell module, and reducing the service life of the battery.

3. BASIC REMOVAL PRINCIPLE OF SOLAR GRADE SILICON WAFER

Alkaline removal can effectively remove the heavy metal impurities on the surface of solar grade silicon wafers by using alkaline reagent solution and adding proper amount of surfactant or chelating agent. Dilute the alkaline concentration agent with water, remove the impurities with the mechanical movement in the cleaning tank and a certain temperature. This method can reduce the cost of heavy metal impurity removal, achieve simple waste removal, and select appropriate removal process according to the type and degree of heavy metal impurities [8]. The main principles of alkaline removal process are summarized as follows: first, dissolution; second, saponification; third, detergency surfactant; fourth, emulsification [9]. In order to effectively remove all kinds of pollutants, high-efficiency synthetic alkaline cleaner can obtain better application results under high-temperature cleaning conditions. As a key step for the whole removal process, rinsing will re deposit on the surface of silicon wafer if it is not completed in time after saponification, emulsification and ultrasonic vibration separation. Therefore, in order to effectively remove heavy metal substances, strong alkali and silicate mixed phosphate are usually used for removal [10].

4. EXPERIMENTAL ANALYSIS

4.1 Experimental Materials and Methods

Graphite furnace atomic absorption spectrometer, sgr40-101 silicon wafer swing ultrasonic cleaner, acidimeter, automatic dryer, A-type alkaline detergent and non-ionic surfactant were used.

Cleaning solution configuration experiment: eight groups of cleaning agents with different concentrations were selected to clean n-type silicon wafers. The cleaning time was set for 3 minutes, the ultrasonic temperature was set for 45 °C, and the silicon wafers with residual mortar and cleaning agent were recorded.

Test of pH value change of cleaning solution: select a continuous cleaning tank of production line, test the pH value of cleaning solution every 1min from the beginning, and test for 15min continuously. The pH value of the newly prepared cleaning solution is the same as that of the newly prepared cleaning solution collected for three consecutive times, and the pH mean value at different time points is calculated.

Surfactant removal experiment: select two cleaning agent tanks, add surfactant in No. 1 tank, and No. 2 tank; take out 20 pieces of silicon chips cut with the same knife, and divide them into two groups, a and B, respectively put them into two medicine tanks for cleaning for 3 minutes, wash them with high-purity water after cleaning, and dry them with silicon dryer, and detect the specific situation of surface and metal content.

4.2 Analysis of Experimental Results

4.2.1 Ratio of alkaline detergent

It is found from the study in Table 1 that under the lower concentration of detergent, the cleaning effect of detergent is not good, and the mortar dirt adsorbed on the surface of silicon wafer still stays on the surface of silicon wafer during cutting. It is necessary to continuously increase the amount of cleaning agent to reduce the number of mortar residual pieces, but this causes new pollution of cleaning agent residual. The optimal cleaning solution ratio is 2.00l.

Table 1 Test results of detergent ratio

Dosage of detergent (L)	Mortar residue (Tablets)	Detergent residue (Tablets)
1.00	10	1
1.20	8	0
1.40	7	1
1.60	5	2
1.80	3	1
2.00	0	0
2.20	1	1
2.40	0	3

4.2.2 Change of pH value of alkaline cleaning solution

Figure 1 shows the pH change curve of alkaline cleaning solution in the cleaning process. It is found that the newly configured alkaline cleaning solution reaches the pH value of 12-13 and has strong alkaline. A large number of bubbles with a diameter of 0.5mm appear on the surface of the silicon wafer when the silicon wafer is placed in it. After continuous reaction,

the pH value of the cleaning solution will gradually reduce by 0.1-0.3, but after continuous cleaning, the pH value will remain at the level of 11.5-12 and will not decline any more, but no stable reaction will be formed, and the reaction will continue to occur in the aqueous solution. If the cleaning solution is reused, the pH value will also be reduced, so the cleaning solution will be replaced after 2000-4000 pieces of cleaning.

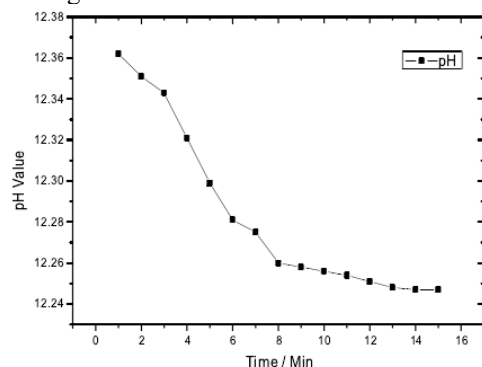


Figure 1 pH value curve of alkaline cleaning solution

4.2.3 Surfactant removal

The surface of silicon wafer is easy to absorb oil, chips and metal impurities during cutting, while the surfactant in the cleaning solution can not only adsorb various particles and molecules, but also form the adsorption film on the surface of silicon wafer, prevent the appearance of adsorbed particles and molecules on the surface of silicon wafer, and also separate and remove the particles and oil from the adsorption interface.

Through the experiment, it is found that adding surfactant in the cleaning solution can effectively reduce the heavy metal impurity deposition pollution on the silicon wafer surface, especially can control the copper and iron content in the controllable threshold. After analysis, by adding surfactants into the alkaline cleaning solution, the following two functions can be achieved: one is to effectively reduce the surface tension. The surfactant arrangement in the solution is related to its concentration. When the concentration threshold is reached, sufficient monolayers will be formed to gather on the solution surface, which will reduce the surface tension, and fully enhance the penetration and wetting effect of the cleaning solution. The other is to improve the efficiency of ultrasound. The main mechanism is to reduce the adhesion of silicon wafer surface by the different functions of wetting, infiltration, emulsification, solubilization and dispersion realized by surfactant, and to separate the impurity contamination from the surface of silicon wafer by multiple physical methods of heating and ultrasound, and finally enter into the cleaning solution for emulsification and dispersion.

5. CONCLUSION

In the process of solar grade silicon wafer processing, alkaline cleaning can be used as the mainstream technology of solar grade silicon wafer cleaning

because of its special and excellent performance. In this paper, the source and harm of heavy metal impurity pollution in the processing of solar grade silicon wafer are analyzed, which will reduce its service life and affect the photoelectric conversion efficiency and power generation of solar cell module. Based on the analysis of the ratio, pH value and the cleaning effect of surfactant on the surface of silicon wafer, the following conclusions are drawn: (1) the optimal ratio of alkaline cleaning solution is 2.00l; (2) the pH value of alkaline cleaning solution can be kept stable for a long time, and the cleaning solution is generally changed after cleaning 2000-4000 pieces; (3) Adding surfactant can effectively control heavy metal pollution, especially heavy metal pollution. The content of copper and iron impurities is within the controllable threshold.

ACKNOWLEDGEMENTS

Yulin 2019 science and technology plan project [subject No.: 2019-112-03].

REFERENCES

- [1] Hou Siyi, Tie Shengnian. Kinetic study on the recovery of solar grade silicon chip cutting waste mortar by acid leaching iron removal, *Silicate bulletin*, 2013, 32(11): 2358-2361.
- [2] Xu Huabi, Liang Zongcun, Li Qingsong, et al. Study on the process of recovering high-purity silicon from waste electronic silicon wafers, *Journal of solar energy*, 2018, 29(5): 560-563.
- [3] Liu Zhidong, Wang Wei, Qiu Mingbo, et al. Study on the mechanism of hybrid cutting of solar silicon wafers by electrospark electrolysis, *Journal of solar energy*, 2019, 30(5): 619-623.
- [4] Yang Luwei, Li Ming, Gao Wenfeng, et al. ICP-OES study of heavy metal elements in the water quality of flat solar collectors in the sun, *Spectroscopy and spectral analysis*, 2019, 39(6).
- [5] Miao Jie, Wang Sentao, Jiao Pengfu, et al. Practical application of silicon chip positioner in solar cleaning velvet equipment, *Energy and energy saving*, 2018, 14(006): 62-63.
- [6] Deng Hongwei, Wu Guansheng, Wei Wen. Prevention and control of cadmium pollution in the production process of CdTe thin film solar cells: a case study of a CdTe thin film solar cell manufacturer in the West, *Environmental impact assessment*, 2014 (03): 51-54.
- [7] Fabienne G, Antonis C, Karin K, et al. Impacts of heavy metal contamination and phytoremediation on a microbial community during a twelve-month microcosm experiment, *Fems Microbiology Ecology*, 2019, (2).
- [8] Zhao Junxia. Analysis and treatment scheme of black core of crystalline silicon solar cell, *Electronic world*, 2015, 475(13): 160-161.
- [9] Song Manman, Yang Hui, Gao Minjie, et al. Study on the recycling process of waste liquid from solar wafer cutting, *Renewable resources and circular*

economy, 2013, (12): 33-35.

[10]Qian Jun, he Fengqin, Lu Gang, et al. Study on the effect of oxygen content in silicon wafer on solar

cell efficiency, China chemical trade, 2015, 000(001): 5-5,9.

The Influence of Music Education on The Quality Education of College Students

Jingzhou Yang

Art Education Center, Zhengzhou University of Light Industry, Zhengzhou 450002, Henan, China

Abstract: The personal quality of college students includes many aspects, such as the ability to deal with people, the ability to cope with emergencies, personalized development, as well as the normal three outlooks and good psychological quality. These can have a direct impact on future learning and life. In today's era of rapid economic and social development, the demand for high-quality modern talents is very large, so colleges and universities carry out quality education to meet the needs of today's society. Music education is an important part of quality education. Music is the greatest gift from heaven. Beautiful music can cultivate people's sentiment and relieve pressure.

Keywords: Music education; Quality education; Influence

1. INTRODUCTION

Music education plays a key role in quality education and is an important part of it. The development of music education in Colleges and universities can well cultivate the comprehensive quality of students and high-quality talents for the society. Under the background of rapid economic and social development, people's material life has been guaranteed. However, under the fast-paced life, people's spiritual level is too empty. In the age of material desire, the construction of spiritual level is ignored by people [1-4]. As time goes on, people pay more and more attention to the construction of the spiritual level. Music education cultivates the comprehensive quality of students by cultivating their artistic sentiment and their interest in music. Music is a beautiful language. Tchaikovsky said, "the sufferings of life can't hold me back. The joy in my heart is not my own. I inject joy into my music to make the whole world feel happy."

Music education is not the education of musicians, but first of all, the education of people. The perception and understanding of beauty are the core and the key point of aesthetic education. To appreciate music, we need to have ears that can distinguish the melody. For ears that can't distinguish the music, no matter how beautiful the music is, there is no meaning in life without music.

2. INTRODUCTION TO QUALITY EDUCATION

2.1 Quality Education Stresses the Development of Morality, Intelligence, Physique and Beauty

The fundamental goal is to improve one's own quality.

It reflects a comprehensive, multi-directional development and common development. Learn how to deal with people and things, and improve EQ and IQ together.

2.2 Music Education Is an Important Part of Quality Education

Through the education of theoretical knowledge, combined with practical operation, cultivate students' artistic sentiment, interest in music, and enthusiasm and initiative in learning music. Music education should also teach students in accordance with their aptitude. Because of individual differences, students' music literacy is also uneven, so we should adhere to the cultivation of students' practical ability and innovative spirit.

3. AN ANALYSIS OF THE CURRENT SITUATION OF MUSIC EDUCATION IN MODERN COLLEGES AND UNIVERSITIES

In the 1950s and 1960s, China has issued the outline of music teaching documents and made plans for the curriculum. After so many years of efforts, China's music education is slowly on the right track. Under the current social background, high-quality talents are the foundation of the country, and there are many music and art colleges and universities in China, each year there are many arts Students of Arts apply for the entrance examination of art universities, and most of the comprehensive universities have set up related majors. Music teaching is becoming more and more formal. In today's society, people pay more and more attention to quality education, which also provides help for the survival of colleges and universities. Students have needs. Colleges and universities set up music quality education, which complement each other. Colleges and universities set up music education, which continuously trains the society Cultivate high-quality talents.

In the increasingly fierce social and international competition, high-quality talents determine the development prospects of a country. Throughout history, no country or nation has long-term stability and stability based on material basis, and the leading position in culture and spirit is the foundation of standing in the world's national forest.

4. THE IMPORTANCE OF MUSIC QUALITY EDUCATION FOR THE CULTIVATION OF HIGH-QUALITY TALENTS

4.1 Music Education Cultivates Sentiment and Relieves Pressure, Which Has a Positive Effect on

Students' Physical and Mental Health

Music education cultivates students' aesthetic and moral values, and brings positive effects on students' personal quality. Since ancient times, China has attached great importance to music teaching. Music is the most beautiful language in the world and the greatest gift given to human beings by the gods. Music is a higher enlightenment than all wisdom and all philosophy. Music can improve personal quality, affect people's hearts and inspire people. Moving forward and inspiring will have a great impact on future growth.

4.2 Enrich the Extracurricular Activities of College Students, and the Combination of Work and Rest Can Effectively Improve the Learning Efficiency

It is useful to study hard, but the efficiency will not be high. Proper relaxation can better study. Music can promote the communication between people, cultivate the ability of college students to deal with people, cultivate their personal quality, and the beautiful music cultivates their sentiment, which makes students get rid of the low taste and establish a good three outlooks. Help college students to establish a positive outlook on life and values. In the modern society with fierce competition, music can let students empty themselves for a short time, slow down the pace of study and life, and experience the beauty of life. Prepare for the future study, so the music education in Colleges and universities is particularly important.

4.3 Music Education Can Cultivate Students' Psychological Quality

In today's highly competitive society, without a strong psychological quality, it is impossible to be based in today's society. Music quality education trains students' personal quality, which has a positive impact on their personal ability and adaptability in the future.

5. PROBLEMS IN MUSIC EDUCATION

5.1 Problems in Music Education

Nowadays, with the rapid development of economy and society, people are too fanatical about material pursuit and too neglecting the spiritual level. Although people pay more and more attention to music quality education recently, they inevitably take many detours. The research on music quality education in China is not very in-depth, only stays in the theoretical analysis process, and overemphasizes the significance of theoretical education. In the future, music teaching should combine theoretical knowledge with practical operation.

5.2 Domestic Traditional Education Mode Restricts Music Education

Although people pay more and more attention to music education in Colleges and universities, however, based on the current situation of education in China, there is still a lack of spare effort. The examination-oriented education in China has a high requirement for the enrollment rate, which makes it

difficult for middle school students to have the energy to learn music. This leads to the fact that students who have not received music teaching are not interested in music teaching after entering university, and are difficult to integrate into it. There are also individual differences, regional differences, and various factors. Conditions restrict the development of music teaching, and the work of music quality education in China has a long way to go.

6. HOW TO DEVELOP MUSIC EDUCATION IN COLLEGES AND UNIVERSITIES

From the fundamental point of view, to cultivate students' artistic sentiment and interest in learning music, we should make students have autonomy and enthusiasm, choose music teaching according to individual differences, there are many kinds of music development up to now, and teach students according to their aptitude according to their preferences. Only in this way can students' interest in learning be aroused. Music, as a practical subject, is different from the traditional teaching methods. It is necessary to combine theoretical knowledge with practice.

Finally, if we want to do a good job in music quality education, we should first create a music atmosphere, let students enjoy it and be infected by it. Music is the most beautiful language in the world. It is infectious, intoxicating, edifying sentiment and relieving pressure. Colleges and universities can set up music associations to let interested students join in, which is very helpful to music education, and can also hold some performances and competitions such as music on a regular basis.

7. CONCLUSION

The real meaning of art is to make people happy, to inspire and power people. Music teaching is special for traditional teaching. It is impossible to use the traditional mode of education. Learning music can cultivate sentiment, relieve pressure, improve learning efficiency, cultivate students' personal quality, and cultivate high-quality talents in many aspects.

ACKNOWLEDGEMENTS

An Analysis of the Influence of Music Education on College Students' Quality Education.

REFERENCES

- [1]Zhao Xiuchen, Yang Ruiping. Analysis of the influence of music education on quality education of college students, *Art review*, 2019 (15).
- [2]Zhao Yaning. The important role of music education in the quality education of college students, *Economic Research Guide*, 2015 (04).
- [3]Wu Shaohong. A study on the function of "moral education" of music quality education in Colleges and universities, *Hebei Normal University*, 2014.
- [4]Shi Haijing. The role of elegant music in the quality education of college students, *Northern music*, 2015, 35 (22).

Research on the Construction of the Curriculum System of Network and New Media Major in Local Colleges and Universities

Tao Yu

College of Arts, Sichuan Minzu College, Kangding 626001, Sichuan, China

Abstract: In recent years, a new course, network and new media, has sprung up in Colleges and universities. In this article, it mainly discusses the development of network and new media major in local undergraduate colleges and universities, as well as the prospect of this major in the era of rapid economic development, the social demand for talents in this major, and the actual teaching in Colleges and universities. At the same time, the course system will be analyzed from many angles, and finally come to a more accurate conclusion.

Keywords: Local undergraduate colleges; Network and new media major; Curriculum system

1. INTRODUCTION

With the continuous development of network technology, the popularity of the Internet is more and more wide, and the demand for new media professionals is more and more. Therefore, the Department of education opened the course of network and new media specialty after discussion. So far, there are more than 100 schools offering this course, and most of them are undergraduate colleges. Due to the short time, this course is still in the exploration stage, and there are many defects in the teaching process and curriculum system [1-3]. For example, some colleges and universities in some places are too mixed in this course, and their knowledge is too wide to aim at a specific point; compared with traditional media news courses, they are not unique; they are not comprehensive, their professional teaching is not detailed enough, and the course lacks a sense of integrity.

2. RELEVANT CONDITIONS OF NETWORK AND NEW MEDIA COURSES IN LOCAL UNDERGRADUATE COLLEGES AND UNIVERSITIES

2.1 Demand for Social and Economic Development

Different regions have different economic levels and different demands for talents. Therefore, when building the course of network and new media specialty, local colleges and universities should comprehensively consider the local development situation, understand the local demand for such specialty and the specific requirements for

professional talents. Of course, we should also combine traditional media news with digital network technology, and strictly control the cultivation of professional talents in terms of professional skills and personality. When training students, local colleges and universities should have a sense of overall situation and keep up with social requirements. For example, in the current talent recruitment market, for two people with the same degree, the recruiter pays more attention to the personal experience of the candidate, which is the embodiment of the candidate's ability. In the era of network development, we should keep the bottom line of Internet users, always demand ourselves with high standards, shape a good image, and actively play the professional subjective initiative through the platform of new media.

2.2 Analysis of the Current Situation of Disciplines in Colleges and Universities

Another term of the course is also called "major". They all express the same content, and carry out specific analysis on some knowledge points. The major of network and new media has evolved on the basis of traditional journalism and broadcasting. In order to distinguish them, local colleges and universities continue to reform, innovate and integrate in their inherent ideas. Of course, there is also a distinction in the curriculum, avoiding the overlap between the two, so that they have their own strengths, but there is also an intersection between the two. Although the names are different, they are all evolved through the media industry in general, so we need to make clear their connections and differences. We can't simply explain the network and new media as traditional paper media, but under the network in the new era products of collaterals.

2.3 Talent Strategic Training

The development of the country is inseparable from talents, and the training of talents is also the ultimate goal of local colleges and universities. The training of talents is inseparable from the setting of courses in Colleges and universities, and the course system is an important step of talent training. Now, the network of local colleges and universities, like the new media major and the national education department, serves for the purpose of training versatile talents. In order to

have a better development space for this purpose, it is necessary to build a targeted curriculum system, otherwise the training of talent strategy is still a step away. This requires local colleges and universities to attach importance to it, actively explore the curriculum system suitable for talent strategic training, encourage students with an open and inclusive attitude in traditional teaching methods, establish a good interactive relationship with students, pay attention to the integration of theory and practice, make students full of interest in their own major, actively study with a positive attitude, and finally not on the Internet Break innovation. In addition, under the requirement of one specialty and many abilities, we should learn professional knowledge well, learn well, use the knowledge we have learned flexibly and make a thorough understanding. Local colleges and universities should also find their own position, actively explore the teaching concept suitable for the development of students on the original basis, and create unlimited knowledge with limited teachers.

3. BUILD A CURRICULUM SYSTEM IN LINE WITH THE NETWORK AND NEW MEDIA SPECIALTY OF LOCAL UNDERGRADUATE COLLEGES AND UNIVERSITIES

3.1 Clear Understanding of Curriculum System

Curriculum system is the main body of a major. To learn a major well, we must have a clear understanding of the curriculum system. Therefore, we should first make clear what is the network and new media curriculum system. Its contents include: objectives, structure and specific requirements. The goal of the curriculum system is to cultivate more talents. It connects the structure with the requirements, and serves for the cultivation of compound talents. In order to create better conditions for students, local colleges and universities should carefully investigate the local education system, clarify the curriculum system and subdivide the teaching tasks. Pay attention to the combination of theory and practice, in the teaching of professional knowledge, cannot ignore the quality of students' character, and develop a practical curriculum system.

3.2 Refining Course Content and Structure

In the course system, the content and structure of the course is the main part. Whether the setting of the course content is reasonable or not has a lot to do with the course system. In order to better cultivate talents with one specialty and multiple abilities, the network and new media majors in local undergraduate colleges have greatly improved in the course construction. Based on the needs of social talents, the courses and knowledge are divided into different plates, and students are classified for teaching. Different demands have different teaching settings, and students' abilities and interests are emphasized. In the course of network and new media, major and minor courses can be realized, and students can choose courses independently, so that they can have a stronger sense

of participation, be more responsible for themselves, and choose reasonably. In the process, we should pay attention to the guidance of teaching methods and create a good learning atmosphere for students. If students increase their interest in learning their professional knowledge, they will put more energy into it and innovate the development of network and new media.

3.3 Supplement Curriculum Implementation and Evaluation

The expression concretization in curriculum is the implementation of curriculum, and students and teachers are the objects of implementation. In order to maximize the role of the curriculum, the teachers of network and new media major in local universities are highly educated, have rich teaching experience, and have their own unique views on the major. As a new professional plate, network and new media need a long process to build a new knowledge framework, and then combine it with practice. Teachers of network and new media are deficient in these aspects. This leads teachers to seek help from the traditional media, lack of the concept of network modernization, and difficult to give students too much help in the teaching process. Practice is the only standard to test the truth. Teachers should also have the idea of endless learning. They should not always rely on the past teaching methods and copy the past teaching models. Especially in the face of the rapid development of network technology, they should learn more, increase experience, feel the changes brought by science and technology, master the latest education methods, constantly explore and innovate, and cultivate the first specialized school. At the same time, the multi-functional talents also add new teaching templates to themselves.

4. CONCLUSION

As a new curriculum, network and new media major in local colleges and universities is an inevitable product of the development of the times. While we are experiencing the changes of the times, we also need to know something about this major. Its development prospect, social concept, and the proportion in Colleges and universities are all important factors for cultivating talents with one specialty and multiple abilities. College teachers should do a good job of guidance, students should actively innovate, and the major of network and new media should keep pace with the pace of the times.

ACKNOWLEDGEMENTS

Research on the construction of incentive mechanism for college students majoring in network and new media to study independently. Approval unit: Sichuan institute for nationalities. Number (Xjjg2018077).

REFERENCES:

- [1]Gong Jianmin, Xiao Lei. An analysis of the concept of system-based curriculum system, China higher education research, 2018 (6): 102.

- [2]Yu Ting, Li Hong. Research and professional training of network and New Media Talents in China, *Modern communication*, 2017 (2): 138.
- [3]Lu Dongsheng. The logic of the division of undergraduate majors and the establishment of interdisciplinary majors, *Teaching of China University*, 2019 (9): 11.

Research on CAN Bus for Automotive Driving Control Based on SAEJ1939 Protocol

Ming Yuan

Suzhou Industrial Park Industry Technology School, Suzhou, Jiangsu, China

Abstract: The paper discusses the experiment is based on the J1939 protocol, the content of which is mainly divided into bus development and performance analysis, in which bus development is mainly node, message and simulation model, performance analysis is divided into functional verification, simulation analysis and load rate analysis, the final results show that this CAN bus can meet the core requirements of driving force control, such as real-time, communication functions.

Keywords: Driver control; J1939 protocol; CAN bus

1. INTRODUCTION

The characteristic of automobile electronation is that ECU is introduced in large quantities. The vehicle network used for a large number of ECUs is usually composed of CAN bus and transmission system. How to ensure the effectiveness of the designed network structure and realize the real-time sharing of functions and information has naturally become the focus of attention. The main contents of the current research are fault diagnosis and the application of CAN bus by automobile instrument. Based on J1939, this paper studies the driving force control, which has a certain practical significance.

2. BUS DEVELOPMENT

2.1 Node Message

The nodes of CAN bus are TCS / AMT / accelerator / engine ECU. Among them, the engine is common rail diesel engine (electronic control), and the bus communication protocol is J1939. The task of the throttle ECU is to collect the analog output of the throttle sensor. Send the opening value to can bus to receive the target opening sent by TCS / AMT via CAN bus. According to the received data, the analog quantity corresponding to the throttle opening is determined and output to the engine ECU. Because the engine ECU receives the analog quantity, it should be paid attention to that the accelerator ECU and DAC are identical in essence.

The number of bus messages is 10, and when defining the messages, the data length, identifier and signal quantity should be defined. For example, APC1_AS send the TCS node, receive the DAC node, its function is mainly when the drive wheel has a slip-turn situation, the TCS corresponding ECU to calculate the target opening, by the message to the DAC corresponding ECU to send, to make the transmitter output torque effectively controlled [1]. In order to make the TCS control of real-time

requirements to meet the consideration, this message will be sent to 50ms, J1939 SPN91 as the use of parameters.

2.2 Simulation Model

The simulation model is established by CANoe, the specific process is as follows: the database corresponding to the control system is established by using CANdb, and the model is given good universality by adding signals, messages, environmental variables and simulation nodes. As the basis of simulation testing, this model can display the physical value of the database file directly, and its advantages include real-time modification of the data sent by the message, which can facilitate the simulation test and the subsequent development. At this stage, this model is often used to describe the relationship between TCS node and signal with high accuracy.

3. PERFORMANCE ANALYSIS

3.1 Feature Verification

The main function of the CAN bus is to control the engine by THE TCS when driving the excessive slip of the wheel, and to reduce the stress moment of the drive wheel by means of output torque and variable speed gear. To change gear, the key is to control the engine speed so that the clutch grinding is reduced. Low-grade to high-grade conversion, the engine speed is reduced, narrow the transmission input shaft, engine speed gap, so that the shift generated impact, the killing is effectively controlled. When converting from high to low gear, the operating focus is on increasing engine speed. The research shows that the use of throttle ECU can make the engine speed and output torque can be controlled.

Using the established model to verify the network function, we can draw the following conclusions: on the premise of TCS playing a control role, in order to restrain the driving wheel slip, the throttle opening corresponding to TCS has a relatively obvious downward trend. During upshift, the change trend of throttle opening corresponding to AMT is similar to that of TCS, both of which are decreasing [2]. It can be seen that the model has complete communication function and can meet the requirements of CAN bus.

3.2 Simulation Analysis

The nodes that canoe accesses can be either physical nodes or simulation nodes. In the simulation experiment, the accelerograph ECU is the access object of the node to canoe. The comprehensive experimental results show that under the normal

driving condition, the opening and closing degree of the pedal is consistent with that of the accelerator ECU. If the control function of AMT / TCS is brought into play and the opening value followed by the throttle ECU, it mainly depends on the requirements of the controller.

3.3 Load Rate Analysis

The research shows that among the many factors that may affect the bus load rate, the most important thing that should be paid attention to is the frequency of transmission system sending node messages. If the communication performance as a foothold, the larger the transmission cycle, often corresponding to the lower load, the bus shows the communication performance, naturally more excellent. If the system requirements, bus utilization as a foothold, the faster the update frequency, the more can achieve excellent results.

In order to ensure the real-time updating of important messages, the key is to send messages regularly. J1939 determines the gear corresponding to the transmission cycle according to the characteristics of different messages. Among them, APP message is the most important one. As the transmission object of accelerator ECU, APP message often has a shorter transmission cycle than other messages, so as to ensure that TCS / AMT can receive the required throttle opening and relevant data in real time. Generally speaking, the bus load rate is easily affected by the transmission cycle. Therefore, in order to meet the real-time requirements of the system and control the bus load rate in a reasonable range, the

corresponding sending cycle of app should be 50ms as the first choice. The results show that the key to reduce the load rate is to simplify the message. For example, when sending a message with a period of 10ms, the 8-byte data can be used to the maximum extent

4. CONCLUSION

The J1939 protocol extended by CAN2.0B, which consists of application layer, physical layer, management and link layer, has been widely used. Based on the J1939 protocol and based on the driving force control, the simulation model applicable to CAN bus is established, and on the basis of a comprehensive analysis of the load rate and communication function of the corresponding control system corresponding to CANoe, the simulation experiment is carried out on the throttle ECU, with the aim of increasing the data available for system test reference or use.

REFERENCES

- [1]Huang Yifan, Meng Shengwang. Automobile insurance classification ratemaking based on telematics driving data, Decision Support Systems, 2019, 127(16): 78.
- [2]Engineering - Automobile Engineering; Data on Automobile Engineering Discussed by Researchers at Chinese Research Institute of Environmental Sciences (Analysis of Emissions from Various Driving Cycles Based on Real Driving Measurements Obtained in a High-altitude City), Journal of Transportation, 2020, (67): 19.

Design of Remote Air Compressor Safety Monitoring Based on Internet of Things

Shirong Zhang

Jiangsu University of Technology, Rugao, Jiangsu, China

Abstract: Air compressor is a common device in related fields. Its operation needs to be adjusted according to the actual situation, otherwise it is very easy to have security problems. However, in the application of traditional air compressor, due to the limitation of technical level, it is necessary to arrange special personnel for real-time care. When problems are found, they need to be solved as soon as possible, which shows that the management of traditional air compressor is very complicated. At the same time, there are artificial instability factors. Under this condition, a remote air compressor safety monitoring system is proposed in the field of modern Internet of things technology. The system can monitor the air compressor remotely and realize the remote-control demand, which shows that the system has high application value. In this paper, the system will be studied, the system control model scheme, module design and remote-control system design.

Keywords: Internet of Things; Air compressor; Remote security monitoring

1. INTRODUCTION

There are some hidden dangers in the operation of air compressor, so it must be strictly controlled. The traditional manual management and control mode is not only unstable, but also exposes people to risks, which shows that this mode has defects. But with the development of Internet of things technology, remote monitoring technology began to penetrate into various fields, including air compressor control. Through this technology to build the system, can effectively eliminate the defects of the traditional mode, is the air compressor operation problem, to ensure the safety of the surrounding. Therefore, it is of practical significance to study the design of remote air compressor safety monitoring system.

2. SYSTEM CONTROL MODEL SCHEME

The control model scheme of the remote safety monitoring system of air compressor is realized by using the fault failure model and the influence analysis method (FMEA), which can monitor and identify the problem of air compressor failure, find the failure of the air compressor, and set the control scheme in the targeted setting. In the FMEA application, it is possible to analyze the failure mode of the air compressor in depth and classify it according to the preset failure level (in this design, the failure level is classified as minor, general, severe, very serious, is a relatively common level of

equipment failure), and analyze the impact of the current failure state on the air compressor, thus realizing the intelligent diagnosis function of air compressor fault. In addition, in order to support the operation of FMEA, the ac-FMEA library is designed in the system, which mainly plays the role of "expert knowledge base" in the system, providing information support for intelligent diagnosis function. Then, based on the constraints of FMEA, the maintenance resources, equipment reliability and other constraints are set, and an optimization model of equipment maintenance decision-making based on complex environment and multi criteria is obtained. The model can intelligently set the maintenance strategy of the equipment and correctly complete the maintenance of the air compressor in the shortest time [1].

3. SYSTEM MODULE DESIGN AND REMOTE-CONTROL SYSTEM DESIGN

3.1 Module Design

3.1.1 Data acquisition module

According to the monitoring requirements of air compressor, in the data acquisition module, data acquisition indicators are designed first, including air supply pressure, exhaust temperature, operation time, loading time, oil filter use time, oil separator use time, air filter use time, lubricating oil use time, dryer operation / stop, operation stop, loading and unloading, empty car too long shutdown, front bearing temperature, etc. After the design of the operation mode of the acquisition module, considering the running state of the air compressor, there are mainly two modes, including embedded controller data acquisition mode and sensor signal data acquisition mode. The operation mode of each mode is data acquisition mode of embedded controller: the embedded controller is mainly used as the support. The controller has the function of supporting multiple communication protocols and can establish communication relationship with various sensors with different signals. Here, the Modbus protocol is mainly used as an example for analysis. Modbus protocol is a kind of communication protocol based on the Internet of things. It can connect the on-site monitoring software and the embedded controller, so as to achieve full duplex acquisition, and send the acquisition data to the terminal, so as to achieve monitoring. Sensor signal data acquisition mode: The core of sensor signal data acquisition mode is the sensor. In the design, the corresponding function sensor is used to frame the Internet of things

framework according to the data acquisition indicators, so that the relevant data on the air compressor can be collected, and then the data transmission can be realized by means of communication technology. The sensors used in the design of this paper are the main pipe sensor of compressed air (Venturi vortex gas flowmeter), main pipe flow flowmeter and pressure gauge vortex flow sensor. The main pipe sensor of compressed air is responsible for collecting gas flow, pressure and temperature. The main flow meter is responsible for collecting the flow data of air compressor. The data collected by the pressure gauge vortex flow sensor is the same as the data collected by the compressed air main sensor, but the former has relatively stable collection function and is mainly used for calibration error [2].

3.1.2 Data monitoring module

The data monitoring module in this system has two functions: online monitoring and fault early warning. Among them, the online monitoring mainly monitors the air compressor all-weather, and analyzes the monitoring data online. The analysis results will enter the expert database for identification, and the identification results will drive the operation of the fault early warning function. When the identification result of the expert database is "the air compressor is currently in fault" and other similar results, the fault early warning function will be activated, and the air compressor fault information will be edited directly, and sent to the user terminal after forming a short message for manual control. Fault information includes fault symptom, fault type, fault source and treatment scheme.

3.1.3 Intelligent troubleshooting module

The core of the intelligent fault diagnosis module is the expert database, that is, through the operation of data acquisition and data monitoring module. The expert database can know the situation of air compressor in terms of monitoring indicators, so as to judge the state of air compressor. If the condition is not good, the fault data of air compressor operation can be identified and diagnosed through the knowledge in FMEA expert database. In this way, the failure of air compressor can be identified and the corresponding treatment scheme can be generated.

3.1.4 Monitoring and management module

Monitoring management module is divided into two forms, namely manufacturer module and user module, which respectively act on the two main terminals of air compressor monitoring. The function of this module includes authority assignment management, terminal attribute setting, terminal condition monitoring, alarm information display, historical data

query, etc. Because the module needs to carry out data transmission with the main body, a data transmission system should be designed. In this paper, DTU system is used. DTU has the function of data wireless transmission, which can meet the needs of data transmission in different occasions. At the same time, the transmission process is relatively stable. In addition, considering the security and functionality of data transmission, MDMP communication protocol is set in DTU system, which can realize communication function, voice transmission, short message notification and other functions.

3.2 Remote Control System Design

In order to realize the remote-control system, this paper will develop it on Visual Studio 2008, using SQL Server 2005 as the database. In the development, asp.net is mainly developed, and C++ language is used to realize the interface connection between sensors and embedded devices. Web is used as the business link framework of the monitoring system. Combined with C/S, B/s to achieve monitoring, in which C/S is mainly responsible for air compressor control, and to achieve air compressor parameter collection, data processing, abnormal state alarm and other functions. B / S is mainly responsible for remote centralized management and control, allowing users to use the Internet for control.

4. CONCLUSION

In conclusion, this paper studies the safety monitoring design of Internet of things remote air compressor, and expounds the system design framework, module design scheme and remote-control system design scheme. The system has two operation modes, intelligent control mode and artificial remote-control mode. The intelligent control mode belongs to the default mode, which can identify the status of air compressor actively. If there is a fault, it will automatically sense and execute the processing scheme, which comes from the expert database. The manual remote-control mode can let people know the status of the air compressor remotely, and control it according to the system function if necessary. Two modes can ensure the stable and safe operation of air compressor.

REFERENCES:

- [1]Zhang QQ, Wang BT, Food Safety Information Platform Design Based on Internet of Things, Information Engineering, 2014, 3: 63-66.
- [2]ZOU Xiuming, Prototype Design of a Remote Medical Monitoring System Based on the Internet of Things, International Journal of Online Engineering, 2016, 12(1): 50.

Research on Hybrid Computing Intelligence Method for Solving Nonlinear Equations

Yao Zhang

Harbin institute of Petroleum, Harbin 150000, Heilongjiang, China

Abstract: Solving equations is a basic problem in engineering research. The traditional methods are Newton iterative method, gradient method and so on. Each method has its own advantages and disadvantages. In order to improve the efficiency and accuracy of the solution, a new hybrid intelligent solution method for nonlinear equations is proposed in this paper.

Keywords: Nonlinear equations; Hybrid computing; Intelligent method; Computer

1. INTRODUCTION

In engineering calculation, we often encounter the problem of solving nonlinear algebraic equations. There are two common methods in the current research: the first is to transform the solution of nonlinear equations into the problem of function finding pole, and the gradient method belongs to this method. The second method is the linearization method. First, the linear algebraic equations are determined according to the problem, and then the approximate approximation of the nonlinear algebraic equations is obtained. Then a group of recurrence formulas are constructed, and the numerical approximation results are selected in turn. There are Newton method, quasi Newton method and so on [1-4]. Among them, Newton iterative method is a common solution, and every step of this method needs to solve the Hesse matrix of the objective function. When using Newton iterative method, the most important thing is to choose the initial point, which directly determines the convergence and speed of the algorithm.

The first method takes the gradient method as an example. The advantage of this method is that the program is relatively simple, the calculation is small, the storage required in the program is relatively small, and there is no strict requirement for the initial point, even if starting from a bad initial point, it can still converge to the local minimum [2]. The disadvantage of this method is that the whole process needs a long time, and the convergence speed is slow. When it is closer to the minimum value, the higher the accuracy requirement is, and it often needs to pay a large price to improve a little accuracy. The second method takes Newton method as an example. The advantage of this method lies in its fast convergence speed, and its disadvantage lies in its emphasis on the selection of initial value. If the initial value is not selected properly, the algorithm may fail to solve [3].

Combined with the advantages of the above two methods, a new hybrid computing intelligent method can be proposed: first, the gradient method in the first method is used to determine the initial value x_0 , when the F value will reach the corresponding level, then the Newton method is used for the dry step search. In this way, the combination of the two methods is realized, and the advantages and disadvantages are complemented. It is not necessary to pay attention to the selection of the initial value, but also to ensure the convergence speed.

2. HYBRID INTELLIGENT METHOD FOR SOLVING NONLINEAR EQUATIONS

2.1 Questions

The existing problems are as follows:

$x \in D, D \subset R^n$ Bounded,

$$F(f_1(X), f_2(X) \cdots f_n(X))^T = 0$$

among, $f_i: R^n \rightarrow R (i=1,2,\dots,n)$ Is a continuous and differentiable real valued function. If present $x^* \in D$ send $F(x^*) = 0$, Then x^* can be regarded as the solution of the system of equations.

Solving equations with the steepest descent method, constructor first

$$F(X) = \sum_{i=1}^n f_i^2(X) \quad (1)$$

To solve the objective function, the minimum value of the objective function is the minimum value of the above-mentioned nonlinear equations.

2.2 Solving Steps

Combining gradient method and Newton method to solve the above problems, the solution steps are as follows: first, determine the initial value x_0 , use the steepest descent method to allow the error to be ϵ , control constant to be C , use Newton method to calculate the accuracy E_1 , E_2 and simplify the m value. Then, X_1 is searched by the steepest descent method. Finally, the Newton iteration method is used for subsequent search. If a better root than x^* can be found, the calculation is ended. Otherwise, return to step 1 and repeat the above steps [4].

2.3 Computer Programming

In order to further verify the feasibility of the above hybrid intelligent method, this paper selects a practical example to verify.

Example:

$$f_1(x_1, x_2) = x_1^2 - x_2 + 1 = 0$$

$$f_2(x_1, x_2) = x_1 - \cos(\sin x_2 / 2) = 0$$

There are two exact solutions to the above equation $x^* = (-1/\sqrt{2}, 3/2)^T, (0, 1)^T$. The main codes of the program are listed below:

```
#include<stdio.h>
#include<math.h>
#include<time.h>
#include<time.h>
#define PI 3.1415926
#define N 2
double x[N+1],a[N+1][N+1],a1[N+1][N+1];
void zsxj(double E,double e)//Steepest descent
method
int i,k=0
double DF[N+1],DX[N+1],F0,sum,RL;
while(fabs(F0)>=E)
F0=F0;//F0
for(i=1;i<=N;i++)
{if(x[i]==0)Dx[i]=e;
else Dx[i]=e*x[i]}
sum=0;
for(i=1;i<=N;i++)
{x[i]=x[i]+Dx[i];
DF[i]=(F0-F0)/Dx[i];
Sum=sum+DF[i]*DF[i];
x[i]=x[i]-Dx[i]}
RL=F0/sum;
for(i=1;i<=N;i++)x[i]=x[i]-RL*DF[i];k++;
Printf("The solution searched by the steepest descent
method:\n");
Printf("k=%d",k);
for(i=1;i<=N;i++)
Printf("x[%d]=%f",i,x[i]);}
void xzNewton(float e1,float e2,int m)//x Newton
method
int i,j,t,ok,k;
double z[N+1],b[N+1],fanshu-z,fanshu-x,fanshu-F;
k=1;ok=1
while(ok)
{ jacobi A0;//For solving nonlinear equations Jacobi
matrix A-10;//Inverse matrix
Jacobi-A0;
for(t=1;t<=m;t++)
b[i]=f(i);
for(i=1;i<=N,i++)
for(j=1;j<=N,j++)
```

```
{ x[i]=x[i]-a1[i][j]*b[j];
z[i]=a[i][j]*b[j];}
fanshu-z=0;fanshu-x=0;fanshu-F=0
for(i=1;i<=N,i++)//求 z,x,F 范数
{ fanshu-z=fanshu-z+fabs(z[i]);
fanshu-x=fanshu-x+fabs(x[i]);
fanshu-F=fanshu-F+fabs(F[i]);}
if(fanshu-z<=e1*fanshu-x//fanshu-F<=e2)
{Printf("\n Solution obtained by Newton method:\n");
Printf("k=%d",k);
for(i=1;i<=N,i++)
Printf("x[%d]=%f",i,x[i]);ok=0;}
else k=k+1;}
void main()
{int i,m;
double E,c,e1,e2;
time-t start,end;//Defining variables
long unsigned t;
Printf("Nonlinear equations:\n");
nline-qs();//Output nonlinear equations
Print("Enter initial point X0:\n");
for(i=1;i<=N,i++)
Printf("x[%d]=",i);scanf("%lf",x[i]);}
Print("Initial point X0:\n");
Printf("x[1]=%lf x[2]=%lf\n",x[1],x[2]);}
From the above results, we can know that the
intelligent hybrid algorithm based on Newton iterative
method and gradient method to solve nonlinear
equations is better than the two methods alone, which
is a feasible numerical algorithm for nonlinear
equations.
```

REFERENCES

- [1]Zhao Mingwang. Quasi Newton method and hybrid intelligent algorithm for solving compatible nonlinear equations, Computer application and software, 2000 (08): 32-37+69.
- [2]Zhao Mingwang. Hybrid intelligent identification algorithm of nonlinear regression model based on steepest descent method, Application of system engineering theory and method, 1998 (02): 37-42.
- [3]Zhao Mingwang. Hybrid computational intelligence method for solving nonlinear equations based on Newton method and genetic algorithm, Microcomputer system, 1997 (11): 14-19.
- [4]Zhao Mingwang. Hybrid computational intelligence algorithm for nonlinear regression model identification, System engineering theory and practice, 1997 (10): 100-104+132.

The Role of Government in the Growth of Small and Medium-Sized Enterprise Cluster Activities

Yuanke Zhang

Sichuan Engineering Technical College, Deyang, Sichuan, China

Abstract: With the continuous improvement of people's creative awareness and economic ability, the number of modern small and medium-sized enterprises has doubled and has been on the rise, so such enterprises have received the attention of local governments. In this case, the government found that many small and medium-sized enterprises will cluster to form activities for mutual benefit. This form of activity is really conducive to the development of small and medium-sized enterprises, so it can be promoted in local small and medium-sized enterprises. In order to promote the cluster activities of small and medium-sized enterprises and make them grow better, the government must understand their role in it. This paper will analyze the specific role of the government, and propose ways to promote the growth of small and medium-sized enterprise clusters.

Keywords: Government; Small and medium-sized enterprises; Cluster activity

1. INTRODUCTION

In the development of cluster activities, the mutually beneficial relationship between small and medium-sized enterprises can at least guarantee the basic economic benefits of enterprises, and through repeated and frequent transactions between enterprises, the capital expansion and structural improvement of both sides can be made, indicating that cluster activities are conducive to the development of small and medium-sized enterprises. However, whether small and medium-sized enterprises can carry out cluster activities, whether they are willing to carry out cluster activities, what kind of cluster activities can be carried out depends on the local government to a great extent, so the local government must be appropriately involved in it, play its role correctly, so that small and medium-sized enterprises can develop through cluster activities, while avoiding the occurrence of irregular behavior.

2. THE ROLE OF GOVERNMENT

2.1 Obtaining Passive Collective Benefits

Passive collective efficiency is a kind of small and medium-sized enterprises gathered in an economic activity, even if no activities can be achieved, this benefit is divided into many forms, such as knowledge spillover effect, labor specialization, sharing infrastructure, promote inter-enterprise competition, positive impact on backward enterprises,

these benefits are collectively referred to as "Marshall externalities". On the basis of "Marshall externality", all passive collective benefits come from the outside of the collection, automatically enter the collection, when the local government as a collection of small and medium-sized enterprises in the external environment has this important hospital, which can enhance the passive collective benefits through various ways, and let the collection faster and better access to this benefit, such as strong investment in common infrastructure, strengthen the professional level of the market labor force, enhance the number of human resources in the market, etc. [1]

2.2 Gaining Active Collective Efficiency

Active collective benefit is in the development of small and medium-sized enterprise cluster, through the business activities of enterprise collection, because such benefits must be generated by the enterprise initiative, and obtained by enterprises, so it is called active collective benefit. Active collective benefit is the main economic source of small and medium-sized enterprises collection, can help the collection of small and medium-sized enterprises to accumulate economy, improve the structure, enhance the core competitiveness of enterprises, which can help enterprises to resist the risks of the external environment, the importance of this benefit can be seen. However, in the process of the development of enterprise clusters, the level of positive collective interests and the type of factors in the collective business activities of enterprises are determined. This form is prone to errors when it is uncontrolled and may not guarantee the maximum level of efficiency. Therefore, the local government does not pay enough attention to this point. Through policy means, propaganda work promotes the rationality and depth of horizontal cooperation and vertical division of labor of small and medium-sized enterprise clusters, helps enterprises to obtain positive collective benefits and ensures considerable benefits [2].

2.3 Reducing the Degree of Reliance on External Resources

The degree of dependence on external resources is one of the main indicators to distinguish between small and medium-sized enterprises and large enterprises, that is, large enterprises are less dependent on external resources, can basically operate independently, while small and medium-sized

enterprises cannot do this, if the sudden removal of external resources support, Small and medium-sized enterprises are likely to close down in a short period of time. Thus, the growth and development of small and medium-sized enterprises is the process of reducing their dependence on external resources, when their dependence on external resources has been reduced to a certain extent, it becomes a large enterprise, which is also the same in cluster development. However, only by providing external resources to support the development of small and medium-sized enterprises, can the dependence on external resources be reduced. If the efficiency decreases slowly, then the local government can improve the efficiency through a series of effective policies, promote the rapid development of small enterprises and medium-sized enterprises.

3. GOVERNMENT'S APPROACH TO PROMOTING THE GROWTH OF SME CLUSTERS

For the cluster activities of small and medium-sized enterprises, the allocation of production resources is the main factor affecting the advantages of cluster activities, the resources generally refer to "funds", "human resources" and so on, how to allocate this reasonable is the local government should consider the problem. This paper thinks that the rational allocation of production resources should focus on at least two aspects, namely, the supply of funds, the labor market, the following two aspects of the allocation method analysis, can play a role in promoting the growth of small and medium-sized enterprise clusters.

3.1 Funding

According to the majority of small and medium-sized enterprises in the cluster development of the funding supply path can be seen, they generally rely on financing, loans to meet their own development of the capital needs, so financing and loan parties are the provider of the supply of funds, and small and medium-sized enterprises are given, whether it is financing or loans, small and medium-sized enterprises only rely on their own ability to operate will encounter greater difficulties, that is, the economic level of small and medium-sized enterprises, income is not high, and the development situation is

not stable, so it is easy to be rejected by financing or loan-to-loan. At this time, local governments in order to promote the development of small and medium-sized enterprise cluster, through a series of policies to reduce the difficulty of enterprise financing or loans, so that the development of clusters more smooth operation. If the use of credit principles to reduce the difficulty of enterprises to bank loans, and set up a special small and medium-sized enterprise loan business, this can also take into account the benefits of banks, can make the supply of funds more reasonable and effective.

3.2 Labour Market

The labor market is the collection of human resources, and in general this collection is more scattered, free, and does not form a market form, while the collection of human resources in the body of the type, professional level, comprehensive quality is uneven, which is the performance of improper allocation of resources. In this regard, local governments can make demands on talent-cultivating institutions according to the development needs of SME clusters externally, and stimulate the concentration of human resources through policies, build labor market, and provide a strong impetus for the development of SME clusters.

4. CONCLUSION

In summary, the development of small and medium-sized enterprise cluster has become the norm, but there are still some unreasonable places in the development, this paper analyzes the role of local government in cluster development, and puts forward corresponding methods, so that local governments can accurately use the relevant methods to optimize the development of clusters and promote the growth of small and medium-sized enterprises.

REFERENCES

- [1] Schaper MT, Carlsen J, Taylor R. The role of government in fostering sectoral SME development: an analysis of the tourism industry in Australia, Hong Kong and Singapore, 2008, 365(1552): 2571-80.
- [2] Lisa J. Wuebker. Safety locus of control as a predictor of industrial accidents and injuries, Journal of Business & Psychology, 1986, 1(1): 19-30.

The Current Situation of Computer Information Network Security and Its Countermeasures

WanWu Xiao¹, Hongming Mo², Ning Xiang³

¹ Department of Physical Education, Sichuan Minzu College, Kangding 626001, Sichuan, China

² Library, Sichuan Minzu College, Kangding 626001, Sichuan, China

³ Leshan Vocational & Technical College, Leshan 614000, Sichuan, China

Abstract: With the development of computer technology, China has entered the era of network information. The current status of computer information network security is not optimistic, because there are many factors, such as diversity and unstable network connection of network servers, which makes users vulnerable to Attacks and diseases of computer offenders threaten the privacy of computer users by using computer virus intrusion. In this manuscript, the current security situations of China's computer information network are analyzed, and some suggestions to solve the problems are proposed.

Keywords: Information network security; Preventive measures; Exploration

1. INTRODUCTION

With the rapid development of Internet technology, computers and the Internet have become one of the most important tools in our lives, playing a very important role in people's work and life. However, the computer network is highly open, and information is easily stolen and destroyed by criminals when it is spread on the network. If the confidential information stored in the computer is not well protected, it is easy to make the information stolen and destroyed. User's file information will be threatened [1-4]; thus, we need to pay attention to the security procedures of the computer network

2. CONTENT AND SITUATION OF COMPUTER NETWORK SECURITY METHODS IN CHINA

2.1 Contents of Computer Network Security

The security of the computer information network is mainly for the maintenance of the Internet and hardware, while the security management of the information network is mainly to maintain the entire Internet security system by various methods to ensure the overall security of the computer network. At the same time, remote real-time monitoring of computer hardware devices is also possible. The above work can enable each user to use the computer network in a stable environment

2.2 Attacked by Lawbreakers

In the process of information security management of computer network, it is easy to invade by criminals. These intrusions will have a significant impact on

network security of Internet. These criminals are familiar with the structure of computer networks by mastering computer technology. They can usually use computer operating system and Internet server vulnerabilities to carry out computer network attacks, causing the computer and Internet system to be paralyzed and stealing confidential information from the computer [5-9]. The main purpose of these criminals to attack computer networks is to steal confidential information from computers or invade cameras to observe the situation in certain areas. These actions will cause the computer information security to be threatened. Moreover, these criminals often use security holes in computer systems to carry out covert attacks highly. It is difficult for computer security systems to detect these attacks effectively.

2.3 There Are Security Holes in Computer Software, Which Provide a Way for Lawbreakers

China's computer technology is now in a stage of rapid development, and computer software is updated with the development of this technology constantly. Although these updates have fixed the security vulnerabilities that have occurred, many times new vulnerabilities will appear after the software update is completed. In addition, the computer network has the characteristics of high openness, which provides more ways of intrusion for lawbreakers' means and means. It is normal for security vulnerabilities to appear when writing computer software and operating systems. Finding and fixing these security holes can maintain the security of the computer network, but this requires a lot of time and effort from the programmer. During this time, criminals can use these security holes to invade, destroy, and steal this information from computers and the Internet. The security of computer networks is severely damaged by confidential documents.

2.4 Serious Cyber Crime

At present, China has increased its efforts to the area of network security management. Compared with the past, the use of computer networks in criminal activity has decreased, but it is still very serious. There are many types of cybercrime activities, some of which use the defects of computer operating systems and security systems to invade other people's computers. Some of them use the Internet to spread

Trojan horse programs and invalidate computer networks. In society, most illegal activities of computer networks often go through the network hack into other people's computers and steal users' private information. In recent years, criminal activities such as fraud and obscene live broadcasting using computer networks have become increasingly serious, which has greatly affected people's lives.

2.5 Using Computer Network to Spread Virus

Since the emergence of computer viruses, it has posed a great threat to the information network of computer networks. It is highly concealed and has the ability to replicate itself. If a stand-alone computer without a network is infected with a virus, it will only lead to system failures, crashes and massive data destruction. But at present, the computer network is developed, and the spread of computer viruses is very high, which can be hidden in various files. When two computer users exchange files over the network, these viruses will enter other uninfected computers along with the files. In addition, with the continuous upgrade of these viruses, there are more and more types, which greatly increases the threat to computer network security.

3. COUNTERMEASURES FOR NETWORK SECURITY

3.1 Strengthen the Control of Network Information Security

In computer networks, information security management is often influenced by multiple factors. In the course of work, we must coordinate the scope of responsibilities between the various subjects to ensure communication and the various subjects in order to better achieve the purpose of collaborative work. When the Internet society manages information security in computer networks, it needs the power of relevant departments to manage jointly. Both parties will formulate corresponding rules and standards to ensure that the Internet industry can better comply with relevant industry regulations. In addition, other local management units should also jointly promote the implementation of relevant regulations under the guidance of the Internet association, so that the national computer network information security management can play its due role. In addition, we also found and perfected the defects in the computer network information security management system in our work, and divided the responsibilities to everyone, so each employee can understand his own responsibilities and scope of power, these measures can promote China's computer network related industries are better oriented from the perspective of network information security management. At the same time, the Internet association should establish contact with law enforcement units, and they should assist the law enforcement structure to monitor and crack down on illegal activities, and increase the crackdown on illegal activities on the Internet, so

illegal elements can be caught as soon as possible, and reduce the occurrence of Internet violations.

3.2 Use Professional Anti-Virus Software and Open the Firewall of Computer Operating System

In life, not all the people who are proficient in computers are skilled. That is many people currently install anti-virus software on the computer to prevent the invasion of computer viruses and Trojans. Anti-virus software can detect the computer operating system in real time, protect the information security in the computer, and thus protect the user's personal information. It should be pointed out that when selecting anti-virus software, download and install it regularly, update anti-virus software regularly, and improve the anti-virus software's ability to prevent it.

4. CONCLUSION

To sum up, the developed computer and Internet technology can help people to work and live more conveniently, but they also bring some risks. Therefore, we should take precautions against these risks in time to ensure the security of computer information network.

REFERENCES

- [1]Wang Lifang. Research on computer network security and computer virus prevention measures, *Network Security Technology & Application*, 2019 (10): 1-2.
- [2]Wang Xintang, Liang Zhifeng. Discussion on the current situation of computer information network security and preventive measures, *China New Telecommunications*, 2019 (08):1-2.
- [3]Pan Tan. Analysis of the current situation of computer network security and countermeasures, *Heilongjiang Science and Technology Information*, 2014 (36): 151-152.
- [4]Lan Shimei, Li Song. Analysis of the current situation of network security in Guiyang College campus and preventive measures, *Journal of Guiyang University (Natural Sciences)*, 2013 (01): 30-33.
- [5]Hu Yubing. Analysis the current situation and prevention of computer network security, *Journal of Changjiang Engineering Vocational College*, 2011 (04): 70-72.
- [6]Wang Hongli. The current situation and prevention of computer network security, *Information Security and Technology*, 2012 (04): 13-14.
- [7]Zhang Lan. A brief analysis of the current situation and countermeasures of computer network security, *Intelligence*, 2010 (08): 71-73.
- [8]Wang Lu. Discussion on the current situation of computer network security and prevention technology, *Computer CD Software and Applications*, 2012 (09): 139-140.
- [9]Sun Huiang, Cao Shiwei. Technical research on the prevention of the current situation of computer network security, *New Technology & New Process*, 2012 (12): 58-59.

Research on the Lifelong Talent Training Model of Internet and Continuing Education

Yue Zhao

Jiangsu Maritime Institute College of Navigation Technology, Nanjing, 210000, Jiangsu, China

Abstract: The application of Internet plus continuing education in the field of education can build a comprehensive life-long talent training system. Based on this, this paper from the information sharing, non-out-of-production and non-departure, the whole network examination, personalized, double-channel five angles of detailed analysis of the "Internet and continuing education" based on the life-long talent training system, hoping to provide a help for the development of China's life-long education.

Keywords: Continuing education; information sharing; talent development

1. INTRODUCTION

From the perspective of the spirit of the 19th National Congress of the Communist Party of China, the education sector is actively improving its own talent training system, and integrating Internet technology into the cause of continuing education, and delivering more excellent talents to the society. Therefore, in order to continue to promote the progress of lifelong education, educators should analyze the mode of "Internet plus continuing education" and take effective measures to improve the efficiency of education and promote social development.

2. TALENT TRAINING MODE FROM THE PERSPECTIVE OF INFORMATION SHARING

Generally speaking, Internet technology has the advantages of strong openness, high information transmission performance and low cost. By integrating it with continuing education, educators can give full play to the function of Internet information sharing, improve the efficiency of learners' knowledge acquisition, reduce the cost of continuing education, and contribute to the development of national overall quality. Because the object of continuing education is mainly for adults, and adults need to bear more burden of life than students, so they are restricted by space and time. But under the condition of "Internet plus continuing education", major educational institutions have launched continuous education online courses, promoting flat development of quality education resources, breaking the constraints of time and space factors on continuing education activities. For example, the "Internet plus continuing education" system created by dual education groups. The group applies internet live broadcast, VR and other technologies to the creation of continuing education products, and provides learners with online services

for the whole learning and examination process, such as charging, learning, registration, etc., and constructs a complete online learning service chain, which reduces the cost of adult education. At the same time, the system also supports mobile terminal, which can help learners make full use of fragmented time and deepen the implementation of lifelong talent training mode.

3. TALENT TRAINING MODE FROM THE PERSPECTIVE OF NO OFF JOB AND NO OFF-POST LEARNING

Lifelong talent training mode emphasizes continuous learning, while most adults need to carry out full-time work to ensure their own living standards. Therefore, the traditional face-to-face teaching mode of continuing education is difficult to meet the requirements of life-long talent training mode for the flexibility of educational activities. The Internet plus continuing education has the function of remote and mobile, which effectively avoids the shortcomings of flexibility in traditional education, and ensures that continuing education activities can be carried out without breaking out of production and leaving the post. This enhances the feasibility of continuing education and speeds up the development of education. In education online, Internet plus continuing education can build a lifelong learning system for all citizens, providing sufficient learning opportunities for the nation and promoting the rapid development of society. For example, the strategic cooperation between China Education online and the National Distance Education Cooperation Group Based on "Internet plus continuing education" is a strategic cooperation. Through joint resources integration, we have strengthened the work of "Internet plus continuing education" in the fields of popularization, research and development, publicity and so on. We have gradually improved the lifelong learning system established by them in cooperation and development, which is conducive to the development of lifelong training for talents.

4. TALENT TRAINING MODE UNDER THE ANGLE OF THE WHOLE NETWORK EXAMINATION

Generally speaking, the talent training ability of an institution is mainly reflected in the passing rate of the examination. Meanwhile, obtaining corresponding documents through examinations is also one of the important purposes for adults to receive further education. Therefore, the passing rate of students can

directly affect the implementation effect of the Internet plus continuing education mode. However, under the traditional education condition, the restriction of work on adults to a large extent causes them to be unable to successfully complete the tedious registration, application and examination process, and frustrates the enthusiasm of the masses to accept continuing education. And the mode of talent training based on Internet plus continuing education usually supports the function of the whole network examination, that is, the students can complete the examination process of registration, examination and examination results through online operation. Weakening the difficulty of the implementation of continuing education will help to improve the enthusiasm of the people for lifelong learning. In this process, each educational institution can set up the whole network examination as its own educational service function, build a service platform integrating teaching and examination, and improve the development level of the field of continuing education.

5. TALENT TRAINING MODE FROM THE PERSPECTIVE OF PERSONALIZATION

The traditional continuing education mainly focuses on the imitation and replication type of compensation education, which makes it criticized by people in terms of quality, leading to the gradual marginalization of continuing education under the impact of higher education. Therefore, educators should take into account the wide individual differences between adults and recognize the utilitarian and practical characteristics of adult learning. Educators should abandon the traditional teaching mode of systematic knowledge and build a teaching content system based on post skills and occupation skills, and give full play to the open advantages of the Internet plus continuing education talent training mode. By giving learners plenty of choice space, the educational products can meet the personalized needs of all kinds of people, and improve the operation level of the lifelong training mode of the talents. In addition, for the institutions of continuing education, the uneven source of students is an important factor affecting the effect of education. The "Internet plus continuing education" talent life-long training mode improves the over average defects in the traditional "march in step" education form. This can not only deepen the implementation of the layered teaching method, make personnel training

easier to fit personal characteristics, but also help to improve the operation level of Educational Institutions [1].

6. TALENT TRAINING MODEL FROM THE PERSPECTIVE OF TWO CHANNELS

In the implementation of the lifelong education mode of "Internet plus continuing education", educators still need to give the foundation of online education. Therefore, in the implementation of the training mode, the construction of online and offline dual channel teaching system is an important measure to deepen the implementation of the training mode. In this process, educational institutions can provide offline education services to students based on the smart classroom, ensure the consistency of online and offline teaching efficiency, and give students sufficient choice space to improve the service level in the field of continuing education. For example: double track teaching mode created by super star continuing education. In this teaching mode, students can not only learn and test through mobile learning platform, MOOC learning platform and online examination system, but also accept teaching in various forms of smart classroom. This teaching mode has realized the lifelong education of "Internet plus continuing education" combined with online and offline education, and optimized the development level of [2] in the field of education.

7. CONCLUSION

To sum up, under the background of "Internet plus continuing education", actively developing the lifelong talent training mode can strengthen the comprehensive quality of the people. In the field of continuing education, with the help of Internet plus continuing education, we can reduce the cost of adult learning, maintain continuity of education, enhance national learning enthusiasm and enhance teaching effectiveness. Give students enough choice space, so that the development of education to a new level.

REFERENCES

- [1]J.M.F. Ferhatoglu, A. Kartal, A.L. Filiz, A. Kebudi. Comparison of New Era's Education Platforms, YouTube® and WebSurg®, in Sleeve Gastrectomy. Obesity Surgery, 2019, 29(11).
- [2]J. Shuguang Guo. Research on Burnout of continuing Education of International Logistics managers in the era of Mobile Internet, Frontiers in Educational Research, 2019, 2(7).

Design Basis and Application of Passive Ultra Low Energy Consumption Building

Buhong Jiang

Ningxia Institute of Building Science Co, Ltd. Wuxi, 214000, Jiangsu, China

Abstract: With the continuous development of society, people's requirements for their own living environment are becoming higher and higher. The continuous influx of rural people into the city, greatly increases the energy consumption of the city. The passive ultra-low energy consumption construction design can improve the problem of urban energy consumption. This kind of design idea changes the living environment of people very well, makes the home greener, more environmental protection, healthier, the appearance of this kind of design conforms to the current development demand of China very much. In this paper, the basic research and elaboration of the design and application of passive ultra-low energy buildings are carried out.

Keywords: Passive; Ultra-low energy consumption; Architectural design; Application research

1. INTRODUCTION

In recent years, the development of real estate is very rapid, whether in the house price, or in the economic development is very important. However, the continuous consumption of real estate construction on the environment has also become one of the concerns of the people. The emergence of passive ultra-low energy consumption building design has improved this problem. This design scheme not only changes the space use of the building, but also is an important breakthrough in energy saving. Passive ultra-low energy consumption is through reasonable space design in natural ventilation, natural insulation, natural lighting and other energy-saving ways have changed, changing the comprehensive quality of the building, greatly reducing the damage of the construction industry to the environment, but also trying to change how to achieve green living environment under ultra-low energy consumption, passive ultra-low energy consumption has become the most important concept of many construction industries [1-4].

2. DESIGN BASIS OF PASSIVE ULTRA LOW ENERGY CONSUMPTION CONSTRUCTION

Passive ultra-low energy consumption refers to how to use the appropriate natural climate and conditions in the construction industry to build a more reasonable house without changing the quality of the building itself, such as improving the comfortable indoor environment and building by using renewable energy and building envelope with higher thermal insulation performance and air tightness performance.

The building concept solves the problems of air tightness design and heat insulation in the building, which is of great significance to the green, energy saving and environmental protection of the building.

2.1 Environmental Factor

In China's construction industry, environmental problems are very important factors. It is also one of the most important factors in the design of passive ultra-low energy consumption buildings. However, there are great differences in the environment of our country, and the climate characteristics of each region are quite obvious, especially in some hot or cold places, the requirements for buildings are very high, such as near Hainan Island, which is hot all the year round, in the hot summer, the temperature is higher, which makes people have higher requirements for cooling. On the contrary, in the cold northeast of China, how to keep warm is also their key consideration. Therefore, in the construction industry, our country's construction personnel have changed a lot by changing the design structure and method of the building. This design according to local conditions has important significance in the construction industry of all parts of China. At present, when passive ultra-low energy consumption design method is used, the primary task is to investigate and study the environment near the building. And make a reasonable design plan, analyze the specific design impact in the construction process.

2.2 Fine Expression Method of Outdoor Natural Climate

In the design concept of passive ultra-low energy consumption, how to reasonably implement this concept has become one of the important methods in China. But so far, China has a set of design process in the implementation plan, mainly including the following three stages:

2.2.1 Data collection and collation

So Far, data collection and collation have been carried out mainly for the natural climate of the past 30 years in China, and targeted problems have been extracted from the data, such as the fixed temperature and climate in each region every month every year.

2.2.2 Analyze inherent data

Analyze seed factors and data conditions under the same conditions, such as wind speed, humidity, radiation, precipitation and other factors of each month in each region

2.2.3 Cumulative analysis

Accumulate the data generated in each month and calculate the research results. This type of method can provide reliable data for passive ultra-low energy consumption building design

3. DESIGN AND APPLICATION OF PASSIVE ULTRA LOW ENERGY CONSUMPTION BUILDING

In the process of passive ultra-low energy consumption construction in China, the main core idea is to focus on the climate conditions of every place. Therefore, in the application of passive ultra-low energy consumption design, we should follow the policy of "adjusting measures to local conditions", different urban environment, geographical location, climate and other aspects can be implemented after inspection. This technical design not only improves the comfort of the building, but also meets the requirements of energy conservation and emission reduction on the basis of political policies. However, in the process of construction, it is necessary to develop environmental technical requirements as much as possible, which are more convenient for the construction industry and the building itself. For example: many people have high requirements for the building of houses in China, most of them have high requirements for the North-South ventilation, and the North-South ventilation can be a great help for the cleaning of houses. And the problem of facing the sun in the living room and bedroom of the house is also an important consideration for the residents, which can not only bring good light to the house, but also bring good mood to themselves.

3.1 Insulation Design

In the design of passive ultra-low energy consumption buildings, the design scheme has different requirements for the environment and climate of different regions. For example, in view of the cold climate in Northeast China, we can use extruded polystyrene boards and other similar materials in the cold weather. This type of material has excellent thermal insulation properties. This material is also known as extruded polystyrene foam board, referred to as extruded plate. It can not only use the heat preservation of the wall and the top of the floor, but also can be used in a series of high temperature and moisture-proof fields such as storage warehouse, airport runway, expressway, etc.

3.2 Installation of Doors and Windows

There are clear requirements for ventilation, sound insulation, lighting and other aspects of the construction, which are often the standards to measure the building. How to ensure these requirements of the house, there are clear standards for the selection and use of the doors and windows of the house. However, for different regions, the use of materials is also different. For example, in the south of China, where the climate is mild, the requirements for doors and windows are mostly convenient ventilation. The main

purpose of this choice is to make the room have good ventilation effect and to ensure a comfortable temperature.

3.3 Solar Energy Utilization

In recent years, China has made remarkable achievements in the use of solar energy. For example, the solar water heater designed for the water heater has greatly reduced the environmental pollution caused by the energy consumption. However, China is rich in land and material resources. In today's resource shortage, the reasonable development of solar energy sources is also an important architectural concept in these years, which fully embodies the construction of green buildings the remarkable wisdom and talent of the modern people. For example, Shenzhen started to encourage public buildings and houses with more than 12 floors to be equipped with solar water heater system in 2011, and air source heat pump is used as auxiliary heat source to achieve the purpose of energy saving. According to the research conclusion, the solar energy + air source heat pump scheme has a very reasonable economic recovery effect. The implementation of this plan also responds to the national policy of energy conservation and environmental protection, and makes outstanding contributions to the improvement of the national ecological environment.

4. CONCLUSION

To sum up, in the reasonable use of passive ultra-low energy consumption building design, it can better improve the living environment of the people themselves, but also promote the change of ecological environment, further meet the policy requirements of energy conservation and emission reduction, while making rational use of resources, building a good social environment. However, in this paper, there are many requirements for passive ultra-low energy consumption. For example, there are clear instructions on environmental factors and regional climate planning, while the specific implementation and application are mainly reflected in the regulations on building temperature. For example, there are different choices on materials used in different regions and temperatures, like heat insulation materials and door and window types. Therefore, China should strengthen the construction and development of passive ultra-low energy consumption to contribute to the construction of green and environmental protection of the ecological environment.

REFERENCES

- [1] Han Jing. Research on design and application of passive ultra-low energy consumption buildings, Engineering construction and design, 2019 (02): 25-26.
- [2] Li Dongsheng. Research on design and application of passive ultra-low energy consumption buildings, Building materials and decoration, 2019 (03): 117-118.

[3]Cao Fei. Design basis and application of passive ultra-low energy consumption building, Green building materials, 2019 (01): 84.

[4]Zhu Yongjie. The basis and application of passive ultra-low energy consumption building design, Modern property (mid ten issue), 2019 (01): 119.

The Enlightenment of Enterprise Participating in the Training Mode of Accounting Information Talents

Yan Wang

Shandong Institute of Commerce & Technology, Jinan, Shandong, China

Abstract: With the continuous development of China's education, accounting information is also constantly updated and improved, and accounting information is also applied to various fields, becoming increasingly common. The main training mode of accounting information talents is through the school. In order to meet the requirements of today's information society, more colleges and universities are constantly innovating in the process of talent training, and some enterprises are involved in the training process, combining the school and the enterprise, so as to achieve the seamless connection from the school to the enterprise, and to improve the training of information talents. It has provided favorable help.

Keywords: Enterprise accounting; Accounting informatization; Personnel training; Mode

1. INTRODUCTION

At present, with the continuous innovation of accounting information education mode, the way of school enterprise cooperation has also been a lot of use and support. School enterprise cooperation refers to a kind of education mode in which schools and enterprises jointly cultivate talents, create talents suitable for the market and social needs, and improve the overall professional quality of students and meet the employment needs of enterprises based on the concept of combination of production and learning and joint participation. Schools need to cultivate high skilled and high-quality talents, and enterprises need to provide practice places and conditions for students, so school enterprise cooperation can maximize the training effect of accounting information talents [1].

2. THE NECESSITY OF ENTERPRISES PARTICIPATING IN THE TRAINING OF ACCOUNTING INFORMATION TALENTS

In the current social development, there is a growing awareness of enterprises' information management and the importance of accounting informatization. Therefore, in order to let enterprises, keep up with the pace of the times, the demand for accounting informatization talents is very large [2]. The development and normal operation of all enterprises are inseparable from the participation of information technology, so it is a very important task to actively cultivate and educate accounting information talents, and provide excellent information talents for all enterprises. The combination of school and enterprise

provides sufficient conditions and foundation for the training of talents. While training accounting information talents, we should constantly reform the curriculum, keep up with the development and progress of the times, so as to cultivate more high-quality talents.

3. THE KEY POINTS OF THE CONSTRUCTION OF THE MODE OF ENTERPRISES PARTICIPATING IN THE TRAINING OF ACCOUNTING INFORMATION TALENTS

3.1 Making the Basic Goal of Accounting Information Talents Training

We are in the current information age, so the requirements of society and enterprises for accounting personnel are not only limited to the stage of accounting knowledge, but also better grasp of information technology, including the innovation and processing of information technology, which can be used freely in the daily work of accounting. However, at present, China's information-based accounting personnel are relatively in a relatively small stage, not keeping up with the times. The development of the times has an impact on the progress of enterprise informatization. High efficiency is the main base of accounting information talents. In the process of school training, there are some misunderstandings in the teaching mode, and there are no real information compound talents. Therefore, colleges and universities need to combine with enterprises, from the perspective of market, establish the direction of talents needed by enterprises at present, and formulate the training mode of informatization talents to adapt to the development of enterprises. The trained information talents not only need to master the professional knowledge of accounting information, but also use the information technology freely. The development of society cannot be separated from such compound talents. The training of information talents can comprehensively promote the progress and development of society [3].

3.2 An Important Construction Method of Training Mode of Accounting Information Talents

The major of accounting informatization in colleges and universities provides strong support for the needs of enterprises' informatization talents. In daily teaching, schools should formulate targeted teaching programs and create compound talents in combination with the development direction of enterprises and the

actual situation of the market. And in the establishment of a good talent training model, we still need to combine some methods of continuous innovation and improvement.

First of all, we need to constantly optimize and strengthen the faculty, which is the primary basis for training talents. Teachers should master the latest information technology and accounting professional knowledge, and make targeted teaching programs. If teachers' professional ideas are relatively backward, it will affect students' learning. The school must be equipped with a strong teaching staff. The overall quality and teaching practice experience of the teachers need very high standards. Only when the teachers' compound knowledge reaches a certain degree, can the real compound accounting information talents be cultivated.

Secondly, we need to actively carry out school enterprise cooperation activities and constantly update teaching materials. In the training of accounting information talents, the involvement of enterprises can make the school better define the current teaching objectives, and also let students adapt to the environment and requirements of enterprises in advance, which plays a very good role in the training of accounting information for students. In the process of school enterprise cooperation, schools and enterprises can understand each other, so as to achieve the renewal and progress of accounting information teaching materials resources, and improve the level of training talents in this aspect from the whole. In the process of compiling accounting information textbooks, we can take the method of case telling, add more large-scale cases in the textbooks, let students fully understand the needs of the society, improve their practical ability, and promote the overall mastery of accounting information technology [4].

In the process of training accounting information talents, we should constantly improve the proportion of experimental courses. The cultivation of information talents is not only limited to the mastery of theoretical knowledge, but also has great requirements for practical ability. Only by combining theoretical knowledge with practice, can we contribute the best power to the enterprise. In the plan of teaching mode, the school needs to constantly improve the proportion of experimental courses, so that students have more practical opportunities. In general, the establishment of experimental courses is mainly to enable students to practice and use the theoretical knowledge they have learned, constantly improve their practical ability and practical ability, enable students to skillfully use various financial software, and solve various problems in the use. The development of practical courses has cultivated the students' ability of knowledge integration and practice. In this process, we can understand the daily work of accounting information personnel, and carry out targeted learning.

We should make use of the advantages of the Internet and innovate teaching methods. At present, the development of information technology is very fast. Many advanced network technologies can be used in teaching with theoretical knowledge. And now colleges and universities will set up a professional accounting software laboratory. There are many accounting information software and programs that need to be learned and skillfully used in the laboratory, which provides more learning and practice opportunities for students. Teachers should make full use of network resources in teaching, build a good communication and practice platform for students, and timely understand the learning situation of students, adjust their own teaching strategies according to the actual situation [5].

4. CONCLUSION

In the current knowledge background of the Internet of everything, the cultivation of accounting information talents also needs to keep pace with the times, abandon the traditional teaching methods, and timely introduce and innovate the teaching mode. The enterprise participates in the teaching mode of the school, and the school can make the teaching mode suitable for the current development direction according to the needs and current situation of the enterprise. And to increase students' understanding and understanding of the enterprise, fully realize the work content and direction of the current enterprise accounting personnel, and then learn and practice in this direction, can better adapt to the future enterprise work. Enterprises are not far away from students. School enterprise cooperation can help students grow better to a certain extent, so that students can develop into compound talents needed by the society in this process.

ACKNOWLEDGEMENTS

2013 Shandong Institute of Commerce & Technology teaching research project, Project no.:2014YB16. Project name: Research on the construction of enterprise cost accounting case base and the course reform of cost accounting practice.

REFERENCES

- [1]Huang Lixian. Research on the talent training mode of "emphasizing both morality and technology and five stages of progressive development" in accounting major of secondary vocational school, Guangdong Normal University of technology, 2018.
- [2]Wang Chao, Jin Rong. Reflections on the cultivation of accounting professionals from the perspective of enterprise demand, China Vocational and technical education, 2019 (01): 55-60.
- [3]Li Sha. Research on MPAcc personnel training mode linked with professional standards, Shandong Business University, 2017.
- [4]Fu Haihong. Construction of training mode of accounting professionals in local colleges and Universities under the cooperation of colleges and

enterprises, Human resources development, 2018 (04): 55-56.

[5]Zhang Na. The Enlightenment of enterprises participating in the training mode of accounting

informatization talents in Higher Vocational Education -- Based on the research under the ERP environment, North economic and trade, 2014 (10): 258-259.

How to Give Full Play to the Role of Enterprises in School Enterprise Cooperation

Zhi Cui

College of Information and Electronic Engineering, Yiyang 413000, Hunan, China

Abstract: School enterprise cooperation is a win-win model of school enterprise cooperation. Students can enhance social practice ability and obtain more employment resources in school enterprise cooperation. Based on the current situation of school enterprise cooperation, this paper analyzes the specific problems and causes in the cooperation. Then combined with the actual development situation of market economy, the necessity of cooperation between schools and enterprises is clarified. Finally, four ways that enterprises can play an important role in school enterprise cooperation are summarized.

Keywords: School enterprise cooperation; Enterprise; Social responsibility

1. INTRODUCTION

School enterprise cooperation is an inevitable requirement for the development of regional economic integration, which promotes the reform of the current economic model. The school cooperates with the enterprises to help the students enter the enterprises and go to the actual work posts, and fully practice the knowledge and skills learned, so as to fundamentally improve the students' awareness of work innovation and comprehensive strength. However, the effect of school enterprise cooperation is not obvious. There are some problems that cannot be ignored in the cooperation, which seriously affect the sustainable development.

2. DEVELOPMENT OF SCHOOL-ENTERPRISE COOPERATION

2.1 The Development Status of School-Enterprise Cooperation

As far as the current situation is concerned, there is an incomplete understanding of the win-win mode of school enterprise cooperation. Zhuhai school enterprise cooperation research group conducted a questionnaire survey with the theme of "school enterprise cooperation". The subjects of the survey were 30 companies from state-owned enterprises, foreign capital, private enterprises and joint ventures. According to the questionnaire data, the enthusiasm of enterprises for school enterprise cooperation is not high, 70% of enterprises do not understand the policies and regulations of school enterprise cooperation, 87% of enterprises do not participate in the school curriculum reform and talent quality evaluation, and 77% of enterprises do not provide equipment support to the school. At present, the

school enterprise cooperation is shallow, there is no deeper development. The reason is that the enterprise needs the personnel who have strong technical ability and are familiar with the post, while the students in school need some time to run in in the actual work and apply the knowledge they have learned to practice. Therefore, most enterprises have a negative attitude in school enterprise cooperation, which leads to the failure of cooperation.

2.2 The Necessity of School Enterprise Cooperation

First, the strong support from national policies. On March 4, 2019, the Information Office of Hebei provincial government held an interpretation conference on the implementation plan of vocational education reform in Hebei Province. At the conference, schools were encouraged to cooperate with enterprises with recruitment needs, and preferential policies for tax reduction and exemption were provided to enterprises implementing school enterprise cooperation. Second, the school enterprise cooperation meets the needs of social market development, and the school carries out targeted training through the talent demand of the enterprise. Social practice learning is an important part of school education and teaching, an important link in deepening classroom reform, and a fundamental way for students to acquire the ability to master technology. Third, to reduce the cost of enterprises, enterprises directly recruit the right talents from schools to reduce the recruitment cost and save time. Social recruitment needs a lot of advertising and publicity, and school enterprise cooperation can save this part of expenditure.

3. HOW TO PLAY A ROLE IN SCHOOL ENTERPRISE COOPERATION

3.1 Set up Professional Training Base

The enterprise practice base is an important practice and training place for students to consolidate theoretical knowledge and skills, enhance work belief, enhance practical social practice ability, and improve comprehensive professional quality. The practice base of enterprises should meet the needs of basic teaching and set different teaching courses for different majors. To meet the needs of students' practical ability and social practice, only by applying the knowledge learned to practical work, can we better understand and master it. [1] In order to meet the students' personal health and safety, the enterprise should strictly control the students during their stay in the

base, formulate daily work and learning plans, and conduct training in an orderly and reasonable manner. Enterprises should provide full-time personnel to be responsible for students' daily life and work assessment. Students should communicate with the school in time in case of any situation, and provide the school with corresponding assessment report after the internship. The accommodation of the students should be arranged reasonably to provide them with a comfortable living environment. Guarantee the safety of students' lives and properties, and sign relevant agreements. To provide the school with specific job requirements and specific professional requirements, so as to determine the employment direction of students after internship, and provide appropriate financial subsidies for students.

3.2 Fulfill Social Responsibility and Increase Service Consciousness

Enterprises bear the responsibility of promoting social and economic growth. In the project of cooperation with schools, they cultivate students' ability to deal with problems independently, make them realize the perfect transition from school to society, increase students' innovation awareness, and make a contribution to social and economic reform. It is an important measure for enterprises to participate in school enterprise activities and cultivate high-quality and high-capacity talents in line with the needs of market economy development together with schools. Enterprises should increase cooperation with schools to make contributions to the society, and at the same time, they will receive preferential policies and social capital support from the government. [2] School enterprise cooperation is the basic requirement given to enterprises in the new era, and active participation in school enterprise cooperation is the social obligation of enterprises. Enterprises should assist in formulating the functions of each post and provide more training posts for students in schools. The high-quality talents trained by enterprises have reduced the employment pressure of the whole society, eased the tense employment situation and promoted the sustainable development of the economy to a certain extent. In the process of training students, enterprises should enhance their service awareness, provide them with corresponding support and help according to the direction of market development, so that students can better integrate into social work.

3.3 Sign directional entrustment agreement

In order to implement the document of vigorously promoting school enterprise cooperation initiated by the State Council, accelerate the relevant policies of training scientific and technological talents, promote the rapid development of school education, and meet the employment needs of enterprises and institutions, adhering to the concept of "resource sharing, win-win cooperation", when enterprises and schools cooperate, enterprises should sign directional entrustment agreements to ensure the reasonable description of

students. Directional training can enhance the pertinence and effectiveness of education, improve the quality of skilled personnel training. Schools and enterprises are committed to the teaching mode of "directional training", cooperative education and employment. After the completion of the internship, the enterprises shall recruit and sign labor contracts for the students in accordance with the provisions of the agreement, and bear the corresponding corporate responsibilities. Enterprises should provide basic guarantee for students. Signing directional agreements can strengthen students' self-confidence in their careers and enhance their motivation for learning. Only when students have carried out systematic learning in schools and mastered knowledge and technology can they take the lead in future employment. At the same time, signing an agreement can also protect the interests of the enterprise and improve the overall working ability of employees. Enterprises can select outstanding graduates from schools to enter the company, introduce fresh blood, innovate the system and system, change the original mode, and promote the overall economic reform of enterprises. Therefore, the signing of directional agreements not only provides good employment opportunities for students, but also imports a large number of professional talents for enterprises, promotes the economic growth of enterprises, and achieves win-win cooperation.

4. CONCLUSION

To sum up, in order to achieve win-win cooperation, enterprises should play a guiding and managerial role. By defining its own position in school enterprise cooperation, setting up special training posts for students, fulfilling corresponding social responsibilities, increasing service awareness and signing directional entrustment agreements, enterprises can effectively solve the problems in cooperation and promote the healthy and orderly development of school enterprise cooperation.

ACKNOWLEDGEMENTS

This paper is supported by the Education Research Fund of Hunan Provincial Education Department under Grant No XJT(2018)598. The author would like to thank the anonymous reviewers for their insightful comments and suggestions, which have greatly improved this paper.

REFERENCES

- [1]University-Industry Cooperation Group of Kyung Hee University. Patent Issued for Thermoelectric Materials, And Thermoelectric Element and Thermoelectric Module Comprising the Same (USPTO 10, 600, 947), News of Science, 2020.
- [2]University-Industry Cooperation Group of Kyunghee University. Patent Issued for Artificial Cartilage Containing Chondrocytes Obtained from Costal Cartilage and Preparation Process (USPTO 10, 583, 157), Biotech Business Week, 2020.

Research and Design of Starch Moisture Content On-Line Measurement System

Wei Han, Jian Chu

Tianjin University of Technology and Education, Tianjin 300222, China

Abstract: Corn starch is widely used in food industry, sugar industry and medicine industry. Starch is very easy to absorb moisture in the air, in order to better storage and transport, the state provisions of starch water content should not exceed 14 percent. From the perspective of producers' interests, under the rigid conditions of national standards, the higher the water content is, the greater the profits of producers will be. In view of the complexity of starch moisture content measurement and the difficulty of low-cost on-line measurement, an on-line measurement method of starch moisture content based on multi-sensor fusion was proposed in this paper. Using capacitance sensor and resistance sensor to measure the capacitance resistance of starch of different water content, the corresponding BP neural network was trained, measured for offline by actual values compared with prediction, the results show that the water content of the starch based on multi-sensor fusion prediction is feasible, the method can be used as a new method of artificial intelligence to starch factory starch content online measurement.

Keywords: Starch moisture content; Multi-sensor fusion; Capacitance sensor; Resistance sensor

1. INTRODUCTION

The measurement method of starch moisture content in amyl factory mainly adopts the method of offline measurement, that is, sampling at the material exit, and then sending these samples to the laboratory for measurement. This measurement method has a long period and low accuracy, and it is easy to be affected by the external environment. There is also a manual method to judge the moisture content of starch based on workers' experience, but this is not reliable. On the other hand, there are often many production lines in the production site, and it is impossible for every production line to be equipped with such expensive instruments [1-3]. Therefore, only a few starch factories can be equipped with equipment for online starch detection. With the development of multi-sensor fusion technology, artificial intelligence has been widely applied in various fields. Meanwhile, the theoretical technology of neural network is increasingly mature, which is conducive to the multi-sensor fusion of neural network and realizes the reliability and real-time performance of the system.

2. RESEARCH SCHEME

2.1 Research Background

Corn starch is also known as maize starch. The

common name is liu gufen. White microstrip of yellowish powder. The corn was impregnated with 0.3% sulfurous acid and made by crushing, screening, precipitation, drying and grinding. Common products contain small amounts of fat and protein. Strong moisture absorption, up to 30% above. The water content of starch that the country stipulates cannot exceed 14%, water content is lower its quality is better. Starch drying equipment consists of feeder, fan, drying tube, pulsar, cyclone separator, air shutters, electric control cabinet, etc. Supporting heat sources include steam boiler, hot air furnace, electric heater, etc. In the process of drying, starch with relatively low water content can be obtained by increasing the steam flow into the drying tower and increasing the temperature of the steam, and even starch with a water content of 0% can be obtained [4-8]. However, in order to meet the national standards, the higher the water content of starch, the better.

In the actual production, there are often some reasons that lead to the instability of drying, so that the water content of starch at the discharging place is unstable. Through the understanding of a starch factory, it is found that the water content of starch may vary between 12% and 18%. Producers want a water content range (11%, 13%). If it is too high, the starch produced will not meet the national requirements. If it is too low, the profit will be reduced.

This paper aims to use some properties of wet starch, such as resistance value and capacitance value, through the fusion of neural network, research and design an online measurement system of starch moisture, so that starch manufacturers can produce high-profit products on the premise of meeting national requirements.

2.2 Multi-Sensor Fusion Technology

Human beings instinctively have the ability to integrate information detected by various organs of the body, such as the eyes, ears, nose and limbs, such as sights, sounds, smells and touches, with prior knowledge in order to evaluate the environment around them and what is happening. Multi-sensor information fusion is actually a kind of functional simulation for human brain to comprehensively deal with complex problems. Compared with single sensor, using multi-sensor information fusion technology in solving the problem of detection, target recognition and tracking, to enhance the system survival ability, improve the reliability and robustness of the whole system, improve the credibility of the data, improve

precision, exhibition system of time, space, expanding coverage, increase system of real-time and information utilization, etc. As one of the research hotspots of multi-sensor fusion, fusion methods have been paid much attention to. A lot of researches have been done in this field abroad, and many fusion methods have been put forward. At present, the commonly used methods of multi-sensor data fusion can be roughly divided into two categories: random and artificial intelligence methods.

2.3 Bp Neural Network

The basic idea of BP algorithm is: the learning process from the signal forward propagation and the error of the reverse return two parts; In the process of forward propagation, the input sample is passed in from the input layer and processed by each hidden layer one by one to the output layer. If the output of the output layer is not consistent with the expectation, the error will be sent back layer by layer as the adjustment signal, and the connection weight matrix between the neurons will be processed to reduce the error. Through repeated learning, the error is finally reduced to an acceptable range.

BP neural network algorithm is adopted, sensor information is used as the input of the network, and the water content of the discharge is used as the output of the network. Through the training of the network, the relationship between input and output is obtained. This method is divided into two steps, one is offline training, the other is online calculation. Offline training is to select the sample data and compare the corresponding errors of different hidden layer nodes by means of mean square error, so as to determine the optimal structure of the neural network. The online calculation is based on the input of multiple sensor parameters to obtain the moisture content of the starch, as Figure 1.

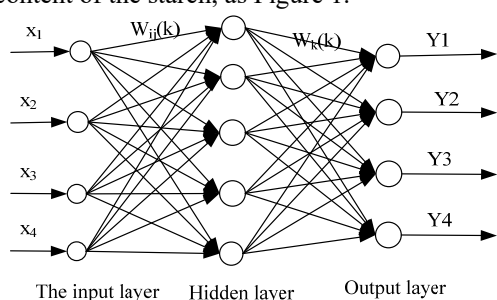


Figure 1 Structure of neural network

3. SYSTEM COMPOSITION

3.1 Overall Composition

The modules of starch moisture content online measurement system based on multi-sensor fusion technology include: resistance moisture sensor module, capacitance moisture sensor module, temperature and humidity sensor module, data acquisition module, electronic halogen moisture meter module and computer module. The system obtains data from the sensor module and the data acquisition card. The collected data are transmitted to a computer

equipped with Labview software, which can process and monitor the measurement data of multiple measurement terminals in real time. The electronic halogen moisture meter can be used for offline data comparison to detect whether the starch moisture content measured online is up to the standard, as Figure 2.

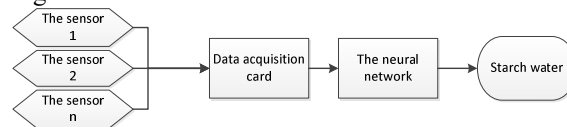


Figure 2 System structure

3.2 Data Acquisition Card Module

This system adopts NI usb-6008 data acquisition card, which provides 8 analog input (AI) channels, 2 analog output (AO) channels, 12 digital input/output (DIO) channels and a 32-bit counter with a full-speed USB interface. It meets the accuracy required by the experiment.

3.3 Resistance Moisture Sensor Module

Resistance moisture sensor module produced by oneself special circuit design, circuit of resistance moisture sensor consists of 15 v power supply, can be measured the resistance value range of starch is 1 mΩ to 2 mΩ. This resistance range includes starch drying and starch moisture content of extremely high conditions, meets the online measurement of starch moisture content of the range.

3.4 Capacitance Moisture Sensor Module

The capacitance moisture sensor module is also made by special circuit designed by ourselves. The capacitance moisture sensor circuit is powered by 15V power supply, and the measurement range of starch capacitance is 30pf-1000pf. The range of capacitance value includes starch drying and starch moisture content of extremely high conditions, meets the online measurement of starch moisture content of the range.

3.5 Cs215 Temperature and Humidity Sensor Module

CS215 USES Sensirion SHT75, a probe that combines temperature and relative humidity to provide precise and stable temperature relative humidity measurements. The output signal of the probe is sdi-12 signal, which can be directly connected to our data collector for measurement.

3.6 System Interface

The system interface is made by Labview software. The DAQ hardware provided by NI company is used for data processing. The online measurement system can realize system setup, data monitoring, real-time curve, data query and other functions, as shown in the system interface in Figure 3.

System interface can display the detection time, data 1 is the water content of starch, data 2 is the humidity data, data 3 is starch temperature, data 4 is starch resistance, for MΩ units, data 5 is starch capacitance value, for nF unit, all data can be real-time display, also have storage capabilities.

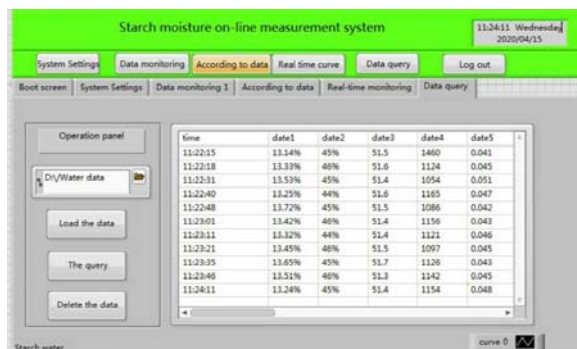


Figure 3 System interface

4. CONCLUSION

The moisture content of grain is an important index to evaluate the quality of grain and a basic item of grain testing. Normal grain contains the right amount of water, and the water content is usually kept within a certain range, which is necessary for the food to maintain its life and to maintain its inherent quality of good seed and food quality. How to ensure the benefit of starch production under the premise of meeting the relevant national regulations is an urgent problem to be solved. An online starch moisture measurement system based on multi - sensor fusion was proposed. The fitting ability of neural network was used to fit the relationship between the characteristic values and water content of starch. The experimental results show that the on-line detection method of starch moisture based on multi-sensor fusion is feasible and can be used as a new detection method to detect starch moisture.

REFERENCE

[1]E. Morse, P. Jaganmohan. 6 DOF calibration of profile sensor locations in an inspection station, CIRP

Annals - Manufacturing Technology, 2020.

[2]R. N. Martins, H. M. F. Moraes, M. F. Portes, W. A. Orlando Jr., M. F. Ribeiro Jr., Do optical sensor readings change throughout the day? An evaluation of two sensor systems, Journal of Plant Nutrition, 2020, 43(11).

[3]I. Ekaette, M.D.A. Saldaña. Barley starch behavior in the presence of rutin under subcritical water conditions, Food Hydrocolloids, 2020,100.

[4]D. Lee, A. Jayaraman, J. S. Kwon. Identification of Heterogeneous Parameters in an Intracellular Reaction Network from Population Snapshot Measurements through Sensitivity Analysis and Neural Network, IFAC Papers Online, 2019, 52(26).

[5]Yang Wenli, Fan Shuangshuang, Xu Shuxiang, P. King, B. Kang, E. Kim. Autonomous Underwater Vehicle Navigation Using Sonar Image Matching based on Convolutional Neural Network, IFAC Papers Online, 2019,5 2(21).

[6]S. Suresh, S. Mohan. NROI based feature learning for automated tumor stage classification of pulmonary lung nodules using deep convolutional neural networks, Journal of King Saud University - Computer and Information Sciences, 2019.

[7]L. Meng, H. Liu, Long Yu, Duan Qingfei, Chen Ling, Liu Fengsong, Zezheng, Shao Kelei Shi, Lin Xianyang. How water acting as both blowing agent and plasticizer affect on starch-based foam, Industrial Crops & Products, 2019, 134.

[8]A. A. Boakye, M. Gudjónsdóttir, F. D. W. Manu, Ibok Oduro, W. O. Ellis, I. S. Chronakis. Water–Starch Interactions of Red and White Cocoyam (*Xanthosoma sagittifolium*) , Starch - Stärke, 2019, 71(5-6).

Effect of Oxygen Vacancy on Physical Properties of Ordered Porous Metal Oxide Films

Xue Hou

Shijiazhuang University of Applied Technology, Shijiazhuang, Hebei, China

Abstract: It is found that the room temperature ferromagnetism of diluted magnetic semiconductor doped with wide band gap semiconductor is not observed. According to the cause of room temperature ferromagnetism, there are different opinions, but there is a consensus that oxygen vacancy will affect the magnetic properties of this kind of materials. In this paper, the specific effect of oxygen vacancy on the physical properties of ordered porous metal oxide films is analyzed, hoping to give some effective thinking to the relevant personnel.

Keywords: Oxygen vacancy; Film magnetism; Porous metal oxide film

1. INTRODUCTION

With the rapid development of semiconductor industry, the important direction of material research in the future is to improve the utilization rate of single material. It is a very effective method to explore a single material with a variety of properties, such as ferromagnetism, ferroelectricity and resistance switch characteristics. From the point of view of material science, binary transition metal oxides have been studied more recently.

2. PREPARATION AND ANALYSIS OF ORDERED POROUS FILMS

The second anodizing method can be used for the preparation of PAA. In the PAA film substrate, through the use of DC reactive magnetron sputtering equipment, we can make the film with different porous metal oxides precipitate on the PAA substrate, and analyze the surface of the prepared samples.

Preparation of PAA film: high purity aluminum foil formed by high temperature annealing is PAA film. At low temperature, we can choose the appropriate concentration of oxalic acid, sulfuric acid, phosphoric acid, chromic acid and other related electrolytes, apply appropriate DC voltage in a certain range, after a certain period of anodizing, we can get porous and ordered aluminum oxide film. The outstanding advantage of anodizing is that it does not rely on high precision instruments, but also has good reproducibility. In the following, the preparation of PAA film will be related to the experimental analysis, the following is the experimental introduction.

2.1 Experimental Instruments and Materials

In the preparation of PAA film, the main experimental

equipment and raw materials are: Plastic electrolyze, DC regulated power supply, ammeter, electronic balance, tube resistance furnace, aluminum foil, etc.

2.2 PAA Film Preparation

In order to prepare highly ordered PAA films, Masuda and Fukuda have been integrated into the secondary anodizing. After the primary oxidation, the porous layer can be removed and the ordered pores can be spread to the whole surface in the aluminum recombination of secondary oxidation. The disadvantage of this method is that the preparation rate decreases. At the same time, a PAA template needs to be prepared in about two working days. The following describes the preparation process of PAA.

2.2.1 Aluminum foil annealing

In order to make PAA film more orderly, it is necessary to cut aluminum into strips and put it into the tube resistance furnace after chlorine gas is introduced. Annealing in 673K for 4 hours can remove the internal force and defects in the aluminum chip and make it have better crystallization. At the end of annealing, the chlorine gas should also be kept in the cooling process to avoid the oxidation of aluminum chips at high temperature. After the aluminum chip cools down, it is required to cut it in round shape, with a diameter of about 2cm, and then press it. During the whole annealing process, the aluminum chip should be kept clean [1].

2.2.2 Electrochemical polishing

Put the aluminum wafer into the mixed solution and polish it at room temperature. The DC voltage is required to be 20V and the time is about five minutes, so that the surface oxide layer and stains in the aluminum wafer can be effectively removed. The components of the mixed solution are perchloric acid and anhydrous ethanol [2].

2.2.3 Cleaning

After finishing polishing, aluminum chips need to be immersed in deionized water for about five minutes, first cleaned with propanol for 3-5 minutes, then washed with anhydrous ethanol for 3-5 minutes, and then cleaned up the residual polishing liquid. Then let the aluminum film dry naturally. Pay attention to place the scratched part upward.

2.2.4 Once, secondary anode oxidation

The formulation of the electrolyte should be carried out at an appropriate concentration. Complete the

oxidation again. The three electrolyte concentrations, according to 45V, 25V and 100V voltage, connected to the Circuit aluminum, the current value will show a rapid increase and then a sharp decline in the situation, slowly increase and then tend to stabilize. As shown in Figure 1 and Figure 2.

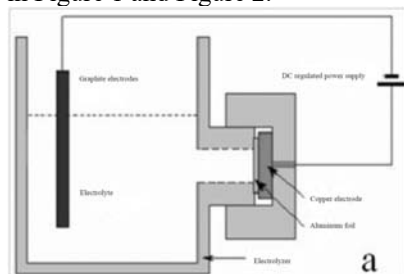


Figure 1 Map of the anode oxidation self-group ingenuity device

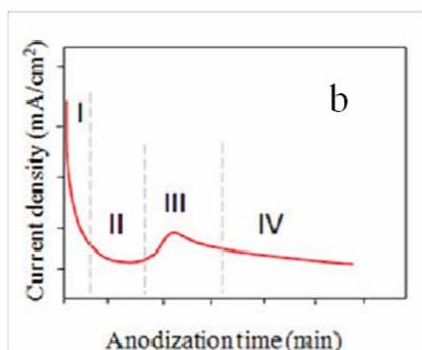


Figure 2 A graph of current changes in oxidation
After the first oxidation, the porous membrane was soaked in 1:1 chromic acid and phosphoric acid, and the porous membrane was removed. Through deionization washing, natural air drying and other links, secondary oxidation is started. Compared with primary oxidation, the voltage of secondary oxidation is the same, and specific oxidation time is set as required.

2.2.5 Remove aluminum base

According to the test process, to remove the aluminum located on the back of the film, only the PAA film is retained. The removal method can choose saturated copper chloride solution to remove the aluminum layer under displacement reaction. In deionized water, it should be carefully cleaned and dried naturally. Finally, the PAA film is transparent.

3. THE INFLUENCE OF OXYGEN VACANCY

Solid defects will have a great influence on physical properties. Defects enrich the physical world. At

present, in the study of physical material properties, the influence of oxygen vacancy defect on it is a topic of widespread concern.

In the oxygen vacancy, the correspondence of the positive center makes the electron easier to capture. Therefore, the large amount of oxygen vacancy will not affect the macroscopic electrical properties of the material, and similarly, it will not affect the related magnetism. The presence of oxygen vacancy defects leads to the extremely unbalanced distribution of the surrounding charge. The positive part of the oxygen vacancy will repel the same metal ions and attract the negative ions. To some extent, the positive and negative charge centers do not coincide. Electric dipole moment, it's very easy to capture electrons, and it's very difficult to escape when entering the hunter's hands, so the electron localization appears. Due to the inherent magnetic moment of local electrons, ferromagnetism will appear to a large extent. The large amount of oxygen vacancy will also affect the conductivity of the material. For example, for the part of the oxygen vacancy that does not capture electrons, after power on, the electrons of the oxygen vacancy experience the filling or charging process, and the oxygen vacancy after charging can release electrons, so that the properties of the semiconductor are affected to a certain extent.

4. CONCLUSION

In this paper, we focus on the preparation of PAA films and the influence of oxygen vacancy on the physical properties of ordered porous metal oxides. Through specific experiments and theoretical analysis, the physical properties of PAA films are found, and felt the important application value of oxygen vacancy.

ACKNOWLEDGEMENTS

Properties of ordered porous metal oxide films 16yb1002.

REFERENCES

- [1]Liu Huiyuan. Influence of structure color and oxygen vacancy of Cu @ PAA film on physical properties of ordered porous metal oxide film, Hebei Normal University, 2017.
- [2]Hou Xue. Effect of oxygen vacancy on physical properties of ordered porous metal oxide films, Hebei Normal University, 2017.

Analysis of Joint Space-Time GNSS Anti-Jamming Algorithm Based on Subspace Tracking

Miao Li

Shanxi Fashion Engineering University, Xi'an 712046, Shaanxi, China

Abstract: This paper introduces the advantages and algorithms of joint space-time GNSS anti-jamming algorithm based on subspace tracking, in order to improve the received signal to interference ratio. This research reduces the calculation burden of the anti-jamming machine of GNSS receiver, enhances the freedom of its anti-jamming processing, and hopes to bring inspiration to the readers.

Keywords: Subspace tracking; Global Satellite Navigation System (GNSS); Joint air-time processing technology

1. INTRODUCTION

At present, GNSS system is widely used in military and civil fields and provides positioning and navigation services. However, due to the weak signal of GNSS, its pseudo range measurement accuracy is easily affected by multipath and interference. Specifically, when the power of interference signal is greater than 5dB, the system performance and code synchronization of GNSS may have problems [1,2]. In order to effectively improve the anti-interference ability of GNSS, this paper uses array anti-interference technology.

2. ADVANTAGES OF JOINT SPACE-TIME GNSS ANTI-JAMMING ALGORITHM BASED ON SUBSPACE TRACKING

The traditional array anti-jamming technology is mainly used in the anti-jamming front-end of GNSS receiver. However, due to the lack of freedom, the receiver cannot work effectively in the scene with a lot of interference. The joint space-time processing technology has the ability to process interference in the broadband, which can increase the number of interference suppression without increasing array elements, and ultimately improve the overall anti-interference ability. Since the time delay unit will increase the computation of joint space-time processing greatly after being introduced, in order to ensure the normal acquisition and tracking of receiver synchronization code, it is necessary to improve the quality of the processor in terms of hardware. In addition, subspace tracking technology can also be applied to avoid direct calculation of R_{xx} autocorrelation matrix [1].

3. ALGORITHMS FOR JOINT SPACE DIVISION GNSS ANTI-JAMMING ALGORITHM BASED ON SUBSPACE TRACKING

In order to improve the anti-jamming ability of GNSS

receiver and reduce the computation of GNSS joint space-time processing, this paper combines the subspace tracking method with the joint space-time processing technology of GNSS anti-jamming antenna array. Through the application of subspace tracking technology to suppress interference, improve the signal to interference ratio of the received signal, and reduce the calculation of joint space-time processing technology.

3.1 Signal Simulation

If the antenna array of the GNSS receiver at this stage is M present, the time delay is the number of P cells, and the unit time of each time delay is Δ . The GNSS signal, interference signal and noise signal received by the antenna array are down converted and chip rate sampled, the expression model of vector $x(n)$ of dimension $MP \times 1$ signal received by the antenna array is

$$x(n) = \sum_{k=1}^K s_k(n) c_k(nTs - \tau_k(n)) \alpha_k + \sum_{l=1}^L u_l(n) d_l + v(n) \quad (1)$$

The equation refers to T_s the sampling interval; K refers to the number of satellites in the field of view; $s_k(n)$ refers to the k -th satellite signal symbol; c_k refers to the k -th satellite synchronization code; $\tau_k(n)$ refers to the k -th satellite signal delay; α_k refers to the k -th Satellite Guidance vector in the $MP \times 1$ dimension; L refers to the number of interference; $u_l(n)$ refers to the l -th interference; d_l refers to the l -th interference guidance vector in the $MP \times 1$ dimension; $v(n)$ refers to the additive white Gaussian noise. By using the vector form of data, we can get (1) by deformation

$$x(n) = s(n) + u(n) + v(n) \quad (2)$$

In $u(n) \Delta \sum_{l=1}^L u_l(n) d_l$, indicates that there L is a interference vector. At the same time, $x(n)$ is the input at m the p first delay node of the array is $x_{mp}(n) = x_m(n - p\Delta + \Delta)$, where $m = 1, \dots, M$, $p = 1, \dots, P$. Finally, the output of the combined space-time processing $MP \times 1$ is:

$$x(n)^T = [x_{11} \cdots x_{1p} \cdots x_{M1} \cdots x_{MP}] \quad (3)$$

3.2 Interference Suppression Based On Subspace Tracking

At this stage, if the signal, interference and noise of GNSS are independent of each other, the covariance matrix of the received signal can be obtained as follows:

$$R_{xx} = E\{x(n)x^H(n)\} = R_s + R_u + R_v \quad (4)$$

(4) $E\{\cdot\}$ refers to statistical expectation; $(\cdot)^H$ refers to conjugate transposition; R_s, R_u, R_v represents the covariance matrix of signal, interference and noise of GNSS, and can be defined as

$$R_s \triangleq E\{s(n)s^H(n)\} \quad (5)$$

$$R_u \triangleq E\{u(n)u^H(n)\} \quad (6)$$

$$R \triangleq E\{v(n)v^H(n)\} = \sigma_v^2 I_{MP} \quad (7)$$

(7) I_{MP} is the unit matrix of $MP \times MP$ dimension.

Considering that in general, GNSS signal is 20db-30db lower than the noise level, in the whole interference scenario, the interference signal occupies the most important part of the received signal power, so the covariance matrix R_{xx} can be approximately expressed as

$$R_{xx} = R_y + R_u \quad (8)$$

At the same time, the R_{xx} receiving signal can be divided into two subspaces by parsing the feature values

$$R_{xx} = \sum_{i=1}^{MP} \lambda_i e_i e_i^H \approx \sum_{i=1}^L \lambda_i e_i e_i^H + \sigma_v^2 \sum_{i=L+1}^{MP} e_i e_i^H \triangleq U_L \sum_L U_L^H + U_V \sum_V U_V^H \quad (9)$$

(9) $\sum_L = \text{diag}\{\lambda_1, \dots, \lambda_L\}$ Refers to the diagonal matrix of the dimension consisting of the L largest feature $L \times L$ values, where the corresponding feature L vectors make up the $e_1, \dots, e_L$. Make up $MP \times L$ dimension matrix U_L and expand into interference subspace. In addition, the column vector of the dimension $MP \times (MP - L)$ matrix has been U_V expanded to become a noise subspace, $\sum_V = \sigma_v^2 I_{MP-L}$ containing the $MP - L$ remaining feature values. As can be seen from the signal model, the guidance vector $\{d_1, \dots, d_L\}$ expands into a interfering subspace, and

(9) $\sum_L = \text{diag}\{\lambda_1, \dots, \lambda_L\}$ in is a diagonal matrix of $L \times L$ dimension composed of L maximum eigenvalues, in which the corresponding L eigenvectors $e_1, \dots, e_L$ constitute U_L of $MP \times L$ dimension matrix and expand into interference subspace. In addition, the column vectors of $MP \times (MP - L)$ -dimensional Matrix U_V are expanded into noise subspace, and $\sum_V = \sigma_v^2 I_{MP-L}$ contains $MP - L$ other eigenvalues. According to the signal model, the guidance vector $\{d_1, \dots, d_L\}$ is expanded into the interference subspace

$$\text{span}\{e_1, \dots, e_L\} = \text{span}\{d_1, \dots, d_L\} \quad (10)$$

In order to reduce the computation burden of the receiver, OJA and DPM algorithms with low complexity can be used in the calculation process. Since FOOJA and FDPM algorithms have the advantages of relatively simple calculation, numerical robustness, strong robustness, fast convergence speed, etc., they can also be applied to the FOOJA and FDPM algorithms applicable to noise and signal subspace tracking to achieve interference suppression [2].

3.3 Experimental Simulation

In order to verify the correctness of the above statement, the simulation experiment can be carried out. In the experiment, the antenna array is 7-element uniform linear vibration, the interval between adjacent elements is half wavelength $\frac{\lambda}{2}$, and the number of delays is 5. At the same time, the experiment takes the GPS signal as the background, samples the C/A -code signal at twice the rate of the code, the processing broadband of the receiver is about 2MHz, and the C/A -code signal uses the common pseudo-random (*GOLD*). In addition, the noise subspace tracking algorithm in the simulation experiment is FDPM algorithm with low complexity.

It is assumed that there are ten-point frequency interferences and eight Narrowband Interferences at the same time. Because seven uniform linear arrays are set in the experiment, which exceeds the processing limit of traditional array processing methods, the above two electromagnetic environments cannot be dealt with by traditional array processing methods. At this time, the joint space-time GNSS anti-jamming algorithm based on subspace tracking is applied to analyze the interference. It can be found that this processing method not only improves the anti-jamming freedom of GNSS system, but also completes the strong interference suppression, and reduces the operation burden of GNSS receiver. Therefore, this method can deal with the complex electromagnetic environment with a large number of interferences and a limited number of elements, which guarantees the effectiveness of the anti-interference algorithm.

4. CONCLUSION

By using joint space-time GNSS anti-jamming algorithm based on subspace tracking, the relevant staff can use joint space-time processing to improve the freedom of anti-jamming processing of GNSS receiver. At the same time, the subspace tracking method used in this algorithm has low complexity, reduces the computational burden of the receiver, guarantees the timeliness of the algorithm, and is convenient for the receiver to have a good signal to interference ratio in the electromagnetic environment.

REFERENCES

- [1] Hao Wu, Yang Dai, Chi Wang. Identification and Forewarning of GNSS deformation Information based on a Modified EWMA Control Chart, Measurement, 2020.
- [2] Qi LIANGANG. Research on Anti-jamming method of satellite navigation signal acquisition in the complex jamming environment, Harbin Engineering University, 2018.

Research on the Reform of Computer Education Course in Colleges and Universities

Ou Li

Xi'an Kedagaoxin University, Xi'an710109, Shaanxi, China

Abstract: with the domestic economic growth, China's comprehensive national strength gradually catches up with the pace of western countries, and all industries have been greatly improved. Among them, education industry, as an industry to strengthen national professional talents, has been greatly concerned by our government. Now China has entered the digital era in an all-round way. How to use its characteristics to help our college students effectively improve computer operation Level has become a major problem for contemporary educators. The arrival of the digital era has seriously impacted the traditional education system of our country. The old computer learning method has long been unable to adapt to the needs of the current stage. This paper analyzes the computer education system of our country at this stage, finds out the existing shortcomings, and puts forward corresponding solutions. I hope that this paper can help the domestic Colleges and universities should help students to study computer courses better.
Keywords: Computer education; Colleges; Universities

1. INTRODUCTION

With the development of the country, the definition of talents in the society has been constantly raised. The traditional concept of computer talents has been unable to keep up with the progress of the times, and the employment situation is not optimistic. This situation urges our country to reform the current computer education. Today, with the popularization of information technology, we must recognize the importance of computer talents and the current computer education in order to cope with the development of the times, our country has trained more computer talents with excellent professional ability [1-3]. This article is for reference only.

2. THE DEFICIENCY OF COMPUTER EDUCATION IN OUR COUNTRY AT PRESENT

2.1 Impact of Regional Differences

Computer is the product of the development of science and technology. Since the birth of computer, human beings have been constantly optimizing and upgrading it, and also attach great importance to the cultivation of computer talents. China's computer education industry is relatively late, which is quite different from the western developed countries. In addition, the economic level of some areas in China is poor. As we all know, the purchase of computers by

schools is usually the same with a large amount of expenditure, the economic level of some areas has restricted the school's development of computer education, and it has not paid enough attention to computer education. In the process from primary school to university, there is a lack of correct computer learning, which leads to a loss of contact with computer education comparison after entering university, a lack of corresponding foundation, and a failure to keep up with the pace of students. Therefore, different places the level of regional economy affects the development of computer education in China.

2.2 Domestic Computer Courses Are Relatively Backward

China's computer education started late, along with the improvement of domestic economic strength, although the promotion of computer has been completed, but the education of computer course is still in the traditional mode, unable to adapt to the development of the times, the computer industry has the characteristics of continuous updating, with the improvement of science and technology, the computer industry will also have a variety of new knowledge Compared with western countries, the existing computer courses are still far behind. In addition, the content of computer education in China also limits the development of college students in China. Its content only focuses on professional knowledge education, and the relevant routers and troubleshooting do not pay enough attention, which will affect the employment competitiveness of students.

2.3 Deficiencies in The Course of Curriculum Education

Most colleges and universities in our country are relatively lax in computer courses, and students are learning through the knowledge points of textbooks when they are learning computer courses. This kind of unreasonable education process leads to a long distance between the computer technology they have learned and the needs of the real environment. Since entering the new era, China's education model reform advocates open style Learning, many colleges and universities choose to watch the students' learning process, let them learn the knowledge they need through their own interests and autonomous learning ability, although this way greatly reduces the students' boredom for the classroom, It also strengthens the freedom of students' learning, but it is not suitable for the computer education. Compared with the simple

computer knowledge before high school, the computer course after entering the university is the real beginning. All kinds of complex information are undoubtedly a huge challenge for the students who have not contacted the computer field before. If we choose to If students are allowed to study on their own, it will be difficult for them to improve their computer technology, which will lead to students' failure to keep up with the progress of the course [2].

2.4 Lack of Computer Teachers in China

At present, the domestic colleges and universities are carrying out the study of computer courses, which provides a large number of employment gaps for the society. However, professional computer educators are relatively scarce. They need teachers to have sufficient professional knowledge storage, and they need teachers to have good communication ability on the basis of having enough solid professional ability. After all, in the process of curriculum development, teachers should have good communication ability the communication between teachers and students also needs some skills. Under this condition, a suitable computer teacher is very scarce. Nowadays, the students of computer major in Colleges and universities are usually science students. They have enough knowledge of computer, but most of them are poor in English, and many of them communicate with each other Ability is not its strong point, which leads to the failure of knowledge transmission between tutor and students in daily teaching work.

3. THE KEY TO THE REFORM OF COMPUTER EDUCATION IN COLLEGES AND UNIVERSITIES

3.1 Reduce Regional Differences

The computer education in our country is affected by the regional differences, which leads to the impact on the basic computer education in some poverty-stricken areas. The most direct consequence of this phenomenon is that the students in the whole region cannot keep up with the pace of the large forces and cannot carry out the correct computer learning after entering colleges and universities. Therefore, according to the actual situation, we make corresponding countermeasures Due to the lack of teachers and equipment resources in the District, the government can provide necessary financial support to the district after corresponding examination to help it establish basic computer courses, or use social fund-raising to promote the development of computer education in remote areas, and promote the disappearance of regional differences in the domestic education environment, so that students can have a good computer foundation after entering colleges and universities, Learn better.

3.2 Strengthen the Comprehensive Ability of Computer Education

In view of the two aspects of curriculum and education mode, we need to change this phenomenon according to the relevant construction. The domestic education system is old. We can change this phenomenon by learning advanced technology, organize the domestic education system personnel to conduct friendly exchanges with the computer education system of western developed countries, and improve the foundation of our country by learning their advanced system Teaching curriculum, to promote domestic educators in education can be more suitable for our students, promote the continuous development of computer education in China.

3.3 Strengthen the Professional Ability of Computer Teachers

The cultivation of computer talents is a long process. It is impossible to increase domestic computer professionals in a short period of time. We should start from basic work, keep up with the pace of information technology, strengthen the updating of teaching materials and equipment, and strengthen the communication ability of computer teachers. Only when teachers have good communication ability in class, can they make their own knowledge in addition, colleges and universities should strictly assess their professional knowledge when recruiting computer teachers. Higher professional ability is the basic requirement of a computer teacher, and strive to provide the best computer education for college students in China [3].

4. CONCLUSION

The development of the computer industry is the product of the continuous progress of the times. In today's intelligent and information-based development, we must reform the current old computer education system, help our college students to receive more professional computer education, and provide a force for the economic development of our country.

REFERENCES

- [1]Zhang Yongjun. Teaching research and reform analysis of basic courses of computer application in Higher Vocational Colleges, Modern vocational education, 2018, (5): 81.
- [2]Wu Chengying, Zhang Hua. Research on the reform of basic computer courses in Colleges and Universities Based on intelligent society, Industry and Technology Forum, 2018, 017 (015): 194-195.
- [3]Li Chaoke, Kou Zhiqian. Research on the curriculum reform of computer network teaching in Colleges and Universities under the background of new education reform, Computer products and circulation, 2018 (09): 169.

Analysis of the Construction of Computer Data Processing Mode in the Age of Big Data

Zinuo Li, Chao Han

Xi'an Kedagaoxin University, Xi'an 710109, Shaanxi, China

Abstract: In the context of the era of big data, people have higher requirements for computer data processing ability, this paper introduces the current computer data processing model challenges and the way to build, in order to make computer data processing technology effective development, hoping to bring inspiration to readers.

Keywords: Era of big data; Computers; Data processing mode

1. INTRODUCTION

In recent years, the society has produced a large amount of data information in the running production process, and there is a certain commercial and economic value in this information, so the effective use of these data has become an important opportunity to promote the promotion of social productivity, in this social context, the use of computers to process data has become an important way to enhance work efficiency and enhance the development potential.

2. CHALLENGES IN COMPUTER DATA PROCESSING MODEL IN THE AGE OF BIG DATA

In the context of the era of big data, the amount of data is rising, these data often exist in the development of important information, but through the survey found that the current computer data technology in the application process of the general lack of necessary protection of data security, data value awareness and other issues, resulting in some important economic value, commercial value and user personal privacy information leakage of information, causing serious economic losses and adverse social impact. Under such circumstances, the computer data processing technology to update the application has become the key to the rapid development of various industries.

3. HOW TO BUILD THE COMPUTER DATA PROCESSING MODE IN THE AGE OF BIG DATA

3.1 Data Acquisition Technology

Data acquisition technology as the basic guarantee of information application in the big data era, that is, all data processing work is based on the collection of data information, and the effectiveness of the collection work is closely related to the actual value of all kinds of data in today's society, so when the computer data processing mode construction in the big data era is started, it is necessary to strengthen the

development of computer information collection technology. In the face of the development of big data, information collection is showing the trend of rapid development, in order to make the complex traditional information collection work become clear and concise, in the formal collection process, staff need to develop a systematic data transmission process to ensure accurate classification of data information. With the support of current computer technology, relevant technical personnel have put forward the concept of structured information and unstructured information, and established the main direction of future information technology development as the basis for the target data source, on this basis, carry out data collection, classification, processing and finishing work, so as to facilitate the future data information processing work. For example, in the process of computer web page production, programmers can use search, incremental storage and other ways in the process of web page writing, write data analysis and collect HTML code related to hyperlinks, and in the follow-up work on the hyperlink data content detailed parsing, so as to improve the efficiency of data collection, to ensure the practical application value of data information [1].

3.2 Data Processing and Storage Technology

Information processing in the era of big data mainly refers to the relevant personnel to borrow computer information processing system and data storage system, the huge data information to deal with the corresponding, in order to make the computer can adapt to the requirements of data processing in the era of big data, data processing technology has become the focus of computer data processing technology development. At the same time, in order to ensure the effective application of data information, data processing technology should be developed in a more efficient direction.

When using computer information storage technology to store data, storage is mainly done by multiple high-speed storage units in computer modules to remember data, because the traditional computer data storage technology is relatively backward, so that the size of high-speed storage units, storage rate cannot keep up with the development of the big data era. With the continuous development of information globalization, the existing computer data storage capacity has been unable to meet the actual needs of users, this situation is not only a challenge for

computer industry practitioners, but also a development opportunity, in order to update backward storage methods, related staff can from the high-speed storage unit of the actual storage number, storage unit size and other aspects of technological innovation, to promote the continuous development of storage technology, and finally meet the requirements of the big data era for data storage.

3.3 Data Dissemination Technology

In the era of big data transmission needs to be read and processed before transmission, so staff should strengthen the monitoring of information accuracy, so as to ensure their own work effect. Taking the computer information dissemination technology in the library as an example, applying this technology to the library book reference can improve the efficiency of the retrieval work, in the actual process, the staff should retrieve the book information in the database, and then the retrieval information to spread. Data dissemination technology is often carried out after the completion of information collection work, its speed is affected by the file size, type, network speed and other factors, at the same time, due to the effectiveness, accuracy and other factors have a greater impact on data transmission technology, the relevant staff in the process of perfecting the technology, need to start from many aspects, strengthen the exploration of technology, to avoid data leakage, loss and other circumstances.

3.4 Data Security Technology

The purpose of computer data security technology is to ensure the security of big data information, and the relevant staff need to establish a scientific security

protection system to enhance the protection ability of data information before carrying out the actual big data processing work. Specifically, in order to ensure the security of data, technicians should update firewall technology, intrusion detection technology, etc. to enhance the security capabilities of computers, to ensure that computer information processing technology can effectively invest in big data applications [2].

4. CONCLUSION

The advent of the era of big data has accelerated the development and progress of our economy, culture and science and technology, greatly improving people's work efficiency and quality of life. However, with big data increasing the application value of computer data processing technology, there are certain defects, so the relevant technical personnel should continue to strengthen the construction of the new computer data processing model, in order to lay a good foundation for future development.

REFERENCES

- [1]Duangdong Oppo Mobile Telecommunications Corp. Ltd. Patent Application Titled "Method for Processing Data, Server and Computer Storage Medium" Published Online (USPTO 20200107010), Telecommunications Weekly, 2020.
- [2]HKC Corporation Limited. Data Processing Method, Data Processing System and Computer Readable Storage Medium in Patent Application Approval Process (USPTO 20200105172), Information Technology Newsweekly, 2020.

The Art Characteristics of Wangkou Ancient Village Ancestral Temple Architecture

Lin Wang

College of Art, Jiangxi University of Finance and Economics, Nanchang 330013, Jiangxi, China

Abstract: The ancestral hall is a typical ancient architectural form in Wuyuan. Its architectural decoration mostly uses carving techniques and rich materials. It is a symbol of the accumulation of traditional culture and history and the unique regional cultural customs. This paper chooses Wangkou ancient village of Wuyuan as the research object, analyzes the architectural art characteristics of Wangkou ancient village ancestral hall, and analyzes the unique artistic characteristics and cultural connotation of local ancestral hall architecture, hoping to provide reference for relevant researchers and enthusiasts.

Keywords: Ancestral temple architecture; architectural art features; Wangkou ancient village

1. INTRODUCTION

Ancestral temple is one of the most important architectural forms in ancient villages. Because of its special use, its architectural history is almost the same as the development history of villages, and it has become a unique representative architectural landscape in ancient villages. The differences of history, culture and customs in different regions create the unique architectural art features of ancestral halls. In the existing more than 300 ancient buildings in Wangkou ancient village, ancestral hall has become the finishing touch. From this point of view, it can help us more accurately analyze the ancient architectural art characteristics of Wangkou ancient village and even Wuyuan area.

2. OVERVIEW OF THE BUILDING OF WANGKOU ANCIENT VILLAGE

Ancestral temple is the material symbol of ancient family relationship. In the development of China's millennium history, ancestral temple has always occupied the most core and sacred position in the family. People build ancestral temples to listen to the stories of their ancestors and receive their admonitions, so as to keep the unique spirit and soul of the family. The clan concept of Chinese people is deeply rooted. In history, almost every surname has built a large ancestral temple, which is subdivided into several ancestral temple buildings in the Ming and Qing Dynasties. Due to the long-standing culture of the rule of rites and clan, ancestral hall has become the representative of the ancient architectural culture of the village, with profound cultural heritage [1]. So far, many ancestral halls are still the core places where people gather during festivals.

The most representative ancestral temple buildings in Wangkou ancient village are Xiaoyou hall, Mingshan hall, jiansanliugong temple, Yu clan ancestral temple, among which Yu clan ancestral temple is the most famous. Wangkou ancient village ancestral hall building has its own unique features in modeling and decoration, which is also the main starting point for us to explore the architectural art characteristics of ancestral hall.

2.1 The Historical Background Development of the Ancestral Temple

On the basis of the shape and characteristics of the ancestral hall building in Wangkou ancient village, this paper analyzes the natural and cultural environment on which the formation and development of the architectural decoration art of Wangkou ancient village depends, and discusses the influence of the natural and cultural factors on the architectural decoration of the ancestral hall in the ancient village, and makes a more careful study on the details of the building components, decorative themes and decorative colors of the ancestral hall one by one. In order to expand the research scope of ancient village ancestral hall decoration, this paper makes a brief discussion and Analysis on the building environment of ancestral hall from the perspective of landscape science, mainly including the building of external and internal environment of ancestral hall and the analysis of landscape elements. Through the research, this paper analyzes the humanistic thoughts behind the ancient village ancestral hall building decoration, and summarizes the overall characteristics of the ancient village ancestral hall building decoration art in Wangkou. The research on the decorative art of Wangkou ancient ancestral hall plays an important role in the nationalization of modern art and the protection of cultural heritage, and the ancestral hall is an architecture of unique significance to the Chinese people. In the history of ancestral hall development in China, this kind of representativeness is reflected in the architectural characteristics of ancestral hall and its close relationship with clan culture. Clan system carries and practices the spirit of clan ethics, and clan ancestral hall is its material carrier and spiritual symbol. In the past research, the research on ancestral temple mainly focused on the aspects of ancestral temple architecture, ancestral sacrifice and the emergence and development of ancestral temple, while the research on clan mostly focused on the category of social and economic history.

3. ARCHITECTURAL ART FEATURES OF WANGKOU ANCIENT VILLAGE

3.1 Overall Art Deco Features

Overall decoration refers to the outline of building facade, side and roof, which constitutes the overall artistic style of the building. The facade size of the ancestral hall generally adapts to the scale of the building. In the decoration of the entrance gate of the ancestral hall, the "five Phoenix gate" is often used. The eaves are like the Phoenix wing plate, and its wing angle is high and raised. For example, the Yu ancestral hall, this kind of decoration form is used. The side facade of the ancestral hall is mostly designed as horsehead wall. On the whole, the walls are stacked layer by layer and gradually progressive, forming a more relaxed transition line shape, which implies good luck and progress. The roof of ancestral hall in Wangkou ancient village is mostly slope. The advantage of this kind of roof is that it cannot only give full play to the effect of roof space decoration, but also improve the performance of fire prevention and drainage.

3.2 Details of Art Deco Features

Wangkou ancient village and even the whole Wuyuan area of the temple building decoration are experienced in the use of carving techniques, including stone carving, brick carving, wood carving and other forms. The prosperity of local architectural decoration and sculpture art is related to the great cultural background of ancient Huizhou. During the Ming and Qing Dynasties, the architectural sculpture art developed rapidly. From the natural things to the trivia of life, from the rural life to the carefree immortals, the contents of local architectural sculpture are rich and varied, and a large number of people's associations with the unknown world are integrated. Because of its spiritual and symbolic significance, ancestral temple architecture has become the key object of architectural sculpture. Observe the existing ancestral temple buildings in Wangkou ancient village, and you can see ingenious carving art everywhere. Even in modern society, we can feel the past of ancestral temple buildings in ancient times.

When it comes to the application of sculpture art in the architectural decoration of ancestral temple, we have to mention the Yu ancestral temple, which is the largest in Wangkou ancient village. Yu's ancestral temple, with its large scale and outstanding structural design features, is regarded as a model work of Huizhou ancestral temple. The ancestral hall was built in the middle of Qing Dynasty, and its scale and layout adopted the typical way of Jiangnan ancestral hall construction. However, in terms of architectural decoration, its use of "three carvings" is amazing. The wood carving of Yu ancestral temple is very rich in the style characteristics of Hui style wood carving. It is exquisite and elegant. It uses a variety of patterns and techniques, such as round carving, openwork

carving, relief carving, etc. The flowers, birds, fish, insects and characters in the architectural decoration and sculpture are mostly used to convey specific spiritual symbols, such as plant patterns to express the praise of human integrity, and to convey people's pursuit of peace, happiness, health and longevity.

Although a lot of sculpture art is used in the same ancestral hall, the view is still dignified, neat and balanced, that is to say, it is consistent with the characteristics of Chinese traditional architectural art. The realization of this "balance" is due to the different emphases and houses in the location of the sculpture and decoration of the ancestral hall in Wangkou ancient village. Still take the ancestral temple of Yu family as an example. From the perspective of the location of the architectural carving art of the ancestral temple, the carving decoration of the ancestral temple of Yu family is mainly located in the interior of the building, the gate, the hall for enjoyment, and other areas are used as auxiliary. In this way, all the biased designs can not only enrich the decorative elements of the whole ancestral hall building, but also make the amazing and ingenious carving techniques everywhere, while maintaining the unity and coordination of the overall artistic style of the ancestral hall building. The main structure of the ancestral hall in Wangkou ancient village mostly uses wood structure. Because of the particularity of the material itself, compared with other carving forms, wood carving is more delicate and exquisite in the presentation of the final decoration works, and the artisans are more skilled in the use of this technique.

The wood carving decoration of ancestral hall buildings in Wangkou ancient village mostly appears in beams, columns, purlins and other positions. Among them, most of the wood carvings are at purlin and beam bottom. In addition, wood carvings can be seen everywhere at the positions of child column, sitting bucket, diagonal brace, etc. If we want to say the exquisite degree of woodcarving patterns, the number of architraves and base plates around the patio is the most, which also shows the importance of the patio in the overall layout of the temple. The patio is regarded as the most important part of the architectural decoration of the ancestral hall. The wood carving decoration is unique in both technique and content [2]. For example, the carvings and decorations in the patio of Yu's ancestral temple use a lot of carving techniques. Around the theme of "fishing, woodcutting, farming, reading, Qin, chess, calligraphy and painting", six lifelike landscape and farming paintings are presented, which makes the visitors linger in the ingenious and strange architectural decoration of the ancestral temple and forget the landscape presented by the carvings and decorations.

4. CONCLUSION

The architectural art features of Wangkou ancient village ancestral hall are formed on the basis of the

thick and prosperous Hui culture, which conveys the extreme harsh attitude of ancient craftsmen towards the architectural art and the yearning of people for beauty and a better life at that time. The analysis of the characteristics of ancestral hall's architectural art is helpful for us to grasp the ancient people's point of view in dealing with the harmonious relationship between man and nature, and provide valuable experience for the contemporary architectural art design.

ACKNOWLEDGEMENTS

Research on the art of human architecture in the

agrestic settlement of Wangkou ancient village (The project has been approved) 2018 (Project No.: YG2018261).

REFERENCES

- [1]Zhou Tao, "On the regional technical characteristics of Wuyuan ancestral hall in Jiangxi." Sichuan building materials, 2019, 45 (05): 43-44.
- [2]Cai Shuaijun, Xue Meili, Zhang Di, et al, "Analysis of architectural decoration of ancient folk houses in Wuyuan." Modern horticulture, 2019 (06): 113-114.

Construction Technology of Expansion Joint in Micro Exploration Road and Bridge Construction

Ruiqiang Qi

Huanghe Jiaotong University, Jiaozuo 454950, Henan, China

Abstract: with the further development of national economy, China is a developing country, because of the rapid development speed, there are many problems. At present, the construction of roads and bridges has become an urgent problem to be solved. Roads and bridges are very important parts of our country. The construction of roads and bridges is also the foundation of our country's connection. In order to reduce the damage of roads and bridges, reduce the deformation in the process of construction and other problems, Chinese scientific and technical personnel through continuous efforts to innovate, invented the expansion joint construction technology. The development and utilization of this technology helps reduce many hidden dangers in the construction of road and Bridge in China, and also helps the construction of road and Bridge in China to be more durable and better in quality.

Keywords: Road and Bridge Construction; Expansion Joint Construction Technology; Application

1. INTRODUCTION

In recent years, our country attaches great importance to the road and bridge construction project. Due to the rapid development of our country, the road traffic management in our country has been greatly affected. Roads and bridges are the places where everyone walks and vehicles pass. Therefore, the road and bridge construction project should perfect the safety system. Only when the people rest assured, the country will rest assured. In the past few years, roads and bridges often suffered from serious damage and collapse [1-3]. Some roads and bridges were built in zigzags, which did not meet the construction standards. In order to better build our country's road and bridge, we use expansion joint construction technology to improve our road system reform.

2. BENEFITS OF IMPROVING CONSTRUCTION TECHNOLOGY IN ROAD AND BRIDGE CONSTRUCTION

2.1 Make People's Life More Convenient

The construction and development of roads and bridges are also for the better life of the people. Although the development of our country is getting better and better, there are still some poor areas, some people live in the mountains, and the problem of daily travel has become their biggest obstacle. In the mountains and in some remote areas, people need to

solve the traffic problem most. The construction of road and bridge projects in China can help those people who have difficulties in traveling to solve their traffic problems, and make their lives more and more convenient. The development of many enterprises in our country is managed by means of transportation. Managers need to deliver goods to all parts of the country by truck. Good road and bridge projects will reduce their time problems and enable them to complete the workload in the shortest time. As the saying goes, "time is life", so they should not waste their time on the road.

2.2 Reduce Traffic Accidents

We can often see a lot of traffic accidents on the news and mobile phones. Some of them are caused by drivers, and some of them are caused by problems in the construction of roads and bridges. Every day, there are vehicles driving on the road and bridge. Safety is the most important thing for everyone. In the construction of road and bridge, safety should be high to ensure the life safety of every citizen. But we can often see such problems. There are often pits of different sizes on the roads and bridges. Some roads are even uneven. The most serious and the last thing people want to see is the collapse problem. These problems are hidden dangers affecting people's own safety. In order to reduce the occurrence of similar incidents, the state has developed expansion joint construction technology, improved road and bridge construction projects, guaranteed people's safety and reduced the occurrence of traffic accidents.

3. CAUSES OF DAMAGE TO ROADS AND BRIDGES

3.1 Materials for Expansion Joint Construction Technology

The most important construction technology of expansion joint is the selected materials. Some opportunists will replace the materials needed for expansion joint construction with other materials, which will cause serious damage to roads and bridges. The selection of expansion joint material is the most important, the quality must be guaranteed, so as to ensure that the expansion joint construction technology can be effectively used in the process of road and bridge construction, and also can extend the use time of road and bridge. If the materials selected for expansion joints are not up to the standard, there will be many problems. If the temperature is too high

or too low, the road and bridge will be deformed in the construction process, which will lead to the construction time is too long and cannot achieve the desired effect. The materials needed for road and bridge construction must not be Jerry built. This is also for the sake of people's own safety. We must ensure the quality of road and bridge construction. Good road construction also adds color to our country.

3.2 Construction Technology of Expansion Joint Requires High Temperature

The constructors will encounter many problems in the construction of roads and bridges, and the temperature is their first consideration. Road and bridge construction projects are all outdoor work, we can imagine how harsh they are on the temperature requirements, of course, this is also for the construction of high-quality road and bridge projects, let everyone rest assured, reduce the existence of hidden dangers. Especially in the process of road and bridge construction, the expansion joint construction technology has higher requirements for temperature, and the temperature is too high, which will affect the measurement of expansion joint construction technology, and the measurement results will become inaccurate, which will lead to the unreasonable use of expansion joint construction technology, and then lead to the unqualified quality of road and bridge engineering. It is also true that the temperature is too low. I think you all know the principle of thermal expansion and cold contraction. In order to better meet the requirements of road and bridge engineering quality, the relevant staff must ensure the temperature problem in the application of expansion joint construction technology, and reasonably arrange the influence of seasonal temperature variation on expansion joint construction technology before construction.

4. APPLICATION OF EXPANSION JOINT CONSTRUCTION TECHNOLOGY

4.1 Application with Asphalt

It is believed that everyone has a certain understanding of asphalt. Asphalt is a dark brown mixture composed of different molecular weight. It can exist in the form of solid or liquid, which is also a major feature of asphalt. Its main function is waterproof and antiseptic. Road and bridge construction project can be said to be a large outdoor project. In order to ensure its quality problems, the characteristics of asphalt and expansion joint construction technology can be used in the construction process. The construction technology of expansion joint is to better connect the junction of bridge and expansion joint and avoid the problems such as gap and deformation of road. The last step is to use asphalt to pave the road. Asphalt also has a good feature, which is the damage caused by the friction of the construction tires on the ground. Of course, when using asphalt to pave the road, we must

not cut corners, choose materials with good quality, and meet the national standards, so as to increase the service life of the road and bridge, and also improve the safety.

4.2 Application with Concrete

In the process of road and bridge construction, the use of concrete is inevitable. No matter what construction project is built, the use of concrete is indispensable. In the construction of road and bridge, there will be gaps of different sizes. To solve this problem by using expansion joint construction technology, it needs the help of concrete. Where there are gaps, it needs concrete pouring, so as to better help bridge and road combine and strengthen the stability of bridge beam. Of course, in the use of concrete also needs certain requirements, concrete temperature requirements are also very high. If the temperature is too high, the concrete will crack, which will seriously affect the safety of the road and bridge. Therefore, if the temperature is too high when using the concrete, the relevant personnel should timely cool the concrete (spray water can be used to cool it); if the temperature is too low, it will also affect the concrete, and the concrete should not be solidified at low temperature, which will greatly increase the completion time of the project, It will also waste the use of concrete resources, so in the process of road and bridge construction, we must pay attention to the seasonal change, the temperature change caused by it, and reduce the cost loss in the construction process. In this way, the construction technology of concrete and expansion joint can play a maximum role.

5. CONCLUSION

People always want to travel safety first, so in the process of road and bridge construction, the first thing is the guarantee of safety and quality. Now, more and more construction talents emerge, which also brings great contribution to the construction engineering in our country. The application of expansion joint construction technology in the road and bridge can reflect that the cultivation of talents in our country has great help to the development of our country. The construction personnel must anticipate the problems that will occur in the process of road and bridge construction and minimize the loss, avoid the uneven road or potholes on the ground, and avoid the collapse of the bridge, so as to improve the level of road and bridge construction in China to a new level.

REFERENCES

- [1]Wang Dongying, "Application of expansion joint construction technology in road and bridge construction." China new technology and new products, 2018 (10).
- [2]AI Xuegang, "Application of expansion joint technology in road construction." Scientific information, 2017 (34).
- [3]Liang Xiaodong, "Application of expansion joint construction technology in highway bridge

construction.” Traffic world, 2017 (25).

Discussion on The Recycling System of Recycled Water in Concentrator

Wanqiang Song

Jia Jiapu Iron Mine, Liaoyang Mining Company, Benxi Steel, Liaoyang, Liaoning, China

Abstract: The water used by production is one of the important energy consumptions. The recycling system of recycled water was built based on existing process equipment, and realized the water recycling without draining. By this way, the water resource is saved, the environment is protected, and the production cost is reduced. Also, the experiences for the use of recycled water are provided.

Keywords: Recycled Water; Cyclic Utilization; Cost; Environmental Protection

1. INTRODUCTION

"Recycled water" mainly refers to the water which is after certain technological treatment come from domestic water and industrial water, that can be used in urban life and industrial cooling water when the quality requirement of water is low. It is called reclaimed water because its quality is between tap water and sewage water [1]. The utilization of recycled water is beneficial to the comprehensive utilization of water resources. It is the main way to improve the economic benefit of enterprises, reduce the discharge of pollutants, protect the environment and prevent and control water pollution.

The large wet ball mill is very effective in the ore grinding [2-4], but the water demand of production in the concentrator is huge, so the choice of water for the concentrator is an important factor which affects the production cost. It is an important measure to improve mineral processing index, reduce production cost and improve production efficiency to establish scientific and reasonable water supply system of the mineral processing according to local conditions.

The water source of the concentrator which discussed in this paper is the recycled water from the sewage treatment plant. The recycled water is recycled after the deposition treatment; an internal cycle is formed in the concentrator. It can not only solve the water source of the concentrator, but also reduce the production cost of the concentrator and the sewage treatment plant. In this way, the water resources are fully utilized, the environment is beautified and the pollution is reduced.

2. THE RECYCLING SYSTEM OF RECYCLED WATER

The water recycling system of the concentrator is composed of pump station of production water, head tank, workshops of grinding and dressing, thickening pond, pump station of recycled water, pump station of bottom flow, agitator bath, pump station of tailings

and water supply pipeline, as shown in Figure 1. The system is designed as a closed-circuit circulation system, there is no waste water is discharged during production.

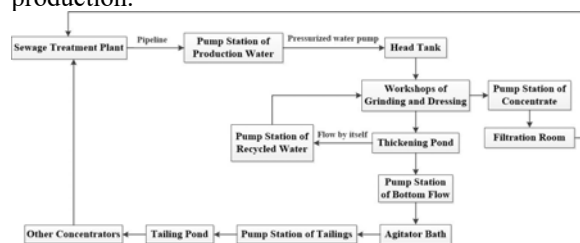


Figure 1 Water recycling system in concentrator

The recycled water is first sent from the sewage treatment plant to the pump station of production water in concentrator, by using pressurized water pump, the water is put to the head tank, and then is sent to the workshops of grinding and dressing through the pipe network which is dendritic. The recycled water is mainly used in mineral processing, such as grinding and separating ore. The production water from the grinding is treated in the thickening pond, the clarified water flow by itself into the suction tank of the pump station of recycled water. After pressed by pump, it can be used by the dressing process again. The tailings are transported to the agitator bath through the pump station of bottom flow. After mixing evenly, it is transported to the tailing pond by the pump station of tailings. The water separated from the tailings can be used by other concentrators. The concentrate is transported to the filtration room for dehydration.

3. THE REFORMING SCHEME OF THE RECYCLING SYSTEM OF RECYCLED WATER

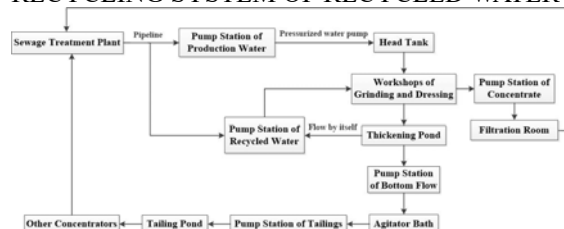


Figure 2 Retrofitted water recycling system in concentrator

In order to further save costs and reduce energy consumption, the water recycling system is renovated. As shown in Figure 2, using the pipe pressure of sewage treatment plant, the recycled water is directly transported to the pump station of recycled water and supplied to the grinding and dressing production process. On the premise that the total amount of water

used for grinding and dressing production remains unchanged, the water transfer quantity of the head tank is reduced. The energy consumption of production water pump is reduced while improving the circulating efficiency of recycled water.

For example, there are three pressurized water pumps in the pump station of production water, the working system is "two jobs and one backup". The No.1 pressurized water pump works 24 hours every day and the No.2 pressurized water pump works 4 hours every day. After the renovation, the work time of the No.2 pressurized water pump is reduced to 2 hours per day. If the power of pressurized water pump is 315kw, the energy efficiency is 0.75 and the work efficiency is 0.95, it can save electricity is 448.9 kWh. If each month is calculated on thirty days, 13500 kWh can be saved.

4. CHARACTERISTICS OF THE RECYCLING SYSTEM OF RECYCLED WATER AFTER RENOVATION

No adverse effect on the quality of the concentrate. In the process of mineral processing, the recycled water is mainly used for ball mill grinding, washing ore powder in magnetic separator and the transportation of tailings. The whole process is mainly mechanical production and physical change [3]. The recycled water goes through physicochemical processes, such as the grid, adjusting tank, coagulating sedimentation, filtration and activated carbon treatment etc. [4]. The water quality fully meets the requirements of mineral processing and has no effect on the quality of the concentrate.

The cyclic utilization rate of recycled water in internal recycle is higher. The concentrate is directly transported to the filtration room through the pipeline, the tailings flow through the thickening pond and then to the tailings pond after flocculation and precipitation. The concentration of overflow water is equal or lesser than 70mg/l. The clarified water flow by itself into the suction tank of the pump station of recycled water, it pressurized by circulating pump station can be used by the dressing process again. The cyclic utilization rate of recycled water reached 90.57% which reached the level that secondary grade of waste recovery and utilization target of clean production in the iron and steel industry.

The regional pattern of water recycling is formed. After the water which is used as the tailing conveying medium flows into the tailing pond, it is recovered by the backwater system and used as the production water of the concentrator. The water which is used as the concentrate conveying medium is sent to the filtration room, and filtered and recycled.

The recycled water of the concentrator is recycled across the region. The cyclic utilization rate of recycled water reached 99.85% which reached the level that first grade of waste recovery and utilization target of clean production in the iron and steel industry. Take a concentrator as an example, its

consumption of production water was $670.1 \times 10^4 \text{ m}^3$ in 2016, average daily water withdrawal was $1.93 \times 10^4 \text{ m}^3/\text{a}$, estimated for 347 days of the year. The balance of recycled water usage is shown in Figure 3.

The supply of recycled water is fully guaranteed. The recycled water used in the concentrator comes from the sewage treatment plant. The intake point is located on the outlet main pipe of the pump valve of recycled water in the sewage treatment plant. The designed capacity of the sewage treatment plant is $13 \times 10^4 \text{ m}^3/\text{d}$, since records began, the minimum yield of recycled water is $8.04 \times 10^4 \text{ m}^3/\text{d}$, in addition to serving other users, and compared with the above data which average daily water withdrawal was $1.93 \times 10^4 \text{ m}^3/\text{a}$, the surplus water in the sewage treatment plant fully meets the production demand of the concentrator.

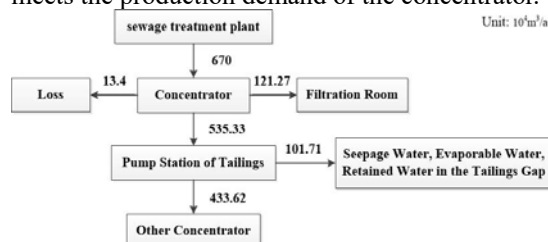


Figure 3 the equilibrium diagram of recycled water

5. CONCLUSION

The recycled water is comprehensively used in the production of the concentrator. The regional pattern of recycled water is established with the internal recycling system as the core, which is cross-boundary and cross-factory. The utilization rate of recycled water in concentrator reached 99.85%, which reached the level that first grade of waste recovery and utilization target of clean production in the iron and steel industry. The recycling system is realized without external discharge. After the recycling system of recycled water was converted, the energy consumption and production cost are further reduced, and the monthly electricity consumption is reduced by 13,500 kWh. In the future, by adding automated control systems and achieving the automatic control of production water demand, the real-time adjustment of water supply can be realized. It can be achieved system optimization, and enhance the sustainable development ability of the enterprise.

REFERENCES

- [1]Wan Wei, "Overview of Research Status and Prospects of Reclaimed Water Reuse. Journal of Anhui Vocational College of Metallurgy and Technology," 2010, 20(3): 46-48.
- [2]Cui Xueru and Liu Houqian, "Discussion on the Measures of Energy Saving and Consumption Reduction in Mineral Processing," Express in Formation of Mining Industry, 2006, 1: 47-49.
- [3]Wen Yi and Zhang Xiaochu, "Some Questions about Water Reuse in Industry. Southwest Water & Wastewater," 2006, 28(2): 29-31.
- [4]Zhao Liang, Liu Huai-sheng and Ma Honggang,

“Application of Intermediate Water Treatment Power, 2009, 1:51-54.
Technology in Iron and Steel Industry.” Metallurgical

Research and Design Analysis of Computer Hardware Virtual Simulation System

Zhi-Wei Chen^{1,#}, Gang Ma^{1,#}, Hong Liu¹, Chun Liu², Shi-Xiong Zhu¹, Chao-Yang Ren¹, Xiu-Juan Dong^{3,*}

¹Zhaotong University, Zhaotong 657000, Yunnan, China

²Yunnan University, Kunming 650000, Yunnan, China

³Hainan Normal University, Haikou 571158, Hainan, China

[#]The authors contribute equally to this paper.

^{*}Corresponding Author

Abstract: Nowadays, computer technology has begun to play an important role in social development. In this context, it is necessary in order to study computer hardware virtual simulation system deeply and make it play a full role in teaching. This paper briefly describes the research background of computer hardware virtual simulation system, and analyzes its design from three aspects of system design, resource development and system application, seeking to improve the level of computer hardware teaching.

Keywords: Computer Hardware; Virtual Simulation System; Resource Integration

1. INTRODUCTION

In recent years, more and more students need to start invest in the study of computer science. Although the level of computer teaching in our country has been improved obviously compared with the past, when there are always some limitations, it cannot meet the teaching and learning needs of teachers and students in related majors. Take into account this, the computer hardware virtual simulation system came into being to alleviate the lack of current teaching conditions.

2. RESEARCH BACKGROUND

In the study of related computer knowledge, it is inevitable to involve the content of computer hardware. Students need to comprehensively grasp its basic structure and operational rules, be familiar with the performance indicators of hardware, and properly handle various problems related to hardware. Nowadays, in the classroom, teachers usually use the form of playing videos and pictures to carry out teaching, which is a challenge for students to fully improve their practical experience in the classroom. Because of the single characteristics of teaching form, students do not have a thorough understanding of all aspects of knowledge [1, 2]. They cannot solve the actual problems of computer hardware. Under this background, this research adopts all kinds of technology synthetically and makes the virtual simulation system of computer hardware.

3. RESEARCH AND DESIGN OF VIRTUAL SIMULATION SYSTEM FOR COMPUTER HARDWARE

3.1 System Design

3.1.1 Feature design

From the contemporary computer hardware teaching specific content, combined with the actual needs of teachers and students, in the design of virtual simulation system project clearly its function is mainly reflected in three aspects. First of all, we should be in a position to clearly understand all parts of the hardware in the computer, secondly, we should be able to split the hardware, and finally we should install the computer hardware. In the design of computer hardware virtual simulation system, we should fully consider the actual needs of students, design a good interface entrance, so as to ease the operation of students. In addition, the function of active menu should be properly developed so that it can be displayed and hidden freely. It is also essential to design the corresponding trigger function, as long as the computer components are stand-alone, you can change the location of the device components [1].

3.1.2 Footage design

In the aspect of material design, we should start from the current development law of computer hardware itself, choose the model suitable for the actual situation, and carry out measurement and photo taking work. Record the relevant parameters of each component, and design the mapping of each component, on the basis of which, develop a more high-quality computer component production.

3.2 Resource Developments

3.2.1 Model design

There are many kinds of 3D modeling software in the market, and computer hardware modeling is commonly used in 3Dmax, in the application of the software can be used to achieve the computer hardware parts of the efficient simulation, and then produce a high degree of simulation of computer hardware model. Modeling computer hardware may seem cumbersome, but in reality, it can be composted with simple geometry, and you can use basic graphics such as rectangles, circles, and lines to expand modeling operations.

3.2.2 Animation design

In the application of computer hardware virtual simulation system, each part and the whole machine should be displayed, and the various hardware of the computer should be split and installed, based on this,

it is necessary to make the aggregation and separation animation of the parts, the rotation animation of each part and the rotation animation of the whole machine. The author mainly analyzes the production process of polymerization separation animation. First, select the motherboard, and set the length of the animation to 100 frames by pressing ALT-Q into isolated mode, with keyframes for 1, 10, 40, and 50 frames. Next, 40 frames are copied to 60 frames, 10 frames to 90 frames, one frame is copied to 100 frames, and reverse animation is rendered, which results in extra animation methods.

3.3 System Applications

3.3.1 Interface design

Interface design is an important part of the virtual simulation system of computer hardware, there are four main interfaces, and their functions are different, respectively, hardware installation, hardware split, basic interface and the main interface. Among them, the main interface function is to provide the system's entrance, the user can click on the system installation, system split and basic stashed button, into their respective subsystems. The rudimentary knowledge interface can meet the needs of the user in the basic knowledge, students can in human-computer interaction, through hardware installation and hardware installation of computer hardware system to produce a deeper understanding. Ps software can be implemented in the design of the host interface. For subsystems, including system installation, system splitting, and basic splicing is designed through unity3D's UI capabilities.

3.3.2 Script development

In the script development of computer hardware virtual simulation system, playback plug-in is mainly used. The plug-in can make the script design show the characteristics of visualization. Users can design the corresponding logic function and interaction function in unity3d without writing the script code. The application of the plug-in in the computer hardware virtual simulation system is mainly

manifested in the following aspects. First, on the interface connection, the application of play maker plug-in can provide the function of entering and exiting the system. Second, you can play separate animation to break up the hardware. Third, the play maker plug-in can complete the menu sliding function, so that the menu can be dynamically displayed and hidden. Fourth, hardware can be split. In the process of clicking each separate, parts can be split one by one. Fifthly, you can install hardware, display each component, add triggers, and play aggregate animation for each component.

4. CONCLUSION

The virtual simulation system of computer hardware effectively combines various virtual reality technology and multimedia technology, and enriches the means of computer hardware teaching. In the process of practical application, the system is helpful to help students master the pertinent hardware knowledge effectively, break the limitations of previous experimental teaching, and improve the teaching level. At the same time, the computer hardware virtual simulation system can also reduce the loss of equipment as much as possible.

ACKNOWLEDGEMENT

This Study was supported by the grant from the Yunnan Provincial Department of Education Fund (No.2019J1134).

REFERENCES

- [1] Rojas Ferrer César Daniel, Shishido Hidehiko, Kitahara Itaru, Kameda Yoshinari, "Read-the-game: System for skill-based visual exploratory activity assessment with a full body virtual reality soccer simulation." PloS one, 2020, 15(3).
- [2] Technology, "Research Results from Xiamen University of Technology Update Understanding of Technology (Design and Implementation of Virtual Simulation Teaching System for Uav Based on WebGL)." Journal of Engineering, 2020(14): 78.

Application of Multimedia Technology in Animation Design

Ou Yang

School of Artificial Intelligence, Shenzhen polytechnic, Shenzhen 518055, China

Abstract: With the rapid development of modern information technology, Flash software in animation design is widely used. Flash animation is a mixture of mask + patching animation + frame by frame animation and components. Through different combinations of elements, we can create a variety of effects. This paper expounds the application advantages of flash animation design software in multimedia technology, and analyzes the application of multimedia technology in animation design.

Keywords: Multimedia Technology; Animation Design; FLASH

1. INTRODUCTION

With the development of the new situation, a variety of visual media began to integrate into people's lives. In the aspect of animation design, flash animation design has become a popular animation design software. Therefore, the relevant animation designers should strengthen the understanding of Flash software, make use of its animation design advantages to better combine with multimedia technology, ensure that the animation form presented is more flexible, and promote flash animation software to create more value.

2. FLASH ANIMATION DESIGN SOFTWARE'S APPLICATION ADVANTAGES IN MULTIMEDIA TECHNOLOGY

In multimedia technology, application software includes flash, PowerPoint, Author ware, etc. Its software features are different. Compared with Flash software, it is more flexible, easy to operate and learn. When designing multimedia courseware, it can run autonomously and has greater application value. Its application development and application promotion range gradually expand. When multimedia technology is applied in animation design, flash animation software can use its own functions to present perfect visual animation effect by frame skipping, MC frame skipping and scene skipping [1]. Flash is particularly useful for creating content that is provided through Internet. As a high-end vector animation software, with flow control technology and vector technology as the core, it has become one of the most popular animation design software. By setting vector components as bitmap output, it can improve the operation efficiency on mobile devices, and has many functions such as drawing graphics, editing graphics, making up animation, etc.

FLASH animation design software can effectively

process and process the relevant information in multimedia courseware, including text, graphics, sound, through further processing, can form a complete system framework, improve the efficiency of the use of multimedia technology, to ensure that more effective information can be transmitted in classroom teaching.

3. APPLICATION OF FLASH ANIMATION DESIGN SOFTWARE IN MULTIMEDIA TECHNOLOGY

3.1 Application in Animated Web Design

FLASH animation design can be designed in various forms of animation effect in web animation, including all animation design, all static page design, dynamic combination design, all animation design is mainly to control the overall animation, grasp the overall animation design, fully reflect the effectiveness advantages; This shows a higher dynamic production effect. Because the flash animation transmission speed in the web page is fast, once a large number of animations appears on the page at the same time, may affect the transmission speed of the page, resulting in the page jam.

3.2 Application in Image Animation Design

In the image animation design, we can use flash animation to design animation characters and optimize the traditional art resources reasonably. In the specific design process, we need to choose appropriate art forms, such as embroidery, Chinese painting and other Chinese elements, fully excavate and interpret the character prototype, and use the appropriate flash animation creation form for character development and research. In animation planning, designers can make the whole picture by flash technology to improve the level of beauty. In the animation design, the animation scene, animation task image, animation music and other related factors are fully considered. According to different animation scenes, different animation characters are presented, and animation shooting is carried out in combination with virtual lens shooting techniques to ensure that each shot can bring visual enjoyment to the audience [2]. At the same time, in the design of animation image and sound, we can match with flash animation software to maximize the effect of animation design. By making web image animation, the animation form is presented in dynamic form, which effectively improves the strong attraction effect of the picture.

3.3 Application in Special Effects Animation Design

In the multimedia design, the application effect of

FLASH animation software is obvious, through the foreground setting, to create a good visual effect, to ensure that the audience feel the artistic beauty of animation design, so as to effectively attract the audience's attention, animation designers, usually add design effects, the use of FLASH animation design software, improve the overall design effect, to ensure that the final effect of animation design has coordination, unity, from the overall embodiment of the artistic beauty and attraction of web design. Based on people's high standards of modern quality of life, the experience of web design, put forward a higher level of requirements, designers need to combine a variety of design styles, elements, fusion FLASH animation software, increase the user's sense of color experience, to meet user needs. In the visual art, visual media gradually integrated into people's vision, one of the outstanding performance is animation production, in the development of the Internet and the era, the need for continuous innovation of animation design means, and effective application in multimedia technology, to promote the level of animation continues to improve.

3.4 Application in Courseware Design

Flash animation software can support the import and export of jif, avi, Fla and other formats. Through flash courseware, it can meet the needs of teachers to produce many different types of files. Flash animation software is used for animation design to provide convenience for teachers' classroom teaching. Students can vividly understand the knowledge points of abstract concepts through multimedia courseware video and audio playback, especially for the explanation of key and difficult knowledge, and use multimedia technology for animation design. Using

the form of courseware of FLA to demonstrate the abstract knowledge with animation, effectively promote students' understanding of knowledge, deepen memory and improve teaching effect. Using jif can display the knowledge structure framework dynamically, and help students analyze knowledge from multiple perspectives. Flash components, including film clips, graphics, buttons, can effectively store static images, and make independent animation, which can show any form of animation content.

4. CONCLUSION

To sum up, with the continuous development of modern information technology, the field of animation design needs to continue to use new software as technical support. Through the use of flash animation design software, improve the ability of web page production, promote the continuous innovation and development of animation design and courseware design technology. Using flash animation design software in multimedia technology is the first choice of animation design enthusiasts, which can effectively meet the needs of multimedia production and other aspects.

ACKNOWLEDGEMENTS

Research and practice of training mode of virtual reality application technology professionals based on OBE, 2019 School project of Shenzhen Polytechnic.

REFERENCES

- [1]Kun He, Dan Wang, Miao Tong, Zhijuan Zhu, "An improved GrabCut on multiscale features." Pattern Recognition, 2020, 103.
- [2]Elif Bozkurt, Yücel Yemez, Engin Erzin, "Affective synthesis and animation of arm gestures from speech prosody." Speech Communication, 2020,119.

Environmental Protection Performance and Development Trend of Inorganic Nonmetal Building Materials

Juan Wang

Jiangxi Arts and Ceramics Technology Institute, Jiangxi 333000, China

Abstract: In the modern society with the rapid development of building materials industry, metal materials and non-metal materials have always been an important research direction, and also play an extremely important role in the construction industry. The chemical industry has always been closely related to the construction industry, and promote each other's development. In this paper, the environmental performance and development trend of inorganic non-metallic building materials are analyzed and discussed for reference only.

Keywords: Inorganic Nonmetal; Building Materials; Environmental Protection Performance; Development Trend

1. INTRODUCTION

Inorganic non-metallic materials mainly include inorganic salts, nitrides and oxides of some non-metallic elements. Common inorganic non-metallic materials mainly include silicide products, such as cement, glass, ceramics or colloids. These materials have been widely used in architecture. With the continuous development of science, various new materials are emerging, which also shows that inorganic non-metallic materials are emerging. It is an important material that will dominate the construction industry in the future [1-4]. According to its emergence time, it can be simply divided into two kinds of traditional materials and new materials. These two kinds of materials widely exist in the construction field and play an important role together with metal materials.

2. ENVIRONMENTAL PROTECTION PERFORMANCE OF INORGANIC NONMETAL BUILDING MATERIALS

Because inorganic nonmetals are more complex in the composition of chemical structure and lack of free atomic structure as support, they show more stable performance, such as temperature resistance, wear resistance, corrosion resistance and oxidation resistance, so they are used in more needed fields, such as construction industry, steel-making aluminum, ceramic manufacturing, these industries often need more materials with this performance. Make the foundation and manufacture. Therefore, inorganic nonmetallic materials are widely used in many fields, but in the process of application, more attention should be paid to the environmental protection

performance of materials.

In inorganic non-metallic materials, many semiconductor materials, crystal materials, high-temperature resistant ceramic materials, on the basis of maintaining the original characteristics, use modern technology to add more wear-resistant, high-temperature resistant materials, making the performance more superior, making the products show more diversity and high quality, so the application of products in the construction industry will be more extensive. In order to ensure the quality, but also more to ensure the environmental performance of materials. Under the national policy of vigorously promoting environmental protection, the production of green and energy-saving materials is the current trend as well as the needs of social development. The country pays more attention to the production of materials in the construction industry and improves the use standards repeatedly, that is to say, it puts forward higher requirements on material processing technology, which is a test of production technology and a deeper requirement on the performance of inorganic non-metallic materials. This requires better investigation and Research on the application of materials by material developers, and targeted and purposeful research and development from the perspective of the field of use. For example, in the production process of ceramics, when traditional materials are added to the mold, they will emit gases that are extremely harmful to the environment and the body during the processing. These gases not only affect the environmental protection and the health of the body, but also will be released and diffused during the use of the product, and then secondary pollution will occur. This is a common phenomenon in the traditional technology, which leads to a lot of problems. Many people suffer from it, and their health is greatly affected. When this traditional material can no longer meet the needs of the society, and can no longer meet the requirements of people for high-quality goods, it is necessary for production enterprises to introduce better production lines. The first requirement is environmental protection and health, and the second requirement is quality assurance, so new inorganic non-metallic materials came into being. The emergence of this material greatly stimulates the determination of producers for environmental protection the safety of users is

guaranteed. In the following, the environmental protection performance of the following inorganic non-metallic materials is analyzed from three aspects:

2.1 Bactericidal and Antibacterial Action

If we want to ensure that the material has bactericidal and antibacterial effect, first of all, we need to add some metal ions into the new material, because metal ions such as silver ions and copper ions have a good bactericidal effect, this kind of ions can prevent and destroy the cell structure of bacteria biology, so that it can no longer reproduce and grow, so it has a good bactericidal and antibacterial effect, in addition, it can add more stable. This kind of material can ensure metal ions to play a more stable role in sterilization and bacteriostatic, so as to better promote the production of safety and environmental protection materials.

Then, some bactericidal materials are often applied on the surface of the material, so that a protective layer will be formed on the surface of the material, which can not only have a more efficient bactericidal effect, but also ensure the stability of the material, which is also an aspect of ensuring the environmental protection performance of the material, the most direct way to protect the safety and health of the users, and also the lowest cost way. This way should be widely used. It is also a more acceptable way for producers to use it in the construction materials industry.

2.2 Thermal Insulation Performance

The more important performance of building materials is thermal insulation. In the process of building, this kind of material is often used in the construction of external and internal insulation of wall, which is also an important aspect of environmental protection performance. Because this material is a new type of material, it also takes the place of the traditional materials. Therefore, some coal chemical products are used as raw materials in the production, and the refining technology is used in the regeneration technology. Therefore, they are more excellent in temperature resistance and insulation performance. The material is somewhat porous in shape, which ensures the durability of the temperature and keeps the temperature. It is a better embodiment of environmental protection performance.

2.3 Volatilization of Harmful and Toxic Gases

For the control of harmful gases in inorganic non-metallic materials, some substances need to be added into the production to neutralize, such as sulfur dioxide and other harmful gases, which need to neutralize with sodium hydroxide or calcium hydroxide to generate more environmentally friendly inorganic salts, thus fundamentally reducing the generation and volatilization of harmful and toxic gases from materials, which is an important aspect of environmental performance. Face [3, 4].

3. DEVELOPMENT TREND OF INORGANIC

NONMETAL BUILDING MATERIALS

In the rapid development of modern society, the development trend of inorganic non-metallic materials is also concerned by the industry, but also involves the development of other industries.

In the field of construction in the world, the development of safety and health of materials has become a trend and necessity, which is not only conducive to global economic development, but also conducive to environmental health. At present, the development of green materials is the main direction, people also prefer healthy materials to meet the needs of life, so in the future, inorganic non-metallic materials will be studied and developed in the direction of more healthy and environmental protection, and will be produced in a more ecological mode. On the basis of environmental protection production, the energy consumption will be lower. In the environment of gradual warming of the earth, production and manufacturing industry is the biggest culprit. In the traditional production and processing mode, a large amount of carbon dioxide and some harmful substances are discharged into the air, resulting in global ecological change and destruction of ecological chain. Therefore, in the future material production industry, it is necessary to actively ensure the strict implementation of environmental protection standards in the production process to ensure the balance and stability of ecological nature. Fixed. It is also an inevitable law for the future and industry development to develop new technology and integrate into intelligent production. Because in the situation of higher and higher modern human cost, it is a significant historical measure to change the production line. Transforming the traditional production mode into a more efficient and intelligent production and manufacturing mode is an application field of the future development of social intelligence and an inevitable means to meet the future development of society.

4. CONCLUSION

In the current situation of good development of inorganic non-metallic materials, researchers and producers only have to keep a healthy and good mentality and determination together, in line with the development trend of science and environmental protection, they will certainly benefit better in the development of building materials, but also benefit future generations.

REFERENCES

- [1]Chen Zhilin, Wang Qun, Zhang Xuelian, et al, "Research progress of wood / inorganic nonmetal composite materials." Journal of Beijing University of technology, 2013, (29).
- [2]Liu Bo, Xu Shunjian, Liao Weibing, et al, "General situation and development trend of inorganic non-metallic new material technology and industry." Journal of Xinyu University, 2018, (05).

- [3]Zhang Guanglei, "New building materials." phase change building materials in the field of building energy conservation." Harbin: Harbin Engineering University, 2018.
- [4]Zhang Yakun, "Research on the application of

The Development and Application of Computer Artificial Intelligence Technology

Kan Wang

Henan Institute of Economics and Trade, Zhengzhou 450018, Henan, China

Abstract: With the improvement of modern science and technology, people have done a lot to the artificial intelligence technology of network, which has developed well in the new era. With the intellectualization of people's network life, people's requirements for computers are getting higher and higher, so computer developers are gradually making computer applications more intelligent, more able to meet people's life needs. This paper will explain the development and application of AI technology in computer.

Keywords: Artificial Intelligence; Computer; Development and Application

1. INTRODUCTION

With the progress and development of science and technology, the pace of human modernization is also gradually accelerating. For the aspect of artificial intelligence, it provides great convenience for people's life and work. Most of the artificial intelligence is used in the work technology. At present, some of the artificial intelligence technology has been used in people's work. Small to the operation of smart TV and mobile phone applications, large to the use of smart machinery. Artificial intelligence has also brought a lot of convenience to human life, and it has developed rapidly in the field of computer [1-3]. It also keeps exploring and applying on this road, providing greater convenience and getting more development in science and technology.

2. ARTIFICIAL INTELLIGENCE

2.1 Characteristics of Artificial Intelligence

Artificial intelligence, first developed as a way of imitating human activities and consciousness, is a process of the development of machine intelligence. It has a wide range of applied knowledge, including linguistics, science, and biology. It has a strong comprehensiveness, which is also the technology and technology of the continuous development of artificial intelligence. Artificial intelligence has gradually come to a mature Road, which is often used in our daily life, bringing many conveniences to people's life. For example, when dealing with some more dangerous work, we can use artificial intelligence to replace people for work, which not only has a safety guarantee, but also is the continuous improvement of scientific and technological progress. Moreover, the application of artificial intelligence is very fast, which can integrate the data quickly,

achieve the rapid sharing of data, further save the working time and improve the working efficiency. In the part of the combination of artificial intelligence and computer, it can be said that it tends to the operation of information and data, improve the accuracy of data and the working efficiency. Behind artificial intelligence, there is a huge the database, can establish a very comprehensive information base to help extract the data needed for timely feedback. So, the application of artificial intelligence in computer helps us greatly improve the level of network monitoring.

One of the major characteristics of AI technology is that it can deal with all kinds of complicated and complicated information. In the Internet life, people are most worried about the security of information. Combined with the operation and management of computer, AI provides a relatively accurate and safe information platform to help users reduce the human errors in artificial calculation and ensure the authenticity of feedback information to the greatest extent and accuracy. Because in the network operation, it is inevitable that a small amount of erroneous data will appear in the implementation process of computer staff, and the use of artificial intelligence can greatly reduce the occurrence of this situation, and every data has a detailed record of real-time monitoring, which can quickly organize the data.

Second, the learning ability of AI is extremely high. In the network supervision of computer application, it can ensure that the network performs tasks in a safe environment. However, in the application, the supervisor often has problems such as insufficient personnel, heavy workload and low work efficiency, which leads to the limited operation of the network. Artificial intelligence can greatly solve this problem. He not only has a fast learning ability, but also has the ability to integrate the volume data has a whole control in a short time. After a short time of processing, information can be extracted, and the accuracy and security can be guaranteed.

Using artificial intelligence greatly reduces the running cost of computer network. Generally, the cost of computer network staff is relatively high, but a large amount of artificial intelligence is put into network management, which can not only improve the security of network life, reduce some security risks, but also improve work efficiency. On the other hand, it can reduce the operation cost of computer network. Through the reasonable application of artificial

intelligence for network data, it helps to reduce the tedious work procedures, improve the work efficiency and greatly reduce the operation cost.

3. APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGY IN COMPUTER

3.1 Application of Network

In the aspect of network security, artificial intelligence occupies a large part, which provides a lot of convenience for people, but also reflects its importance. For example, the firewall of computer and the intrusion detection of virus are the applications of artificial intelligence in computer, and are widely used by people. The intelligent firewall is a program that the intelligent enterprise computer enters into the computer, through a series of checks, and then improves the security of the computer, providing a safe network environment for users. Second, before using the network technology, the appropriate security check can improve the stability of computer operation, and is conducive to the collection of data information and integration of data, which can eliminate some garbage information. Usually in the use of network, people often see a lot of junk information and advertisements, and the computer in the aspect of artificial intelligence is greatly reduced, helping to provide users with a safe and stable computer network environment.

Second, in the aspect of network management, there are special technicians to operate and manage behind the network database, which can not only control the whole network system as a whole, but also master the dynamic information of network information at any time, which improves the management level to a certain extent. Artificial intelligence in computer technology has mastered a lot of professional knowledge, as well as the way to deal with problems. In the experiment, it can easily deal with a lot of network problems. With the help of artificial intelligence, it can speed up the transmission of information and improve the efficiency of work.

Thirdly, artificial intelligence is widely used in teaching. Under the reform of education system, the way of education has been improved from traditional book education to the way of combining with multimedia, which can help students better understand the teaching content in the new era. The way of teaching also gradually tends to the way of artificial intelligence to convey the teaching content

in the form of numbers, for example, it can transfer the Japanese teaching content. What we often talk about is organized into PPT and then taught to students through digital media projection to help students better understand the teaching content in a digital way. Students can feel the data intuitively and get the conclusion directly through calculation.

Generally speaking, AI has been put into human life, for example, it can help people use mobile phones to control some machines in a long distance, and create a more comfortable living environment for people. When applied to enterprise management, it can also provide an alarm system, including automatic alarm and monitoring system, which provide great convenience for enterprise management, make the enterprise in a safe environment and reduce the operation cost of management. With the application of artificial intelligence technology, both in enterprise management and for the improvement of people's living standards, there is a great improvement and development.

4. CONCLUSION

Generally speaking, the technology of artificial intelligence has been widely used in our country, and the development in the field of computer is also very rapid. Because of the convenience of computer, people pay more and more attention to it. Compared with western countries, China's artificial intelligence technology is not so advanced, but it is also vigorously cultivating the technology of computer intelligence, and in the aspect of intelligence, the development progress in China is very fast, and it has been applied to many fields, providing us with great convenience.

REFERENCE

- [1]Zhang Xujian, "Analysis on the effectiveness of flight calibration scheme for civil aviation communication, navigation and monitoring equipment." *Silk Road vision*, 2018 (11): 103-104.
- [2]Wang Jianyu, "Discussion on flight calibration scheme of civil aviation communication, navigation and monitoring equipment." *China new communication*, 2019 (10): 5-6.
- [3]Kong Xiangyao, "Lightning protection strategy of civil aviation air traffic control communication and navigation monitoring equipment." *Electronic technology and software engineering*, 2018 (02): 42-43.

Research on The Application of Big Data and Internet of Things Technology in Smart City

Ning Xiang

Leshan Vocational & Technical College, Leshan 614000, Sichuan, China

Abstract: With the replacement of the old and the new era, the domestic production research mechanism in various fields has started its own reform and innovation, so as to improve its work efficiency and production quality, and meet the actual development needs of the current society in various fields. In recent years, China has been committed to the sustainable research of innovation and development, and the extensive application of big data technology, Internet of things technology and the active construction of smart city have accelerated the research progress of innovation and development sustainability. In addition, the popularization of big data technology and Internet of things technology has promoted the effective promotion of social economy, thus improving the national economic income and expenditure level, and the quality of life of the people has naturally been improved to a certain extent.

Keywords: Big Data Technology; Internet of Things Technology; Smart City; Application Research

1. INTRODUCTION

Based on the new era development background, the current domestic social economy began to grow rapidly, and the level of national GDP rose in a straight line, providing a solid material basis for the quality of life of Chinese residents, thus promoting the construction progress of smart city. With the in-depth application of big data technology and Internet of things technology in the field of domestic construction, diversified application methods are gradually developed. At the same time, China has carried out a comprehensive and in-depth study on the application of big data technology and Internet of things technology, in order to explore a more efficient application of big data technology and Internet of things technology.

2. OVERVIEW OF BIG DATA, INTERNET OF THINGS AND SMART CITY

2.1 Basic Concept of Big Data Technology

The change of times provides more opportunities for effective communication with foreign developed countries for the research and development of high-tech in China. Therefore, it provides a more solid theoretical basis for the research and development of science and technology in China, so that the scientific research activities in China can be traced and justified. Given a new era development background, Chinese scientific research institutions have redefined the basic concept of big data

technology. At present, big data technology mainly refers to various application technologies formed by using big data, including the construction technology of various big data platforms, big data index system and other big data application technologies. In most cases, the application of big data technology in the construction of big data platform mainly relies on Colleges and universities to provide data science and big data technology professionals for big data technology.

2.2 Basic Concepts of Internet of Things Technology

Internet of things technology is an intelligent product in the new era. Its English name is Internet of things, or IoT for short. Up to now, the Internet of things technology is mainly used in the field of media, and initially in the field of media, born in the third reform of information technology products, which is a new technology. In essence, the Internet of things can connect any object with the network through the use of information sensing equipment and the agreement protocol. Specifically, the object can exchange and communicate information and data through information transmission as a medium. Based on this, the functions of intelligent identification, positioning, tracking, supervision and management are truly realized. The time when the Internet of things first appeared in China was 1999. The Chinese Academy of Sciences proposed and formulated the R & D plan, which accelerated the pace of innovation and development in the following decades [1].

2.3 Basic Concept of Smart City Construction

Smart city, the English name of smart city, comes from the field of media as Internet of things technology. It combines and integrates the city's modern system and services through the flexible use of various information technology and innovation concepts, so as to greatly improve the efficiency of the use of relevant resources. The concept of smart city has been put forward and received widespread attention from all walks of life. With the in-depth implementation of the specific construction plan, smart city has truly achieved the optimization of urban management and service functions, and effectively and significantly improved the quality of life of urban residents in China. As a new concept under the background of the new era, smart city gives full play to the positive effect of big data technology and Internet of things technology, transforms the traditional urban form into the advanced form of urban informatization based on the innovation of the next

generation in the knowledge society, effectively guarantees the seamless connection of informatization, industrialization and urbanization, and helps China's modernization, popularization and development effectively alleviate The development pressure improves the quality of urbanization construction, so as to meet the fine and dynamic management requirements of the state for modern urban construction. In addition, it improves the positive role of urban management and improves the quality of life of urban residents in China [2].

3. DEVELOPMENT STATUS OF BIG DATA, INTERNET OF THINGS AND SMART CITY

3.1 Big Data Technology Development Status

The change of times provides a relatively good development environment for big data technology. Through in-depth application in various fields in China, big data technology has become the most important in the process of innovation and development in China. At present, big data technology is mainly used in information transmission, storage and production in China, and has achieved better application results. The implementation of big data technology promotes the progress of innovation and development in China, and effectively improves the quality and efficiency of innovation and development in China. As one of the mainstays of China's innovation and development, big data technology will inevitably give full play to its own positive effect in the process of innovation and development, and help the country achieve the reform and innovation goal [3].

3.2 Development Status of Internet of Things Technology

As for the Internet of things technology, China started the research and application of the Internet of things system as early as 1999. In the following decades, relevant scientific research institutions gradually developed the core sensor network technology of physical network, and in terms of the Internet of things technology alone, China's R & D level has always been in the forefront of the world. Then, as one of the leading countries in the field of sensor network in the world, China has a high amount of patents, that is to say, China has a large amount of Internet of things related resources, so it provides a wealth of optional resources for the research and development of Internet of things technology. With the wide application of Internet of things technology in various fields in China, most colleges and universities in the implementation of the new curriculum reform in the process of Internet of things technology as a regular curriculum standard, so as to make human resources guarantee for the innovation and development of our country. In 2010, the first college of Internet of things engineering was established in China, and the school of information engineering of Jiangnan University and the school of communication and control engineering of Jiangnan

University were officially merged into the "College of Internet of things Engineering". The establishment of the college has attracted extensive attention from all walks of life, and once became a hot college in the current domestic higher vocational colleges [4].

3.3 Current Situation of Smart City Construction and Development

In the process of realizing the goal of innovation and development in China, the construction of smart city often intersects with the related concepts of digital city, perceptual city and wireless city, so that people cannot clearly distinguish the information concepts of e-government, intelligent transportation and smart grid industries. Once these concepts are confused, the construction speed of smart city will be greatly reduced. Based on the analysis of the organizational structure of smart city, the idea is to establish scientific and reasonable hardware facilities such as Internet of things infrastructure, cloud computing infrastructure, geospatial infrastructure, etc. on the basis of big data technology and Internet of things technology. In addition, tools and methods such as wiki, social network, integrated integration method and all media integration communication terminal belong to the main means of smart city construction. Based on this, the smart city has truly realized the comprehensive perception of relevant concepts, practically achieved the integration of traditional cities and intelligent concepts, and innovated the important components of urban transportation, power grid and communication [5].

4. APPLICATION OF BIG DATA AND INTERNET OF THINGS TECHNOLOGY IN SMART CITY

4.1 The Storage Cost of Big Data Technology is Relatively High

In recent years, great changes have taken place in China's social and economic system, which is changing from traditional market economy to diversified development. Traditional market economy cannot provide sustainable conditions for China's innovation and development, and higher and higher economic demand will only block the country's development speed. Therefore, reform and innovation have been carried out for traditional market economy, aiming at improving social economy Growth speed, accelerate the innovation and development speed of our country, improve the innovation and development efficiency of our country and make a solid material guarantee for its quality. Under the background of traditional economic development, data and information storage technology has been difficult to meet the actual development needs of the current society. The continuous improvement of its operation cost has greatly reduced the application efficiency of big data technology, which has a certain impact on the overall innovation and development of the country [6]. In addition, the scale of relevant data generated in the production process of various fields is growing, so the cost of data storage is increased, which restricts the

construction and development of smart city in some way. Up to now, the relevant construction departments of smart city are committed to the effective solution of this problem and specific construction planning, striving to minimize the time required to store data, shorten the data storage cycle and timely update the storage amount of relevant data, etc., based on which to achieve the phased development goal of maximizing economic benefits [7].

4.2 Retrieval and Extraction of Information Data Cannot be Completed Quickly

Although the arrival of the information age has brought rare development opportunities to many fields in China, there are still some negative problems in the application of big data technology, which affect the overall innovation and development process. For example, the retrieval and extraction speed of information data are slow. In the application process of big data technology, the related work reduces the difficulty of data collection and information storage as much as possible. But in the process of data query and analysis, the final work efficiency and quality will be affected to a certain extent due to the instability of its performance. The decrease of retrieval and extraction speed of corresponding information data will affect the storage and collection of data at the same time. For example, when storing traffic information, it may reduce the system's recognition of the information due to the incomplete description of some information details, mainly including accident details and causes of accidents [8, 9].

5. APPLICATION OF BIG DATA AND INTERNET OF THINGS TECHNOLOGY IN SMART CITY

5.1 Establish an Open Long-Term Data System

With the in-depth implementation of reform and opening up, China has increased opportunities for exchanges with foreign developed countries in various fields, so the relevant work efficiency and work quality in various fields have been effectively improved. In the process of communication in the field of smart city construction at home and abroad, a large number of advanced construction concepts continue to flow into the domestic market. Based on this, it provides more favorable help and theoretical support for the formation of data collection system in smart city. China started to study big data and Internet of things technology in 1999, which is relatively late compared with the research practice of some developed countries. Therefore, Smart City builders should fully learn from the mature construction experience of developed countries, learn from each other's strengths and make up for each other's weaknesses, and devote themselves to the construction of smart city data collection system in China. Combined with the actual development of most cities in China, and adhering to the principle of open and complementary construction, an open

long-term data system is gradually formed in the process of innovation and development, which is more suitable for the foundation of sustainable development in China. The open long-term data system can ensure the integrity of relevant data and information in the construction process of smart city. However, when establishing the open long-term data system, it is not allowed to copy the developed countries. Due to the different nature of countries, there will be some differences in the corresponding smart city construction work. It is necessary to formulate scientific, reasonable and feasible data system based on the current development situation of China Targeted construction plan [9].

5.2 Strengthen the Construction of Privacy Guarantee System

In the process of realizing the goal of innovation and development in China, big data technology, Internet of things technology and other high-tech technologies play their own positive role. Up to now, with the rapid development of big data technology and Internet of things technology in China, the privacy and security of users are ignored. As we all know, the privacy of network users is directly related to their personal security and property security. In recent years, various kinds of network apps emerge in an endless stream, and related recharge systems are set up. Therefore, the property of some urban residents is more or less stored in each major network app. If the relevant responsible person ignores the security of user's privacy information in the daily management process, then the user The security of property will not be guaranteed, which will threaten the personal safety of users. In order to ensure the safety of the construction process of smart city, it is necessary to strengthen the quality of privacy protection work. The staff must clearly recognize that privacy protection work is the basic guarantee for collecting relevant data and information. If the security of relevant privacy information cannot be guaranteed, the construction quality of smart city will be greatly reduced.

5.3 The Relationship Between Big Data, Internet of Things Technology and Smart City

Combined with the analysis of the current situation of smart city construction in China, big data technology, Internet of things technology and smart city construction have mutual integration, mutual benefit and complementary relationship, which can fully stimulate the maximum effectiveness of each other. Big data and Internet of things technology can help smart city speed up its construction and consolidate the construction quality of smart city, so as to improve the overall innovation and development quality of the country. In addition, the builders of smart city should also flexibly use big data technology to grasp the problems in practical work, and explore the specific causes of the problems. Based on this, combined with the current situation of smart city construction and relevant regulations, formulate scientific, reasonable

and feasible solutions. It can be seen that big data technology and Internet of things technology can not only help the builders of smart city master the work problems, but also help them master the development trend of the future society.

5.4 Application of Big Data Technology in Smart City

In the process of building a smart city, a large number of relevant data and information will inevitably be generated. As the construction of a smart city involves a wide range of aspects, the data and information sources generated in the process are also wide, which further expands the application scope of big data technology, and adds a certain degree of difficulty to the storage and processing of data and information. City construction cannot do without city data simultaneous interpreting. Based on this, the construction of smart city should strengthen the application of big data technology, expand the application means of big data technology, improve the application efficiency and application quality of big data technology in smart city construction, so as to improve the construction speed of smart city. Combined with the current situation of smart city construction, the existing information processing system is improved reasonably to improve its performance and efficiency of information processing, and improve the security and effectiveness of relevant data and information.

6. CONCLUSION

To sum up, this paper first discusses the basic concepts of big data and Internet of things technology. Big data and Internet of things technology are all from the information field, and are applied to the transmission, storage and production of information data. Secondly, it briefly describes the development status of big data technology and Internet of things technology in the current society. Basically, big data and Internet of things technology have been effectively integrated into the innovation and development process of the current society, and achieved high application results in many fields. Then combined with the application status of big data

technology and Internet of things technology in China, the paper analyzes the related existing problems, mainly including the relatively high storage cost of big data technology and the relatively slow retrieval and extraction speed of information data. In the end, the paper puts forward some relevant application approaches for the application of big data technology and Internet of things technology. This article is for the reference of relevant personnel, in order to contribute a little to the application research of big data and Internet of things technology in China.

REFERENCES

- [1]Song Zhuangwei, "Research on management and application of firefighting technology in smart city." *China high tech Zone*, 2018 (02): 243.
- [2]Chu Ke, "Research on Key Technologies of smart city information system." *Smart building and smart city*, 2018 (01): 18-19.
- [3]Ning Lili, "Research on the application of cloud computing and Internet of things in the construction of smart city." *Smart building and smart city*, 2018 (01): 20-21.
- [4]Wang Zhaoqing, He Yong, "Research on smart city construction supported by big data." *Internet of things technology*, 2018,8 (01): 46-48.
- [5]Wang jiesong, "Application Research of big data and Internet of things technology in smart city." *Wireless Internet technology*, 2018,15 (03): 29-30.
- [6]Dai Qinghong, "Analysis of the current situation and application prospect of Internet of things technology." *Network security technology and application*, 2018 (02): 139-140.
- [7]Dong Ni, Ding Hao, "Research on smart city construction based on Internet of things technology." *China strategic emerging industry*, 2018 (16): 18.
- [8]Jiang Wei, "Application of Internet of things technology in the construction of smart city." *Modern information technology*, 2018, 2 (03): 192-194.
- [9]Wang Wenjiang, "Application of big data and Internet of things technology in smart city." *Communication world*, 2018 (03): 1-2.

Application of Blockchain Technology in Cross-Border E-Commerce

Bin Yang

Guangzhou Vocational College of Technology & Business, Information Engineering School, Guangzhou 511442, Guangdong, China

Abstract: With the rapid development of social economy, people's way of thinking has changed dramatically. More and more people want to master new knowledge. The traditional backward era has become the past style. People should keep up with the pace of the development of the times. The progress and wide application of modern information technology also indicate that the staff should pay more attention to the cultivation of this aspect. The former old students the mode of production has been far from meeting the needs of the present, and people urgently need to master more advanced technology to get better jobs. At present, it is a period of great development of blockchain technology. People should firmly grasp this critical stage, understand the knowledge about e-commerce, and acquire more professional skills. Colleges and universities also adapt to the needs of the country. At present, the e-commerce specialty offers this course in many schools. Blockchain is playing a more and more important role in cross e-commerce. Staff should strengthen innovation in blockchain technology while working. Science and technology are the first productivity. The development of science and technology cannot be separated from the hard work of staff. Innovation is the cornerstone of continuous development of technology. Next, the application of blockchain Technology in cross e-commerce will be analyzed in detail.

Keywords: Blockchain Technology; E-Commerce; Application

1. INTRODUCTION

Nowadays, blockchain technology is widely used everywhere. In a prosperous city, including the design of high-rise buildings, the bright lights on the street, and the mobile phones that we can't live without day and night, blockchain technology plays a huge role. It's hard to believe what kind of living conditions people will face without the use of blockchain technology. As a result, it may take a few months to communicate with family members by letter. The traffic is inconvenient and people's living conditions will restrict people's normal activities [1, 2]. Therefore, people should seriously explore the application of blockchain technology in cross-border e-commerce, especially in shipping management. For some goods that are far away and inconvenient to walk on land, the staff should adopt the shipping

method for long-distance transportation. The form of shipping is faster and reduces the cost of transportation. At present, the blockchain is in the critical period of transformation and upgrading, which requires the staff to complete all the work steps with a rigorous attitude. Therefore, the application of blockchain technology in cross-border e-commerce has become a widely recognized special technology.

2. BLOCKCHAIN TECHNOLOGY

2.1 Content of Blockchain

Blockchain technology is the application form of e-commerce. Blockchain technology contains many different kinds of technology applications. It is a product formed by the combination of a number of technical conditions. The information it covers has an unforgettable role. It is shown in the form of public sharing. Blockchain technology is a technology invention shared by all mankind. Including huge storage space, the speed of information transmission is extremely fast. Once illegal elements steal confidential documents, they can be detected by the staff at a very fast speed. Therefore, this also reduces the probability of crime. Blockchain can also be traced back to the previous files, which have been kept for a long time to reduce the loss of files. The blockchain has drawn in the distance between people, allowing people thousands of miles away to communicate and cooperate normally. Blockchain has just appeared, and has been recognized by many people. Some enterprises should strengthen the application of blockchain, pay attention to the role of blockchain, and maximize its function.

2.2 Application of Blockchain in Agriculture

Nowadays, with the progress of the times, although there are still many people who devote themselves to agriculture and feed their families by planting crops. But the difference is that the mode of production in the farmland has changed dramatically. In the past farming era, it is not only hard to work, but also the income is very small. Plus, a certain amount of taxes, the income of farmers is very small. Nowadays, due to the improvement of technical conditions, people apply blockchain technology, spend more time and energy to study some blockchain projects and apply its technology to agriculture. In the past, farmers should look at the crops all the time, fertilize and water the crops regularly, instead of using blockchain technology to achieve 360 degrees of all-round monitoring, and use the relevant technical conditions

to water and fertilize the crops regularly. It can not only increase the output of crops, but also make precise fertilization. By installing some cameras in the farmland, the staff can master the growth of crops when sitting in the office.

3. E-COMMERCE

3.1 Field of E-commerce

Some enterprises develop new products in the form of electronics for consumers to buy, including the mobile phones we usually use. Through the mobile phones, we can get in touch with each other for a long distance, learn about the latest events and grasp the surrounding situation at the first time. For example, in the recent epidemic, at the beginning of the epidemic, people know the current extent of the epidemic through mobile phones, so as to make corresponding response measures, so that people can do a better job in epidemic prevention and control. There are also televisions we watch every day. The staff have developed televisions so that people can understand what policies have just been implemented in our country every day, hold the meeting for the first time, and let people know that the specific adjustment of e-commerce made by the state involves all aspects. People should make full use of this favorable condition, so as to make the current e-commerce more convenient life.

4. APPLICATION

4.1 Application of Blockchain Shipping Management in Cross-Border E-Commerce

The shipping method is suitable for some projects with large load capacity. At present, it is in the rapid development stage of the blockchain. Enterprises can effectively reduce the pressure of transportation by shipping some goods. The scale of shipping is relatively large, and there are many workers to carry. If air transportation is adopted, though the speed is relatively fast, the cost is high, and the number of transportations is increased, and the transportation between enterprises is relatively troublesome. Blockchain technology combined with the application of e-commerce can play a great role in shipping and realize a new leap in e-commerce technology. It can also expand the transportation channels of blockchain, understand the common points of blockchain and e-commerce, and master more new data, because they are new technologies just emerging, and can also deepen the understanding of staff on them.

4.2 Blockchain Technology Indicates Payment of E-Commerce

In the past, there are many problems in the way of cash payment. For example, when people need to carry out a transaction with a large amount of money when they travel, people will face the problem of how to carry cash. Many people will feel that the

transaction is not convenient and there will be many dangerous situations in the process of transaction. E-commerce payment efficiency reduces the risk of transaction. E-commerce has become a common way of transaction in our daily life. People can easily complete a transaction by scanning and transferring the code through simple electronic products. Blockchain technology is indicating the payment method in e-commerce. E-commerce also has some problems in payment.

4.3 Blockchain Points Out the Shortcomings In E-Commerce

Before the rise of e-commerce, it was more about physical sales and on-the-spot purchase of goods. However, with the improvement of technical conditions, the blockchain pointed out the shortcomings in e-commerce. At present, more businesses adopt the form of online sales. These manufacturers reduce the cost of renting commodity houses. Because consumers can only watch samples online, they can't be authentic. Restore the original goods, so that some businesses send to consumers by taking some pictures that do not conform to the physical objects, resulting in the phenomenon of cheating consumers, while the development of blockchain technology can identify the fake goods sold by e-commerce cross-border. Reduce the number of cases in which consumers are cheated.

5. CONCLUSION

Blockchain technology is more and more widely used in cross-border e-commerce, which can be used for long-distance transportation in shipping management. Now, major enterprise platforms pay more and more attention to the application of blockchain technology in cross-border e-commerce, and staff should seize this favorable opportunity to continuously expand their knowledge field, increase their knowledge, and cultivate their professional quality, so as to improve their professional quality. Good investment in the cause of e-commerce. Nowadays, the combination of blockchain and e-commerce technology has become an indispensable part of people's life, strengthening the communication between people, not only the convenience of shipping, but also enriching people's daily life.

REFERENCE

- [1]Zhou Xiang, he Yinchuan, Cai Qiaowei, "Application of blockchain technology to optimize cross-border e-commerce payment mode. Technological innovation and application," 2018 (8):22-23.
- [2]Zhang jiebin, "Building the e-commerce ecosystem of China Europe road border with blockchain technology." China's circulation economy, 2018.32 (2):66-72.

On the Cultivation of Creative Thinking in The Course of Visual Communication Design

Gang Yao

Chengdu College of Arts and Sciences, Chengdu 610401, Sichuan, China

Abstract: visual communication design is one of the key courses in Colleges and universities, and it is also the content that needs to be studied. In the actual teaching work of visual communication design, teachers should pay attention to training students to form good creative thinking, ensure the smooth development of teaching work, and improve the overall teaching quality. Therefore, paying attention to the cultivation of students' creative thinking ability is the premise and guarantee to promote the smooth development of visual communication design course. Teachers should pay attention to changing the traditional teaching concept and means, reflecting innovation in the teaching process, so that students can get a good learning experience, and ultimately significantly improve the overall teaching quality. Therefore, this paper will focus on the cultivation of creative thinking in the visual communication design course as the theme to carry out the analysis, through a detailed understanding of the value and role of cultivating students' creative thinking in the visual communication design course, and then put forward the feasible countermeasures to promote the cultivation of students' creative thinking in the visual communication design course.

Keywords: Shallow Visual Communication Design Course; Creative Thinking; Training

1. INTRODUCTION

It is of practical significance to cultivate students' creative thinking in the course of visual communication design, because it has certain abstraction for the teaching work of visual communication design. Only students have good creative thinking, can they obtain good learning experience. As a qualified teacher of visual communication design course, we must change our traditional teaching Learning ideas and means, to realize the implementation of training students' creative thinking in all teaching links, and actively lead students' comprehensive cognition and learning modern design ideas, so that students always pursue creative design with creative thinking, and provide guarantee for promoting students' comprehensive development and reflecting their own value after entering the society [1].

2. RESEARCH ON THE KEY MEASURES TO PROMOTE THE CULTIVATION OF STUDENTS' CREATIVE THINKING IN THE COURSE OF VISUAL COMMUNICATION DESIGN

2.1 Carry Out Case Teaching

For students who have just come into contact with the visual communication design course, it is likely that their understanding of the course is not in-depth and comprehensive, and they do not even know what they need to learn and what professional knowledge they can master. At this time, teachers should be good at guiding students, so that students have a correct way of learning, pay attention to accumulation, and realize their own material library in this imperceptible process. Through watching and exploring all kinds of design works to stimulate their own creativity, provide guarantee for the smooth development of teaching work, and let students experience the interest of visual communication design course learning, let students through observation and analysis of all kinds of design works in the case, not only can promote students to obtain good memory effect, but also achieve the goal of directly using design works. Therefore, the application of case teaching mode is of practical significance. When students get a good learning experience, at the same time, stimulate students' creative thinking, improve their enthusiasm for learning and creative confidence, and finally achieve good teaching results. In the follow-up teaching work, teachers should display various design works with entrepreneurial thinking for students, explore and analyze with students, and cultivate students' creative thinking [2].

When teachers are developing design competitions for students, they can also use them as cases to carry out teaching work, because they have all kinds of modern avant-garde design concepts in design competitions, each designer has its own unique innovative thinking, and high-quality design competitions can attract outstanding designers from the society to participate in them. When the results of the design competition are displayed, the creative thinking of the students will always be in an active state to stimulate their own design enthusiasm, and it can better help the students to rationalize the use of their own creative thinking, while the teachers need to reflect the guiding role, properly assist the students, and ensure that the students can correctly use their creative thinking.

From the perspective of visual communication, the scope of design competition is very broad, including multimedia, fonts, posters and planning cases. In this paper, we will take the poster design competition as the research to carry out the analysis. When we carry out the poster design competition, we need the

Organizing Committee of the design competition to put forward a reasonable design theme for it, and people who participate in the competition need to use various technical means to complete the design works according to the theme requirements. After watching all kinds of competition requirements, most of the students will use rational thinking to show the poster content objectively. But it is undeniable that this kind of rational thinking form is difficult to stand out in the competition. Because as an excellent professional poster design, the work should be able to have a visual impact on people and attract the attention and curiosity of the vast audience [3].

Therefore, only by increasing the attention can we further observe the various contents described in the poster. At the same time, it is necessary to have all kinds of creative ideas. Because an excellent professional poster should reflect its artistic conception, such as being able to arouse people's thinking and have the characteristics of funny and humorous, so that the audience will be impressed. Therefore, in the actual design work, it is necessary to be good at using the means of "metaphor", that is, to make the reasonable metaphor of the performance object become the content related to the design theme, and the performance form. Only in this way can the works be concerned and recognized by the public. Therefore, in the actual training process, teachers need to change the traditional teaching form, pay attention to strengthen the training and learning of students' performance means of "playing metaphor", let students further carry out professional practice through graphic creativity and mind map, so as to learn how to turn entrepreneurship into excellent design reasonably.

2.2 Actively Adopt Information Reorganization

The so-called information reorganization, in other words, is to use the old information to form a new mode, so as to carry out the re-creation of design works. Second, the types of the old information include a wide range, which mainly refers to the known and habitual contents of the masses, while the new combination is to achieve the effective connection and reorganization of the original things through the use of unique and creative thinking forms, so as to design a new work, which can achieve a more significant design effect. Therefore, teachers should be good at guiding students to form new

concepts of all kinds of new things, and then add value-added forms to attract and reorganize, and the rational application of value-added is to implement the integration of comprehensive knowledge into the old knowledge, realize the integration of the two, produce collisions, and friction new sparks. And teachers should further explore the unique functions and meanings of their things, realize the strengthening of various connections between things, and use this form of reorganization to promote students to have creative thinking, so that students can get a good learning experience, create more creative design works, so as to improve their learning quality [4].

3. CONCLUSION

Through the analysis of the above problems, we fully realize the importance and necessity of cultivating students' creative thinking in the visual communication design course. As for the visual communication design course, it has a certain abstraction, which requires the students to have good creative ability to get a good learning experience and improve the overall teaching quality. And teachers should pay attention to changing the traditional teaching methods and ideas, and implement the innovative thinking teaching form in the follow-up visual communication design course to achieve the stable development of graphic design. At the same time, teachers should carry out case teaching and actively adopt information reorganization to improve the effectiveness of visual communication design course teaching, so as to lay a solid foundation for improving the overall teaching quality and cultivating students to form good creative thinking.

REFERENCES

- [1] Yang Shuai, Li Jiaqian, "Exploration and practice of modular teaching method of hand painting performance techniques. Design," 2018 (9).
- [2] Liu Tao, "Research on chemical teaching design based on the cultivation of creative thinking. Master's thesis of Qufu Normal University," 2016.
- [3] Zhang Wenying, "The cultivation of creative thinking in the course of landscape architecture planning and design." Chinese landscape architecture, 2017 (02).
- [4] Yang Shuai, Li Jiaqian, "Exploration and practice of modular teaching method of hand painting performance techniques." Design, 2018 (09).

Technical Scheme and Reliability Analysis of Power Supply and Distribution for High-Rise Buildings

Pan Zhai

College of Electrical Engineering, Shandong Huayu University of Technology, Dezhou 253034, Shandong, China

Abstract: The continuous development of social economy and science and technology has promoted the process of urbanization. China is a country with a large population. The continuous improvement of urbanization process has increased the number of urban populations. At present, the housing pressure is increasing in the development of our country. In order to effectively utilize the land area reasonably, more and more high-rise buildings have emerged in the development of the city. Although the development of high-rise buildings in the city has effectively improved the situation of lack of land resources, some high-rise buildings that are soaring to the sky have also brought difficulties to the construction of buildings and the installation and use of relevant supporting systems in the buildings. The power supply and distribution system are one of the difficulties. For the reasonable construction of power supply and distribution of high-rise buildings, it is necessary to strictly require the corresponding construction technology and make a reliable construction plan, this article, mainly on the high-rise building power supply and distribution technology plan and reliability analysis and research.

Keywords: High Rise Building; Power Supply and Distribution Technology; Technical Scheme; Reliability; Analysis and Research

1. INTRODUCTION

1.1 Basic Requirements

The space of high-rise buildings is large, so the power supply and distribution system used has the requirements of many equipment, large demand, strong sustainability, high security and economic rationality. The power consumption of high-rise buildings is usually large load type, and the power supply and distribution system should also meet the use of smoke exhaust facilities, lighting, sewage and fire power supply and distribution in high-rise buildings [1-4]. Therefore, the planning of power supply and distribution should also be based on the first level load, only in this way can the normal operation of daily electrical equipment in high-rise buildings be effectively guaranteed. Secondly, most of the electricity in high-rise buildings Gas equipment has a high continuity, which will cause any electrical equipment failure in the use of

electrical equipment will affect the normal operation of other electrical equipment, so, in order to avoid this situation, we can design dual power mutual power supply in high-rise buildings, through the radial and trunk power distribution mode to ensure the safety of high-rise buildings.

1.2 Technical Requirements for Power Supply and Distribution System of High-Rise Buildings

The power supply and distribution system are an important part of the whole power system in the building. Its main function is to distribute and use the electric energy in the power system. The use of the power distribution system in the high-rise building directly provides the electric energy for the equipment, so it is very important to ensure the safe use of the power supply and distribution. The power of the power supply and distribution system flows in one direction, usually from the location of the power supply to the user end. The design of power supply and distribution should be divided according to the different power consumption and load properties of each user, only in this way can the feasibility and durability of the power supply scheme be guaranteed.

2. CONSTRUCTION PRINCIPLE OF POWER SUPPLY AND DISTRIBUTION RELIABILITY OF HIGH-RISE BUILDINGS

2.1 Principle of Reliability Analysis

The reliability analysis of power supply and distribution system in high-rise buildings needs to be verified by a large number of experiments on electronic components. The data of reliability analysis is obtained through specific work and needs to be analyzed and studied for a long time. According to the reliability analysis and research of power supply system in actual work, it is concluded that the electrical equipment is divided in the construction of high-rise buildings. During the analysis, not only the scientific rationality of the analysis should be guaranteed, but also certain principles should be followed. The principles include: first, the uncertain situation in the electrical equipment cannot be treated as the fault reason. Second, the time for improvement of electronic equipment cannot be calculated together with the time of failure. Third, the failure of electronic components cannot occur in the standby state.

2.2 Coordination Principle of Various Facilities

In the construction of high-rise buildings, the

interruption and connection of security power supply do not need manual operation. Because the system is automatic operation, it can not only make timely response to the management of power supply, but also effectively save the use of people, materials and financial resources. The automatic power control switch can be disconnected in time in case of circuit failure, which improves the reliability of power supply system in high-rise buildings. One of the measures to improve the reliability of power supply and distribution in high-rise buildings is the use of automatic switching system. The generator power supply of automatic switching system in the use of security power supply is generally two. In the process of operation, if the generator power supply used fails, another generator power supply will be automatically switched to continue to work, which can be well maintained in the construction of high-rise buildings. With the use of power supply, this method can also guarantee the timely repair of building functions. Automatic switching system also does not need human operation, because the system has an automatic system, so in the process of operation, it will avoid the failure caused by improper human operation. The automatic switching system can also analyze the state of the power system. When analyzing the current and voltage of the power system, it is mainly through the voltage on both sides of the power switch. Using the automatic switching system to analyze the state of the power system can effectively avoid the error caused by artificial analysis.

3. MEASURES TO IMPROVE THE RELIABILITY OF POWER SUPPLY LINES

3.1 Do Well in Load Grading Management

The classification of load is based on the influence degree of power supply station interruption. The classification is based on the first level load, the second level load and the third level load. Each load of different levels has different requirements for use. The first level load should have two groups of power supply in addition to emergency power supply. The main function of the secondary load is to recover the electric energy effectively when the circuit is damaged or the transformer fails. The use of three-level load does not require too high stability of power supply, as long as the normal operation of power equipment can be achieved.

3.2 Make Reasonable Arrangement of Power Supply

There are many factors to be considered in the design of power supply location in high-rise buildings. When setting the power supply, it is generally based on the building's demand for electricity. If the power supply of a certain part can't meet the demand of power equipment for electricity, it will lead to the situation that the power supply voltage exceeds the standard. This situation will easily lead to the occurrence of fire in order to prevent the accidents

caused by circuit problems, emergency circuit must be set up when the first level load power supply is set in high-rise buildings, so as to minimize the harm and economic loss caused by power interruption.

3.3 Automatic Switching of Security Power Supply

The stability of automatic switching of security power supply in high-rise buildings can effectively improve the safety and reliability of power consumption in high-rise buildings. To ensure the rationality of automatic switching of security power supply, it is necessary to standardize the automatic operation of power system. In the connection of power supply and standby power supply in the automatic switching system, in order to improve the practicability of the connection between the two, we should use the way of series connection, which can effectively reduce and avoid the risks brought by power switching to a certain extent. Secondly, in order to meet the actual demand of voltage and power supply in the automatic switching system, we should the device of the automatic switching system is combined with the voltage values on both sides of the switch for analysis. When connecting other power supply systems in high-rise buildings, the layout should be reasonable, and the selection of wires used should also be based on the practical functions of the building.

4. CONCLUSION

The construction of high-rise buildings requires high safety and performance use. In order to effectively guarantee the performance use of high-rise buildings in the current development of high-rise buildings in China, automatic and systematic electrical facilities and power supply and distribution systems are generally used to maintain the performance use of high-rise buildings. The installation of such systems is difficult and demanding in order to install the power supply and distribution system, we should not only have a reasonable construction technology scheme, but also ensure the reliability of the scheme. Only in this way can the lighting system, elevators and other electrical equipment in high-rise buildings be able to get continuous power supply under the safety guarantee.

REFERENCES

- [1]Jiang Tao, "Analysis on improving the reliability of power supply and distribution system of high-rise buildings." East China Science and technology: Academic Edition, 2014 (6): 84-84.
- [2]Shi Hongzhao, "Reliability analysis of power supply and distribution system for super high rise buildings." China high tech enterprise, 2017 (10).
- [3]Huang Lijun, "analysis of reliability of power supply and distribution system of high-rise buildings." Jushe, 2017 (26): 143.
- [4]Xie Guobin, "Impact analysis of distribution automation technology on power supply reliability." Citation: engineering technology, 2016:174.

Analysis of The Application of DMAIC Cycle in The Course Teaching Reform Of "Ship Management" In Turbine Engineering

Dong Zhang

Qingdao Harbour Vocational and Technical College, Qingdao 266404, Shandong, China

Abstract: At present, maritime colleges and universities are actively promoting the reform in the teaching activities of ship management. It is of great significance to study the application of DMAIC cycle in the teaching reform of marine engineering ship management. In order to promote the development of the teaching reform of Marine Engineering "ship management", this paper sums up four aspects: the standardization of the course content, the teaching difficulties, the improvement of the course plan and the monitoring of the teaching steps.

Keywords: Course Content; DMAIC Cycle; Teaching Steps

1. INTRODUCTION

DMAIC cycle is a comprehensive and systematic improvement. It can discover difficulties in time, analyze problems in depth and solve problems effectively. DMAIC five step cycle improvement method includes definition, measurement, analysis, improvement and control. The correct definition of specification is needed to use this improvement method. In the actual management process, the assessment, actual operation and error specification should be tracked in time, and constantly improved [1, 2].

2. COMBINE AND STANDARDIZE THE CONTENT OF THE TURBINE COURSE

In the process of definition, it is necessary to determine the objectives and progress. The teaching reform of marine engineering ship management course should have clear training objectives, which can be determined in accordance with the requirements of STCW78 / 95. The knowledge and skills that a crew member needs to master mainly include three levels of responsibility and seven functions. Combine and standardize the course contents of marine engineering, integrate marine engineering management, ship management and ship safety management to form ship management. On this basis, corresponding adjustments and changes have been made, including the professional knowledge of controlling the seaworthiness of the ship, effectively preventing the spread of pollution, the safe operation of the ship, emergency treatment of the ship, communication fault maintenance. After the combination and arrangement of the course content, the adaptability has been improved obviously. For

example, based on the analysis of the new examination syllabus, it is the competency of chief engineer that increases the difficulty of the examination. One course has been added to the examination, from two to three. The number of engineers' examinations has been reduced from 7 to 5. Among them, "ship management" added oil materials and spare parts management, engine room resource management, communication maintenance management and operation economy management. With the course content changed to a great extent, it can better adapt to the development needs of communication specialty. After a long period of development, ship management has become a comprehensive application-oriented course for marine engineering major, covering many fields, including ship power plant technology, ship inspection, ship pollution prevention [1].

3. ACCURATE MEASUREMENT, IN-DEPTH ANALYSIS OF TEACHING PROBLEMS

In the work of measurement, flexible, convenient and reasonable evaluation indexes are needed to realize the accurate measurement of the system software and measure the value. Take the statistical data as the basic basis, so as to grasp the current quality level. In the process of evaluation, accurate measurement is the key to deep analysis. In order to carry out the analysis work, we need to use small tool software to find out several primary conditions that are harmful to quality. The analysis methods include logical analysis, observation and access. Further analyze the causes of the problems, and further determine whether there is a logical relationship between them. Taking DMAIC as the basis, we can reform the teaching mode of ship management and pursue the teaching art better. So as to promote teachers to form a long-term and stable teaching advantage. In practical work, scientific analysis technology should be used to effectively reduce the number of teaching errors. It can optimize the teaching effect and increase the knowledge reserve of students. Improve the teaching concept, and promote the continuous renewal and improvement of the teaching concept. Form a good cultural atmosphere in the campus, so that students can constantly surpass themselves and pursue excellence. Teachers should establish a classroom teaching evaluation system to better promote students' progress. Through the DMAIC cycle, continuous improvement,

improve the quality of teaching, so as to truly achieve the goal of zero teaching defects. Every time the DMAIC cycle is completed, the teaching results will be improved.

4. IMPROVE THE CURRICULUM TO MAKE UP FOR THE LACK OF TEACHING

In the process of establishing the improvement plan, visualization tools and project risk management tools are needed, which are mainly for the first conditions. Under this condition, several improvement plans are made. After a series of discussions, valuable opinions are sought from all parties, from which the most reasonable and effective improvement plans are selected and put into practice. At the same time, the original steps should be improved. If there are many problems in the original step, it means that the plasticity of the original plan is very strong, so it can be planned again to form a new workflow. The improvement of course plan can realize the remedy of ship management course, so as to optimize and integrate the teaching content and links. In general, optimizing individual chapters may not improve the whole teaching process, so we should optimize and adjust each chapter accordingly.

5. MONITOR NEW TEACHING STEPS TO EFFECTIVELY REDUCE MISTAKES

In order to effectively improve the teaching effect, we need to monitor the new steps to ensure that all links can play a role. Take the improvement plan as the main basis, and strictly implement the pre-determined operation specifications. In all the improvement links, we should be able to deal with all kinds of new problems. In this way, the improvement process will not deviate from the pre-determined track, but also can fundamentally avoid great mistakes. For example, a school has determined 104 class hours in this professional course, and the knowledge content to be learned includes engine management, shipbuilding general links, power device technology management,

ship inspection, ship pollution prevention [2]. In the monitoring work, the core content is teachers and students. In the process of monitoring, we need to take the supplement of knowledge field as an important part, and strive for more returns with the best investment. The content of control covers many aspects, including educate, teacher, course content, multimedia, classroom environment, practice environment and teaching means. In the actual teaching activities, we should continuously and effectively improve the quality of teaching, so as to obtain better teaching results. Through monitoring and control, we can reduce or even eliminate mistakes, so as to achieve the goal of zero teaching defects.

6. SUMMARY

To sum up, the application of DMAIC cycle in the teaching reform of marine engineering ship management needs to combine and standardize the contents of marine engineering course. It is not only necessary to do accurate measurement and in-depth analysis of teaching problems, but also to improve the curriculum plan, make up for teaching deficiencies, monitor new teaching steps and effectively reduce errors.

ACKNOWLEDGEMENTS

Construction project of excellent resource sharing course of Qingdao harbor vocational and technical college in 2020 (Project No.: qgyjz [2017] No. 98).

REFERENCES

- [1]Ahmed Selim, "Integrating DMAIC approach of Lean Six Sigma and theory of constraints toward quality improvement in healthcare." *Reviews on environmental health*, 2019, 34(4).
- [2]Elin Kragesand Hansen, Hanna Barbara Rasmussen, Marie Lützen, "Making shipping more carbon-friendly? Exploring ship energy efficiency management plans in legislation and practice." *Energy Research & Social Science*, 2020, 65.

Research Progress and Application Analysis of Computer Artificial Intelligence Technology

WenBo Zhen, Yuchuan Ji, Peng Zhao

Shandong Labor Vocational and Technical College, Jinan 250022, Shandong, China

Abstract: with the continuous progress and development of science and technology, artificial intelligence appears in all aspects of people's life, especially with the continuous deepening and progress of current computer technology, it also promotes the expansion of the field of artificial intelligence technology to a certain extent, but at present, the analysis of the development of artificial intelligence in China, due to the late start of our country, although it has made a lot in recent years Compared with the developed countries in the world, there is still much room for the development of AI technology.

Keywords: Computer; Artificial Intelligence Technology; Application Analysis

1. INTRODUCTION

With the continuous application of enhanced science and technology, its development situation has attracted the attention of the state and people from all walks of life. Because of this, artificial intelligence technology has also made rapid progress. As a high-end science and information technology, the operation of this technology is inseparable from the various functions of computer simulation [1-3]. Of course, this simulation is also based on the traditional thinking mode of human beings the application of this technology is extensive and far-reaching, which brings convenience to human production and life. Of course, its technical potential has not been fully developed, which requires in-depth discussion and research by relevant staff.

2. INTRODUCTION TO ARTIFICIAL INTELLIGENCE TECHNOLOGY

Artificial intelligence technology is more challenging than another research. If we want to achieve a breakthrough in this discipline, we need researchers to have profound theoretical knowledge as support, but also need to have higher psychological quality and moral literacy. Artificial intelligence is actually a multi-disciplinary science, which contains knowledge in various fields, but in the end, it can In the form of a computer or a machine. The analysis data is transmitted to human beings, and then human beings complete the corresponding work, that is to say, it is a technical form to replace human beings to complete more complex work.

3. RESEARCH DIRECTION OF ARTIFICIAL INTELLIGENCE

At present, the research direction of artificial

intelligence is mainly to break through some problems that need to be solved by human brain labor. For example, in recent years, we can see the breakthrough of chess technology. Artificial intelligence continues to beat chess masters in the world. In fact, the same is true of artificial intelligence technology. It decomposes some more difficult problems into easier problems. And to collect and summarize these problems, so that these complex problems become a simple symbol or formula, through such a form to connect these knowledges, can be better used by people. In addition to transforming these abstract knowledges into symbols, it also has higher language processing function, which is one of the research fields of early artificial intelligence, and it can pass through internal database. To answer questions in other languages, these programs build a large number of text materials and internal databases. Artificial intelligence, as its name suggests, should be developed in a more artificial field. As an important symbol of human intelligence, learning and obtaining knowledge from it. It is a very important skill, so mechanical learning is also called artificial intelligence. There are also efforts to discover and explore the mechanism of human learning and reveal the mystery of human brain.

4. DEVELOPMENT STATUS OF ARTIFICIAL INTELLIGENCE

4.1 Computer Research

As a very hot topic in recent years, computer is very important in the application of artificial intelligence technology. Because the premise of artificial intelligence is based on computer, so when the staff carry out the research plan of this technology, they need to combine the technology of artificial intelligence and the technology of computer software engineering closely, and deepen the software technology Through the analysis and discussion of the two technologies, the breakthrough and innovation of development mode and management mode can be realized. In order to facilitate the subsequent maintenance and modification of the computer artificial intelligence system is more convenient.

4.2 Research Achievements in Computer Field

The research results in the field of computer can be seen clearly now. When designing some engineering projects, we can make full use of the artificial neural network system to make decisions. Moreover, these intelligent systems can assemble large-scale software systems together, so as to realize the basic needs of

villagers, improve the friendliness of user interface, and enable the development of this technology has made some progress, but there are still many problems to be solved in the future development process.

5. PRACTICAL APPLICATION OF ARTIFICIAL INTELLIGENCE

5.1 Application in Enterprises

Artificial intelligence technology is widely used in some large enterprises, such as our common alarm system, automatic control system and so on. These traditional operations may require a lot of human and material resources. It is greatly influenced by human objective factors, but the participation of artificial intelligence technology enables these problems to maintain at a higher level, and to carry out the development and management of enterprises. It has a very useful help, at the same time, it can create more economic benefits for enterprises. The application of this technology makes the enterprise to systematize some information when carrying out the basic work, so as to realize the beneficial monitoring of these products production and the monitoring of personnel and equipment in the production process. In this way, it can not only ensure the safety of personnel's property, but also guarantee the service life of equipment, and realize the artificial intelligence system at a certain level Enhance, and provide assistance for the continuous development of the enterprise.

5.2 Practical Application in Daily Home

Artificial intelligence has improved the safety and comfort of housing. For example, it is common for us to control the operation of the sweeper through intelligence. Moreover, the TV can choose different services through voice control system. It can be seen that it provides us with a fresher and more comfortable environment. This technology realizes the function of information monitoring and collection through wireless sensors. It can not only guarantee the safety of human housing, but also ensure the safety of human housing. It can easily solve all kinds of problems through the Internet, so that people can know the national and world affairs without leaving home. To a certain extent, this technology solves many problems in people's lives, and provides great convenience for people. In our daily life, we can see the shadow of artificial intelligence, which shows that it has a great impact on our lives, and the further development of human to artificial intelligence Development is very urgent.

5.3 Application in Construction Industry

At present, there are more and more construction projects, and the risk coefficient of construction projects is higher than other projects. Therefore, the application of artificial intelligence in the construction process of this project can greatly guarantee the construction quality and safety of the construction process, shorten the construction period as much as possible, and reduce the labor intensity of workers. Moreover, the whole construction environment is carried out in the early stage during survey, due to the influence of some fields or construction areas, it is impossible to collect all aspects of information. This is that we can use artificial intelligence technology, such as remote control of some aircrafts, to realize the information survey of each section, collect in the process of subsequent project, and also can use these data to carry out relevant analysis, and the accuracy of these data is high, which has great reference value in the construction process. In the construction process through artificial intelligence and computer system. Analyze the data indicators of relevant equipment, and predict the possible problems and conditions of the equipment in advance. In case of problems, relevant staff can also make corresponding solutions at the first time to minimize the damage to the whole construction project caused by these problems.

6. CONCLUSION

In terms of the current development of artificial intelligence technology in China, although we started late, but in recent years, with the rapid development, we can also feel the changes brought by artificial intelligence to people's lives, which has a very positive impact, so we can know that the development prospect of this technology is very broad. As a relatively advanced science and technology in the current computer technology, artificial intelligence shoulders a major mission. If it can get a good follow-up development, it is believed that it will be able to lead the innovation of a generation of technology and provide many conveniences for various industries.

REFERENCES

- [1]Yang Zhuangyuan, Lin Jianzhong, "Current situation and future development trend of artificial intelligence." Science and technology information, 2010: (04).
- [2]Ma Ming, "The development of artificial intelligence from the perspective of self-organization theory." Friends of Science (version b), 2010: (01).
- [3]Yu Hamming, "On artificial intelligence." Science and technology innovation guide, 2010: (25).

Research on the Ecological Evaluation of Traditional Villages in the Pearl River Delta

Ruiping Chen

Foshan Polytechnic, Department of financial management, Foshan 528137, Guangdong, China

Abstract: As an important cultural heritage of our country, traditional villages have high research value, are the effective preservation of agricultural civilization, and are the carrier of the internal spirit of the Chinese nation. This paper mainly focuses on the ecological evaluation of traditional villages in the Pearl River Delta for reference.

Keywords: Traditional Villages; Ecological Evaluation; Pearl River Delta Region

1. INTRODUCTION

Relevant personnel should strengthen the awareness of the protection of traditional villages, and actively explore the emergence of ecological environment separation in the renewal of traditional villages. Relevant personnel should make it clear that if the ecological nature of the traditional village is destroyed, the village will not be able to play its role in the city, resulting in the lack of the active soil of urban civilization. Therefore, we should pay close attention to the ecological evaluation of traditional villages to ensure the implementation of the protection work of traditional villages.

2. CONSTRUCTION OF ECOLOGICAL EVALUATION SYSTEM OF TRADITIONAL VILLAGES IN THE PEARL RIVER DELTA

2.1 The Purpose of the Evaluation

Through the establishment of a perfect ecological evaluation system, the protection of traditional villages in the Pearl River Delta region can be measured. Under the accurate evaluation of ecology, practical suggestions can be put forward for the problems in the existing ecological protection. To ensure that in some areas with rapid urbanization, their traditional villages can be updated and built in a timely manner, and to maintain the active activity of traditional villages [1, 2]. At the same time, the evaluation of traditional villages based solely on the level of heritage protection will not be comprehensive and will not be able to show the full content solely of village protection, so that in the evaluation process, attention should also be paid to the renewal of villages to cover them.

2.2 Evaluation of The Protection of Village Ecological Pattern

The relevant personnel should take landscape ecology and cultural landscape as the evaluation method, consider the ecological carrying capacity factors comprehensively, analyze the completeness of the village pattern and the ecological tradition of the

village, and regard the environmental quality, the connection between the village and the environment as part of the evaluation index. The rural cultural landscape is based on the special geographical features of the region and is formed in combination with the villages. Villages are based on the ecological environment, and their harmonious coexistence, and meet the fun. By analyzing the ecological pattern of the village, the idea of its location is obtained. The development of industrialization has forced the village to be separated from the surrounding environment, the rural space is constantly being eroded, and the surrounding environmental quality is decreasing, so the protection evaluation index includes the environmental quality protection around the village.

2.3 Evaluation of Village Infrastructure and Building Protection

The relevant personnel should fully follow the characteristics of the ecological suitability of the village, emphasize the effective implementation of the mass protection of the village, and the specific content should be reflected in the evaluation of the village street pattern and the internal open space. At the same time, the protection degree of traditional buildings should be evaluated systematically in the aspects of traditional water circulation in villages. The environmental quality of the village will be directly related to the management of the village, and this evaluation is mainly based on the study of the harmonious relationship between the village and the ecological environment, focusing on the evaluation of the environmental quality.

2.4 Evaluation of the Protection of Village Renewal and Construction of Local Heritage

The long-term development of rural economic reform, some ancient villages have been in line with the development of villagers' lives, which put forward the requirements of accelerating the renewal and construction of villages in the Pearl River Delta region. In the protection work of traditional ancient villages, the construction of villages should be returned to their initial environment. Local inheritance refers to the cultural connotation of traditional buildings and villages. The locality is established in the mass implementation body, which is obvious in the traditional village. The transmission of the locality of architecture mainly comes from the construction skills and building materials of the building.

3. ECOLOGICAL EVALUATION OF TRADITIONAL VILLAGES IN THE PEARL

RIVER DELTA

Through the establishment of a perfect ecological evaluation system for traditional villages, an effective ecological evaluation of 45 traditional villages within the Pearl River Delta region can be realized. According to the evaluation results, many villages in the Pearl River Delta region have suffered from ecological damage to different degrees, which is shown as average in the final ecological evaluation results. Based on ecological evaluation and analysis of its three sub-goals, the protection of traditional villages in the Pearl River Delta is mainly concentrated in the maintenance and protection of traditional buildings, and as the core elements, but in terms of the ecological pattern of the whole village, not enough attention has been paid to, in the process of village construction and renewal, there are also great shortcomings in the local heritage. This also to some extent shows that the ecological problems of traditional villages have common characteristics. Studying the score of ecological evaluation in the Pearl River Delta region can be concluded that its evaluation is closely related to location, but there are still ecological differences in the case of similar location between villages, so in order to ensure that traditional villages get good ecological protection, we also need to pay close attention to the individual differences between different locations.

4. ECOLOGICAL PROTECTION MEASURES IN TRADITIONAL VILLAGES IN THE PEARL RIVER DELTA

Traditional villages in the process of urbanization by the ecological base destruction, ecological destruction, relying on the village itself renewal will be difficult to achieve real village protection. Relevant departments should take active measures to effectively implement village protection at the regional level. With the support of establishing a sound regional policy, specific village protection planning measures are put forward. Relevant departments should improve the ecological compensation mechanism, give ecological land in the approval of the green channel, control the layout and design of ecological land, strongly support the development of ecological protection technology in the region, to the protection of villages in the professional personnel of the protection. Through regular ecological assessment of the traditional

villages in the region, we can ensure that the traditional villages in the region are reasonably restored and protected. Relevant personnel should attach great importance to the problems of traditional village planning in the region, put forward reasonable improvement measures in all aspects and put them into practice. At the same time, in the ecological pattern of villages, the environmental quality around the village should also be regarded as one of the important contents of the protection of traditional villages, and promote the harmonious unity of village and ecological environment. Under the compulsory control means, pay attention to the protection of the internal infrastructure of the village, and further strengthen the restoration of traditional buildings under the introduction of advanced rectification technology, so that the local characteristics of the village can be passed on.

5. CONCLUSION

Traditional villages are of great research value in terms of architecture, site selection and layout pattern. But for now, the destruction of traditional villages has become the focus of attention from all walks of life. In order to realize the heritage significance of traditional villages, to make them a home to retain nostalgia in the true sense, we should pay attention to the protection of their wholeness, take the ecological evaluation of traditional villages as a reference, and promote the further development of the protection of traditional villages in the Pearl River Delta region.

ACKNOWLEDGEMENTS

Special fund project of science and technology innovation strategy of Guangdong Province in 2020(College Students' scientific and technological innovation and cultivation): Ecological evaluation and compensation mechanism of traditional villages in the Pearl River Delta (Project No: pdjh2020b1228).

REFERENCES

- [1]Liao Qihua, Huang Ziyi, "Study on the conservation and adaptive renewal strategies of traditional villages in the Pearl River Delta region: a case study of libian village." *Tourism overview* (the second half of the month), 2019 (08): 186-188.
- [2]Zhang Shijun, "Research on "de ecology" of traditional villages in the Pearl River Delta from the perspective of holistic protection." *South China University of technology*, 2018.

Study on Competency of Mass Basketball Coaches

Xiaodong Wang¹, Liqiu Zhao^{2,*}

¹School of Physical Education, Shaoguan University, Shaoguan, Guangdong, China

²Jiangsu Vocational College of Electronics and Information, Huai'an, Jiangsu, China

*Corresponding Author

Abstract: This paper uses the methods of literature, questionnaire, interview and mathematical statistics to analyze the current situation of competence in five aspects: responsibility, organization and leadership, communication and coordination, inquiry and thinking, professional knowledge and skill mastery of mass basketball coaches in Guangzhou.

Keywords: Mass basketball; Coaches; Competent status quo

1. INTRODUCTION

Basketball is one of the sports which is easy to carry out and loved by the people. With the rapid increase of basketball population, it also reveals the great contradiction between the increasing demand of basketball culture and the present situation of the people. Especially, the low teaching level of the mass basketball coaches has become one of the main factors restricting the improvement of the mass basketball level. Therefore, it is of great significance to study and discuss the ability factors of the current mass basketball coaches in the course of teaching. To improve the level of mass basketball, we must first improve the quality and ability of coaches [1-3]. Moreover, when the basic conditions of sports training are available, coaches will be extremely important dynamic factors in competitive sports, and the scientific training level of coaches plays an irreplaceable role in the improvement of athletes' achievements and the formation of ideological quality. Therefore, it is of great theoretical value and practical significance to investigate and understand the current situation of mass basketball coaches, to analyze the existing problems and to explore the countermeasures to promote mass basketball.

Competency refers to "personal, potential, deep-seated characteristics that distinguish a person who performs well in a particular job from a person who does not perform well". This research is based on competency model to analyze and study the current situation of competency of Guangzhou mass basketball coaches, and to investigate the level and characteristics of Guangzhou mass basketball coaches competency, in order to provide reference for the management and development of Guangzhou mass basketball coaches, the development of competitive sports, the management of sports organization [4, 5].

2. FRUIT AND ANALYSIS

2.1 Establishment of Competency Factors for Mass Basketball Coaches

Table 1. Summary of the results of establishing competency factors for mass basketball coaches

First order factor	Second order factor
Responsibility	Non-discipline hard role, self-discipline hard role, non-discipline soft role
Organizational leadership	Job-oriented, task-oriented, service-oriented mass basketball players
Communication coordination	Use delegation of authority, use familiarity with people, develop expertise, inspire words and deeds
Inquiry Thinking	Value orientation, experience orientation, theory orientation
Professional knowledge	Profitability of teaching materials, media acquisition, professional training acquisition
Skills acquisition	Skilled, standard, comprehensive skills

Secondly, on the basis of the full research data, 15 experts in the field of science, management and sociology in the field of physical education were interviewed to select and confirm the index. Thirdly, 30 teachers and 30 students who have served as the backbone of basketball option course in colleges and universities were investigated to confirm and verify the index. Finally, the principal component analysis method combined with the maximum rotation of variance was used to carry out exploratory factor analysis to obtain 6 first-order factors and 20 second-order factors (as shown in Table 1).

2.2 Present Situation of Competence of Mass Basketball Coaches in Guangzhou

2.2.1 The responsibilities of Guangzhou mass basketball coaches

Table 2. Statistical table of Guangzhou public basketball coaches' responsibility (N=260)

	Non-legal roles	Self-discipline role
n	76	24
%	76.0	24.0

The investigation on the responsibility status of Guangzhou public basketball coaches can be divided into "heteronomy role" and "self-discipline role". As can be seen in Table 2, Of the 100 respondents, the

responsibility of 76 mass basketball coaches is in the "heteronomy role" level, 76.0 per cent of the total; The remaining 24 mass basketball coaches belong to the "self-discipline role". From which we can see, The overall situation of Guangzhou's public basketball coaches' responsibility is mainly reflected in the heteronomy level, His sense of responsibility basketball coach mainly refers to the basketball coach in the completion of their own job tasks, You have to rely on outside or other people's power to do your job. Under the relationship between teachers and students, coaches usually perform teaching tasks, and in the course of teaching they are not bound by any laws or regulations, nor are they required by social thought and morality. Therefore, they do not show a strong sense of responsibility of self-discipline as long as they complete their teaching schedule and teaching tasks.

2.2.2 The current situation of organization and leadership of mass basketball coaches in Guangzhou
Table 3. The current situation of organization and leadership of MASS basketball coaches (N=260)

Request orientation	Practice task orientation	Serving the Public Basketball Player
n 138	96	26
% 53	37	10

Mass basketball coaches need to play an organizational and leadership role in the post, leading the mass basketball enthusiasts to complete the teaching task, so that the students who love basketball can be integrated into a team in a faster time. There are three main types of competence in the organization and leadership of Guangzhou's mass basketball coaches: 56.0% of the applicants, 33.0% of the exercises, and 11.0% of the others. First of all, the mass basketball coaches who take the direction of the Party's request as the direction of the organization and leadership are basically teaching the students' athletes according to the tasks put forward by the Party, although they can meet the requirements of their superiors very well, but in the teaching process they are rather rigid and not targeted. Secondly, they are organized and led by the exercise task. This part of the mass basketball coaches mainly takes the exercise task as the teaching task and teach the students and athletes. Finally, in order to serve the public basketball players as the principle of organizing teaching, this part of the coaches in contact with student athletes, according to the actual situation of everyone to carry out targeted teaching, although so, but sometimes there are teaching tasks cannot be completed on time and so on.

According to the survey in Table 3, the organizational leadership characteristics of mass basketball coaches are mainly demand orientation and practice task orientation, accounting for 56.0% and 33.0% respectively, while the service of mass basketball players is less, accounting for only 11.0%. reflects the current situation of the organization and leadership of

the mass basketball players from authority or task-oriented, rather than people-oriented service-oriented characteristics.

Communication and Coordination 1.2.3 Guangzhou Mass Basketball Coaches

Table 4. Statistical table of communication and coordination status of mass basketball coaches (N=260)

Use authority	Use of familiarity	Expertise	Encouraging words and deeds
n 93	78	60	29
% 36	30	23	11

Table 4 shows that 36% of coaches choose to use the method of authorization, 30.0% choose to use the familiar interpersonal circle, 23%, and 29, 11%. On the whole, the communication and coordination of the competence of mass basketball coaches is mainly to use the authorization of the applicant and the use of the original familiar interpersonal circle, rather than rely on their own personal ability, in the communication with the mass basketball players is lacking.

2.2.3 The present situation of professional skills of mass basketball coaches in Guangzhou

Table 5. Statistical table of professional and skill status of basketball coaches in Guangzhou (N=260)

Professional knowledge			Skills acquisition		
Access to materials	Media access	Professional training received	Skill ed	Skills specificat ion	Skills comprehensive
n 88	84	88	133	96	31
%34.0	32.0	34.0	51	37	12

The survey shows that the professional knowledge of mass basketball coaches mainly comes from the acquisition of teaching materials, media access and participation in professional training, accounting for 34%, 32.0%, 34.0%, respectively, as Table 5. It shows that the mass basketball coaches have a relatively average acquisition of professional knowledge, in addition to participating in professional training to obtain professional knowledge of teaching ability, but also pay attention to the media or reading basketball textbooks to obtain relevant knowledge.

From the aspect of skill mastery, the skill competence of mass basketball coaches is manifested as skill proficiency, skill standard and skill comprehensive type, among which skill proficiency and skill standard are the main types, accounting for 51% and 37% respectively. However, in the survey, it was found that only a few coaches had comprehensive skills, accounting for 12%. The main reason was that Guangzhou Volkswagen basketball coaches had less comprehensive training in professional basketball knowledge and skills.

3. COUNTERMEASURES TO IMPROVE COMPETENCY OF GUANGZHOU MASS

BASKETBALL COACHES

3.1 Increased Sense of Responsibility of Mass Basketball Coaches

Public basketball coaches should have a strong sense of responsibility, in training students, not only to teach basketball skills, but also to improve their sports ethics and psychological quality, coaches should pay more attention to the players, to care about the lives of students, so as to enhance the students trust in coaches, can improve the basketball ability of students, so as to play the greatest value of basketball coaches. In training basketball coaches, we need to improve their sense of responsibility, coaches need to invest more love, in the process of training, coaches should love students, but also set training goals for students, in the guidance of students, to make them have the correct ideas of competitive sports, improve the understanding of basketball, in the process of training, skills is important, but through the right way to win, students cannot opportunistic, must have good sports virtue. Coaches also need to lead by example, to set a good example, in the process of daily training, coaches should take effective training methods, but also strengthen the management of students.

3.2 Improved Organizational Leadership of Mass Basketball Players

As a mass basketball coach, the students are from all levels of society, so we must have a strong organizational and leadership ability to successfully form a system of players. Therefore, when leading the whole team, the public basketball coaches should not only show their authority in the teaching of professional basketball knowledge, but also care about and pay attention to the dynamics of each player's knowledge and life in the process of teaching, and create emotion harmoniously between the players, and guide them to learn basketball in a relatively pleasant environment. In addition, we should be able to deal with all kinds of emergencies in training and competition at ordinary times, when unfair punishment of the players in peacetime, while comforting the players but also to a certain extent to affect the referee, if there is a fight and fight, while dissuading the players, but also to make some measures to protect the players; to encourage more, but also fair and just punishment, to avoid fighting and other similar things happen again.

3.3 Improved Communication and Coordination Skills of Mass Basketball Coaches

Basketball coaches should show their better coordination and communication skills in the team. Basketball is a multi-person adversarial group activity, especially the composition of the mass basketball team. Although the starting point of the team is because they like and love basketball, but because of the different levels from all walks of life and all ages, each player's character, skill mastery, ability to resist pressure and performance are quite different, so in the

normal teaching, training, competition process, there will often be mutual questioning, mutual viewing or even mutual attacks, usually at these times, coaches out to coordinate. Therefore, coaches should have good communication and coordination ability. First of all, coaches should learn how to treat people sincerely and think from each other's point of view in the stage of continuous self-learning and self-adding. At the same time, they should pay close attention to the habits and mentality of each player.

3.4 Improvement of Professional Skills of Mass Basketball Coaches

Modern popular basketball coaches not only have comprehensive technology, professional level, rich and systematic professional theoretical knowledge and basic theoretical knowledge, but also have rich practical experience. First of all, basketball coaches should master the basic skills and tactics, for example, to be familiar with and standardize the basic basketball operations such as moving, passing, pitching, defending, etc. Only when the coaches have a good grasp of the skills and tactics, can the basic basketball movements and skills be displayed to the students in the course of teaching. Secondly, coaches should improve their comprehensive ability in continuous learning, only to maintain the mentality of lifelong learning, in the work can continue to self-value-added, at the same time their own advanced ideas, skills to teach students; Finally, coaches should constantly improve their physical training ability. In basketball teaching, besides teaching players about basketball movements, skills and tactics, they are not rich enough in physical strength, coordination, agility, etc. Therefore, mass basketball coaches should constantly study the specific methods and means of basketball specialized physical training, so as to solve the bottleneck of basketball team and mass basketball players development more effectively.

4. CONCLUSION

The competency factors of mass basketball coaches include six aspects: responsibility, organization and leadership, communication and coordination, inquiry and thinking, professional knowledge and skill mastery. The present situation of mass basketball coaches' responsibility is mainly "hegemonical role "; the present situation of coaches' organization and leadership is mainly oriented by candidates' requirements and practice task orientation; the present situation of mass basketball coaches' communication and coordination is mainly to use candidates' authorization and use the original familiar interpersonal circle; the professional knowledge of coaches is relatively rich, the way to obtain professional knowledge is composed of teaching materials, media, professional training, etc.; the skill competence of Guangzhou mass basketball coaches is characterized by proficiency, skill norm and skill comprehensiveness, among which skills proficiency and skill norm are the main types.

REFERENCES

- [1]Chen Guohua, "Compilation and Test of Competency Assessment Scale for Taekwondo Coaches." *Journal of Hebei Institute of Physical Education*, 2013(4):75-78.
- [2]Faye Wong, "A study of competency models." *Journal of Jilin Institute of Education* 2011(23):138-140.
- [3]Wang Fengyan; Zheng Hong, "Discussion on

Types and Levels of Responsibility." <http://www.doc88.com/p-6952030499211.html>.

- [4]Wei Lixin, "Give full play to the role of sports backbone in physical education." *Journal of Qiongzhou University*, 2003(6):100-101.
- [5]Yin Jun, "A Study on the Knowledge Structure of Excellent Coaches in Some Projects in China." *Journal of Wuhan Institute of Physical Education*, 2000(1):41-44.

Research on The Application Prospect of Intelligent Logistics Under Internet Plus

Na Liu

Human Resources Office, Zibo Vocational Institute, Zibo 255314, Shandong, China

Abstract: In recent years, with the development of information technology in the world, the application of the Internet in all walks of life has gradually increased. Because the use of the Internet is not limited by age, after the accumulation of time, various derivative industries based on the Internet have also been greatly improved. At present, online shopping has gradually become an indispensable part of our life, and with the advent of the era of online shopping, With the rise of the logistics industry, more and more logistics companies provide strong and powerful support for China's economic development. However, with the development of the logistics industry, we find that there are still many deficiencies in its work process, which affect the pace of China's sustainable development. Therefore, based on the current logistics industry, this paper carefully analyzes the future of the logistics industry in the Internet era, and put forward relevant suggestions to promote China's economic development. This article is for reference only.

Keywords: Internet Plus; Logistics Development; Application Prospect; Intelligent Research

1. INTRODUCTION

With the development of science and technology, the function of the Internet is also increasing, which not only promotes the economic development of our country, but also brings great pressure to various traditional industries. If we want to catch up with the trend of the times and attract people's eyes, we must strengthen the close cooperation with the Internet and carry out the transformation and optimization of the existing production mode. Therefore, for the logistics industry, to accelerate the development of the logistics industry, we must the intelligent construction of the body is the most important task at present. At present, many regions in China still use the traditional logistics mode. The overall work efficiency is relatively low, and there is a lack of effective work system planning. In the process of work, various problems often occur, resulting in the loss of reputation of logistics enterprises.

2. ANALYSIS OF INTELLIGENT LOGISTICS

The logistics industry has a long history in China, but the concept of intelligent logistics didn't appear in China until 2009. It is a relatively new concept of logistics, which has made great changes to the existing logistics industry at that time. Through the wisdom of the logistics industry, it can have a

stronger perception ability, effectively deal with various problems, and in this process, it can also self the intelligent logistics system also has the ability of independent learning and growth. It can carry out a real-time management of all kinds of goods at work, effectively control every link of them, and put an end to all kinds of mistakes. If you want to complete all the above work, the traditional logistics mode will certainly not be able to To meet its needs, it is necessary to increase the application of the Internet, and complete the transmission of various information through the convenient and quick features of the Internet, so as to promote the work efficiency of the logistics industry, and make it have the characteristics of controllability, networking, automation, visualization and intelligence [1].

The reason why intelligent logistics has strong competitiveness is mainly because it has the following three characteristics: first, it has strong incorporation, because intelligent logistics is based on the Internet, so it can use the characteristics of the Internet to obtain a lot of information. Then there is the modern information and sensor technology. In the traditional logistics mode, the inventory and proofreading of goods need to be done manually. The huge workload makes the logistics enterprise have to increase the number of workers in the enterprise, otherwise the work efficiency cannot be guaranteed, and the emergence of intelligent material flow system changes this situation. In the cargo inventory work, the intelligent mode has no Compared with the comparable work efficiency, at the same time, it also reduces the probability of all kinds of errors. In this way, our burden on capital will be greatly reduced, and the benefits we reap will increase continuously. Moreover, due to the reduction of the error rate, the customer experience will also be enhanced, which is a favorable condition for the improvement of the core competitiveness of enterprises. Finally, we use the characteristics of the Internet to complete the production and distribution of goods. In the traditional logistics mode, we often encounter the phenomenon of express delivery loss, which is often caused by the loss of goods in transit, but there is no way. The artificial distribution mode cannot eliminate this phenomenon at all, while the intelligent system is different. By strengthening enterprises and customers in addition, in the controllable, intelligent, systematic, intuitive and automatic intelligent logistics, the most direct contact with the public should be automation,

intelligence and informatization. In the whole logistics, the most direct contact with the public should be automation, intelligence and informatization in the process, the express delivery personnel only participate in the final distribution work, but only through this distribution work, customers can feel the intelligent convenience. Through the division of logistics information, the logistics system will automatically divide all kinds of items to facilitate the express delivery work [2].

3. THE CURRENT SITUATION OF INTERNET PLUS INTELLIGENT LOGISTICS IN CHINA

Although our country's logistics work has a relatively large scale of industry, there are still many deficiencies compared with western developed countries. First, the most prominent point is the application of logistics industry informatization. Due to the late start of China's economic development and the lack of corresponding hardware facilities, China's Internet popularization has been unable to achieve effective development. In order to improve the information level of the logistics industry, the Internet is an essential basic support, so the traditional logistics mode has a greater disadvantage on the basis of hardware. Nowadays, China's economic level has been greatly improved, and enterprises have joined the field of logistics, which leads to huge competitive pressure in the whole industry. Logistics companies and e-commerce enterprises often cause disputes for various reasons, which is bad news for the traditional logistics industry. At present, logistics enterprises have built a relatively large information platform, strong the large data system has effectively improved the working efficiency of the logistics industry, and the intelligent logistics has begun to take shape. This competitive environment is likely to cause data and information loopholes, which will affect people's information security. Therefore, in recent years, China has continuously strengthened the construction of information security, and made the behavioral standards of the logistics industry by improving the corresponding laws and regulations. Standardize, improve the competitive atmosphere of logistics industry, and speed up the construction of intelligent

logistics.

4. PROSPECTS FOR INTELLIGENT LOGISTICS IN THE INTERNET PLUS CONTEXT

As far as the current situation of logistics in China is concerned, most enterprises are excessively inclined to the change of internal resources, which is not desirable for the current competitive environment. To strengthen their work efficiency, we need to consider from a larger perspective. The most important thing in the logistics industry is customer satisfaction. To improve satisfaction and strengthen the contact with users is undoubtedly a effective strategy: in the logistics work, we should pay attention to the communication with users, strengthen the collection of information, constantly increase the information storage in the database, and provide basic information support for the development of intelligent logistics. At the same time, we should strengthen the application of Internet technology and mobile technology. In the future, it will belong to the era of Internet. Through the combination of the two, we will be able to Collection will also be more convenient [3].

5. CONCLUSION

At present, the Internet has been widely spread in China. The intelligent logistics based on the Internet plus is gradually being known to the public, and because of its strong advantages, it is loved by the vast majority of the people. However, due to the fact that its own system construction is not yet perfect, it still needs to strengthen its construction work.

REFERENCE

- [1]Wu Ping, "New energy, situation and path of intelligent logistics development in the context of Internet plus." *business age* 2018, 000 (007): 81-83.
- [2]Song Xin, "Becoming the beauty of logistics with the power of wisdom- Research on the application and development of China's intelligent logistics." *China Urban Finance*, 2018 (9): 68-70.
- [3]Li Xiaoting, "Research on application and development prospect of unmanned warehouse in modern logistics system based on SWOT analysis." *Mall modernization*, 2018, no.873 (12): 49-51.

Application of Automatic Foam Deliquification Technology in Natural Gas Wells

Tong Liu, Wei Lei, LinYu Yao, WanShu Huang, Jie Ni, ZheJun Zhao

Petroleum Engineering Technology Institute, Sinopec Southwest Oil & Gas Branch, Deyang 618000, Sichuan, China

Abstract: Aiming at the problems of traditional artificial foam deliquification methods, such as high intensity of labor, low frequency of injection and poor management, first, the automatic injection process of foam deliquification is designed. Secondly, the remote monitoring software of injection device is developed, and 3 operation modes, manual injection, automatic timing injection and intelligent injection, are put forward. Then, according to different well station conditions, three series of automatic foam injection devices were developed. Since 2019, the device has been applied in 16 wells in the old area of Western Sichuan, with 2374 times of automatic operation and 18.79881 million cubic meters of natural gas produced. Compared with the previous artificial work, the gas production has increased by about 10%. The labor cost has been saved by 486000 yuan. The cost has been reduced and the efficiency has been increased significantly. At most, the automatic round injection of 8 wells by one pump has been realized, creating the four records of “automation, intelligence, network connection and 8 branches” in western Sichuan. The application shows that the device has the functions of intelligent injection, remote transmission and remote control, automatic alarm, multi well round injection, multi-source power supply, portable and so on. It can meet the requirements of intelligent foam injection operation for unattended wells, cluster well groups and remote wells. It has potential to be popularized in gas well deliquification.

Keywords: Natural Gas Well; Deliquification; Automatic; Intelligent

1. INTRODUCTION

In the middle and later period of gas well exploitation, the bottom hole liquid accumulation will occur due to the low liquid carrying capacity, which will cause the gas well death. Foam deliquification technology is an effective way to unload gas well liquid and maintain production stable. It is the most widely used technology in all kinds of deliquification. Taking the West Sichuan gas field as an example, about 80% of the 1500 production wells need foam deliquification to maintain stable production. There are some problems in the traditional methods of artificial identification of liquid accumulation and artificial

foam deliquification [1-6]. The traditional methods include not timely warning of liquid accumulation, high labor intensity, failure to maintain stable production of gas wells, frequent vehicle utilization and manual operation, which increase operation cost and safety risk, reduce the application effect of foam technology, and restrict the improvement of gas reservoir recovery.

The process of automatic foam injection is designed, the decision-making software of remote monitoring for foam injection is developed, and 3 operation modes of manual injection, automatic timing injection and intelligent injection are put forward, and the automatic safety protection system of foam injection is provided. The single well automatic injection device, cluster well automatic wheel well injection device and self-generation automatic injection device are developed. The mode of unattended, safe and efficient operation is formed, which improves gas well production and reduces operation cost.

2. DESIGN OF AUTOMATIC INJECTION DEVICE

The automatic injection process of foam deliquification is designed, the hardware of automatic control system is matched, the remote monitoring and decision-making software is developed, the safety system is integrated, and the design scheme of automatic injection device is formed.

2.1 Device Principle

The automatic injection device for gas deliquification in gas well is composed of a storage device, a power system and a control system. It includes liquid storage tanks, agitators, liquid level meters, pressure sensors, high pressure pumps, motors, various pipelines, valves, control cabinets, and wireless receivers. The device is installed at the wellhead of the gas well. Under the command of the control cabinet, the foam agent in the liquid storage tank is automatically pumped by the high-pressure pump. It automatically filled into the gas well through the injection valve and the single flow valve. The parameters such as the injection pressure, the liquid level of the tank and the wellhead pressure are collected in real time. For cluster wells with many wells, multiple wells can be automatically rotated. For remote wells without commercial power, photovoltaic products can be used for off grid power supply. In order to facilitate centralized management of the central station, remote monitoring can be

carried out by using computer or mobile app. Instructions can also be sent through remote automatic decision-making software to meet the needs of remote automatic and intelligent foam injection for single well, cluster well and remote well.

2.2 Automatic Control System

During the operation of the system, the control software sends the control command to the frequency converter of PLC controller through different signal transmission modes. The frequency converter is closed and the plunger pump is opened. The switching value feeds back the opening state of the plunger pump to the control software, and the control software displays on the interface that the plunger pump is opened. When the plunger pump stops running, the control software will send out the command of power off or pump stop. After the PLC controller receives the command, the relay will be disconnected and the plunger pump will stop. After the switch value receives the instruction of power off or pump stop, the command will be fed back to the control software, and the control software will display that the plunger pump has stopped on the interface.

2.3 Remote Monitoring Decision Software

The decision-making software of remote monitoring is developed by using C# programming language. On the one hand, it is used for real-time monitoring of injection pressure, tank level, displacement and other equipment parameters. On the other hand, it controls the start and stop of pump by remote command. There are three control modes:

2.3.1 Manual control. manually control the start / stop of the pump;

2.3.2 Automatic control. time control the start / stop of the pump, set the automatic filling time interval, filling time, single filling amount, etc.

2.3.3 Intelligent control. online diagnosis of fluid accumulation and automatic sending of control command to the equipment to control the start / stop of the pump. On the basis of traditional casing differential pressure diagnosis of liquid accumulation, an analytical method of liquid accumulation depth based on five indexes, such as flow pattern and liquid holding rate, is established to form multi index liquid accumulation on-line digital diagnosis technology. An on-line early-warning software for liquid accumulation in gas wells is developed to automatically prompt the liquid accumulation in wells and shafts. It solves the problem of large error in single index identification of liquid accumulation. The accuracy of on-line early-warning for liquid accumulation is $\geq 90\%$.

2.4 Safety System

Overpressure, low liquid level, and overload protection are the key to ensure the safe operation of automatic foam deliquification process. When the outlet pressure of the pump is too high, it is required to stop the pump automatically to prevent the pipeline

from bursting. When the liquid level of the medicine tank is too low, it is required to stop the pump automatically to prevent the pump from idling. When the starting current of the pump is overloaded, it is also required to stop the pump automatically. If necessary, it is required to increase combustible gas alarm and temperature monitoring to ensure the safe operation of the equipment.

2.5 Technical Characteristics

The automatic injection mode based on the online digital diagnosis technology of multi index liquid accumulation can improve the injection efficiency, and improve the gas well production and life;

The mode of multi well automatic round injection greatly reduces the cost of cluster well foam deliquification;

The remote well automatic injection mode based on photovoltaic products can solve the problem of automatic foam deliquification of remote wells without power supply;

It can be used not only to automatically add foam agent to gas wells, but also to automatically add defoamer to surface pipelines;

The displacement of the equipment is variable, the injection system is adjustable, the continuous working time is long, anti-theft, rainproof, etc. It also has the alarm cut-off functions of low liquid level, overpressure, overload, etc. The on-site inspection is safe and reliable;

Save labor, equipment and operation cost to the maximum extent. Eliminate the leakage and leakage caused by manual operation and personnel safety risk. Realize remote, fine and centralized management of gas wells.

3. DEVELOPMENT OF AUTOMATIC INJECTION DEVICE

Three series of products have been developed: gcy-pp-02 single well automatic injection device, gcy-pp-03 cluster well automatic injection device and gcy-pp-04 self-generating automatic injection device. The working pressure of high-pressure pump is $0 \sim 25\text{MPa}$, the displacement is $15\text{-}900\text{L/h}$, the volume of storage tank is $1\text{-}5\text{ m}^3$, the explosion-proof level is ExdIIBT4, the wireless network interface is 4G, and the working medium is foaming agent or defoamer.

3.1 Single Well Automatic Agent Injection Device

Gcy-pp-02 single well automatic injection device is designed and developed. It can automatically, regularly and quantitatively inject foaming agent into a single gas well. It also has intelligent injection function, i.e. automatic diagnosis of liquid accumulation, automatic early warning, automatic decision-making, adaptive injection based on the change of liquid accumulation. It is suitable for the unattended single well that needs intermittent injection or continuous injection of foam, as shown in Figure 1.



Figure 1. GCY-PP-02 intelligent agent injection device of single well

3.2 Cluster Well Automatic Agent Injection Device

In view of the problems such as high labor intensity, low injection efficiency, and many potential safety hazards in cluster well foam injection, gcy-pp-03 cluster well automatic injection device is designed. It developed to meet the requirements of automatic, timed and quantitative injection of multiple wells by one pump under the well factory mode. The biggest advantage of the equipment is that the more cluster wells are used, the more obvious the cost reduction is. When the equipment is used in 6 wells at the same time, compared with the traditional pump, the cost reduction of the equipment can reach 75%.

Furthermore, a portable assembly structure is proposed to solve the problems of heavy weight, high transportation cost in mountainous areas. The pump module, valve module and control module are separately set in the corresponding cabinet. The fast connection and assembly are realized between different cabinets through the quick plug connector. It reduces the handling cost of the device, shortens the installation cycle of the device, and avoids the shutdown of the gas production process caused by the maintenance of the device, as shown in Figure 2. The weight of the device is only 200 kg, and the weight of a single module is about 50 kg.



Figure 2. GCY-PP-03 automatic agent injection device of cluster well

3.3 Automatic Agent Injection Device of Self Generation

Aiming at the problems of foam deliquification in remote areas, such as no electricity supply, scattered well location, gcy-pp-04 automatic injection device of self-generation is designed and developed. It is on the basis of gcy-pp-02 automatic injection device of single well. Solar energy power, wind energy power, anti-theft and heat preservation functions are added.

It meets the requirements of automatic injection, small dose, intermittent injection of foaming agent, as shown in Figure 3.



Figure 3. GCY-PP-04 self-generation intelligent injection device

4. FIELD APPLICATION

Since 2019, the devices have been used in 16 wells in West Sichuan gas field, accumulating 2374 wells automatically, and accumulating 18.79881 million cubic meters of natural gas. Compared with the previous artificial foam injection, the production increased by about 10%. The cost of artificial foam deliquification was 486 thousand yuan, which reduced the cost and efficiency. During the operation period, the hidden danger was prompted 17 times, and the automatic alarm was cut off 13 times. It creates four records of "automation, intelligence, networking and 8 branches" of foam deliquification in West Sichuan gas field, achieving significant economic benefits. It improves the fine, safe, efficient and human management level of gas well deliquification.

4.1 Automatic Foam deliquification Test of Well Js203-7hf

Well x203-7hf is located in a horizontal well in the east of West Sichuan depression, West Sichuan, with a depth of 1830m. The inner diameter of tubing string is 62mm. Before the test, the production is maintained by injecting foam with truck. The injection cycle is twice a week, with each injection of 15kg of foaming agent. The ratio of foaming agent and water is 1:10. Due to the high labor intensity, the manual filling frequency does not meet the needs of deliquification.

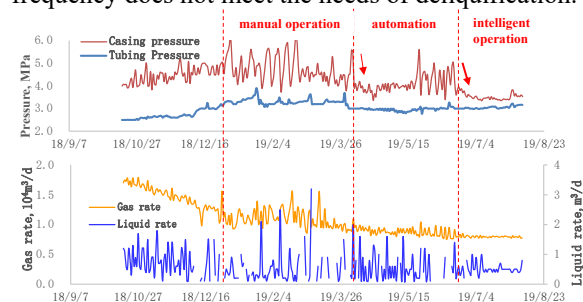


Figure 4. Intelligent injection test of js203-7hf well

On April 3, 2019, gcy-pp-02 single well automatic agent injection device was adopted. The foam

injection cycle was shortened from 4-5 days to 2 days. The casing pressure difference was reduced from 1.33MPa to 0.78MPa. The production decline rate was reduced from 643m³/month to 460m³/month. On June 22, the intelligent foam deliquification was tested, the foam injection cycle was adjusted adaptively, the casing pressure difference was further controlled from 0.78MPa to 0.39MPa. The production decline rate was further reduced from 460m³/month to 191m³/month, the foam injection is more continuous and the gas production is more stable. The casing pressure difference of the well is sensitive to the influence of liquid accumulation, and the intelligent injection mode has higher efficiency. See Figure 4 for the production curve of foam deliquification in three stages of the well.

4.2 Wheel Injection Test of Automatic Foam deliquification In Well Station x886

There are four wells x886, x887, x890 and X51 in x886 gas gathering station, which were put into production before September 10, 2006. They have been in low pressure and low production for a long time, and there is a lot of liquid in the wellbore. The way of daily feeding of solid foam rod and injecting 10 kg liquid foam agent every 3-5 days (ratio 1:15) is adopted to maintain stable production, with high frequency of foam injection and high labor intensity.

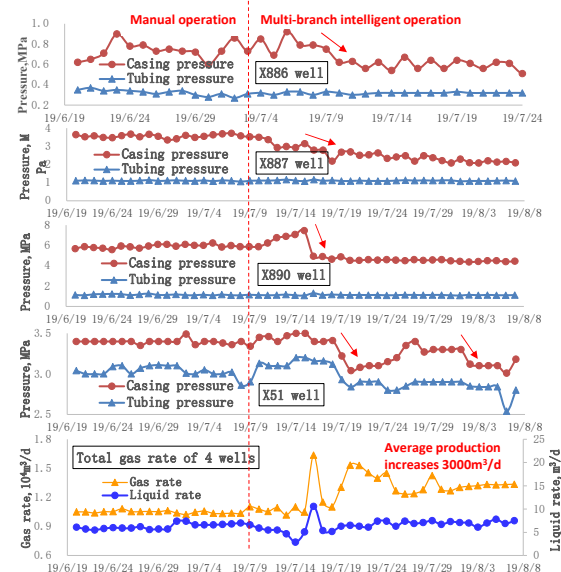


Figure 5. Automatic alternate injection test of X886 well station

On July 9, 2019, after the gcy-pp-03 cluster well automatic agent injection device was adopted, the tubing casing pressure difference of the four wells decreased from 0.45MPa to 0.27MPa, 2.45mpa to 1.0MPa, 4.78mpa to 3.3Mpa, 0.44Mpa to 0.3MPa. The combined gas production increased from

1.0365×104m³/d to 1.3357×104m³/d, the combined water transportation increased from 5.8m³/d to 6.5m³/d, and the average production increased by about 3000m³/d, as shown in Figure 5. At the same time, the injection times of the truck have been reduced nearly 200. The cost of labor operation saved about 120000 yuan. One pump saves land area and equipment investment for multiple wells, the equipment can be reused for a long time once put into use. Each well will save about 62800 yuan of vehicle injection operation cost every year. The technology has been successfully applied in 8 wells of L111 well station recently, which has created a record of one pump injection in 8 wells in Western Sichuan.

5. CONCLUSION

The automatic foam deliquification device has the functions of intelligent filling, remote transmission and remote control, automatic alarm, multi well wheel injection, multi-source power supply, portable and portable functions. It satisfies the unattended, safe and efficient working mode of foam deliquification.

The device has been successfully applied in 16 gas wells of West Sichuan gas field. The operation is stable and the production is increased, which verifies the reliability of the device.

The device can meet the requirements of unattended well, cluster well group and remote well automatic foam injection operation. It has potential to be popularized in gas well deliquification.

REFERENCE

- [1]Zhu Xun, Zhang Yabin, Feng Pengxin, et al, "Research and application of digital drainage gas production system in Sulige gas field." Drilling and production technology, 2014, 37 (1): 47-49.
- [2]Zhang bailing, Zhou Jing, "Application of foam deliquification technology in new tight sandstone gas reservoir." natural gas industry, 2003, 22 (3): 126-129.
- [3]Gan Zhenwei, "Theoretical innovation and technical progress support leading the construction of 10 billion gas fields." Natural gas industry, 2016, 36 (12): 1-9.
- [4]Li Shilun, "Natural gas engineering." Second edition. Beijing: Petroleum Industry Press, 2008:225-226.
- [5]LEA J F, NICKENS H V, WELLS M R, "Gaswell deliquification."Second Edition. Gulf Professional Publishing, 2008:232-235.
- [6]Zhu Qingjie, Bi Wei, Guo Wenmin, "Application of digital drainage gas production technology in gas field." Oil and gas field surface engineering, 2015, 34 (12): 83-84.

Analysis on Three Women's fate in *Absalom, Absalom!* From the Perspective of Patriarchal Culture

Fang Xiang

School of Foreign Languages and Cultures, LeShan Normal University, LeShan, Sichuan, China

Abstract: Patriarchal culture prevailed in the old south, and exerted a great influence on the southern life, especially on women's life. In the novel, *Ellen, Rosa and Judith*, they suffered the infliction of their fate which was mainly ordained by the patriarchal society. Therefore, this thesis tries to analyze the fate of *Ellen, Rosa and Judith* from the perspective of patriarchal culture, and reveals how tragic their life is, through which it also shows how the patriarchal culture tortured and twisted women.

Keywords: Patriarchal Culture; Fate; Marriage

1. INTRODUCTION

The great novel *Absalom, Absalom* relates a story of Sutpen's ambitious and unscrupulous design to establish a pure white dynasty consisting of a manor, a son and the slaves, but the design failed with the fratricide and his death. Critics pay a lot of attention to the narrative art, the narration art, class consciousness, and the racial problem in this novel. Brooks (1982) analyzed the incredulous narration in the novel. Arthur L. Scott (1954) pointed that *Absalom, Absalom* is a fictional experiment in time and space, especially it resembles two earlier art movement: Cubism and Futurism (1954). Justus (1962) argued that *Absalom* is more an epic than a tragedy from analysis on the four aspects: high seriousness, amplitude, a control equal to the material, and a choric quality. Aswell (1968) pointed out the central theme in the novel is the mystery of human contact and man's futile but compulsive efforts to control, limit, define, explain, and conquer that mystery and representing a radical questioning of the ability of the human mind to deal adequately with its own experience. Rollyson, Jr. (1977) analyzed this novel from the historical perspective. Edenfield (1999) claimed that Rosa designed to fulfill her role in the family. Lazure (2009) analyzed that Rosa tried to fulfill the role as a mother. In the novel, the three women *Ellen, Rosa and Judith* grew and lived in the south, and suffered a lot in their lives [1-8]. This thesis tries to explore the reason that led to the tragic fate of the three women.

2. ELLEN'S EMPTY LIFE

In the south, the plantation economy is the basis for the patriarchal culture.

Southern society was almost from the outset a family-centered society. Indeed, in the Old South the

patriarchal family typified to a large extent the proper relations between ruler and ruled and so supplied the primal model for social organization and political government. Father and master in one, the slaveholding planter of prewar South was the source and locus of power: as paterfamilias, he claimed full authority over wife and children. (Bleikasten, 1996, p. 156)

Accordingly, Women are subordinate to men in economy and social status, and can only gain their own identity through the marriage. Bearing children and raising children are their main tasks in the marriage. Sutpen's great ambition to establish a pure white dynasty with a manor, a son, a wife is in fact a world of patriarchy. In the marriage, *Ellen* is more of a shadow than a real flesh. Her life is void and empty. *Ellen's* marriage to Sutpen is a business exchange between Sutpen and her father Mr. Coldfield. Though Sutpen built a big mansion, he was still disdained by the residents in the town, because he was a stranger here and didn't have a name. Marriage to Sutpen is a part of his design of a big plan. "Then he needed respectability, the shield of a virtuous woman, to make his position impregnable against the men who had given him protection on that inevitable day and hour when even they must rise against him in scorn and horror and outrage." (Faulkner, 2013, p. 8) Marrying *Ellen* is a way for Sutpen to eliminate his disgraceful past and establish his status and reputation in the town, for *Ellen's* father, Mr. Coldfield who possessed a good reputation of integrity in the town. *Ellen* was just a trade object between her father and Sutpen. The detail of the mysterious trade is not related in the novel, but Sutpen won *Ellen* and gained a massive wealth from the trade, and Mr. Coldfield refused to accept part of the profits he deserved in the trade which he thought might ruin his reputation in the town. "When Goodhue and Sutpen trade whatever they supposedly trade-swapping, it appears, the merchant's credit for the pistol-toting upstart's bravado-they also trade *Ellen*." (Parker, 1996, p. 240) It's hard to explain why Coldfield accepted Sutpen's proposal, at least Mr. Coldfield foresaw Sutpen's prosperous future and *Ellen* would marry the wealth though he also looked down upon this man without name and history in the town. Just as Rosa said "Yes, blind romantic fool, who did not even have that hundred miles of plantation which apparently moved our father nor that big house

and the notion of slaves under foot day and night.” (Faulkner, 2013, p. 9) Their father was attracted by the great land Sutpen owned, so he agreed this marriage. Therefore, this marriage relieved Mr. Coldfield of the family burden, and also established a good reputation for Sutpen. Ellen’s marriage became a counter and helped the two men reach their own aim. In this respect, Mr. Coldfield had an absolute power on Ellen’s marriage. Obviously, this reflected the patriarchal system in the south where the father claimed all power on everything in the family, including the children’s marriage. In the marriage, Ellen was invisible to Sutpen. Sutpen was indulged in his own way of entertainment, like going out to drink or fighting with the Negroes for fun. While Ellen was paralyzed in this affluent life provided by Sutpen who “had corrupted Ellen to more than renegadery, though.” (Faulkner, 2013, p. 55) “The woman then rose like the swamp-hatched butterfly, unimpeded by weight of stomach and all the heavy organs of suffering and experience, into a perennial bright vacuum of arrested sun.” (Faulkner, 2013, p. 53) Ellen was compared to the butterfly which symbolized her vanity and brainless. “She had succeeded at last in evacuating not only the puritan heritage but reality itself; had immolated outrageous husband and incomprehensible children into shades; escaped at last into a world of pure illusion in which, safe from any harm, she moved, lived from attitude to attitude against her background of Chatelaine to the largest, wife to the wealthiest, mother of the most fortune.” (Faulkner, 2013, p. 52) It seems Ellen didn’t get the love from Sutpen, and she gradually withdrew into her private world. Ellen was lost in her empty, lonely but affluent life and paid little attention to her own family members. Just like the mother Caroline Compson in the *Sound and Fury*, Ellen didn’t develop an intimate relationship with her children, and seldom showed any love toward them. When she went back to see her father and younger sister, she just “fill it too with that meaningless uproar of vanity, of impossible and foundationless advice about Miss Rosa and her father, about Miss Rosa’s clothes and the arrangement of the furniture and how the food was prepared...” (Faulkner, 2013, p. 56) She was a shallow and selfish woman who was proud of the wealth and prestige provided the family. But the patriarchal family deprived her of her independence and freedom, she was just like a beautiful butterfly, when the calamity fell on the family, she was too fragile to bear and retreated into her own pains, waiting for death just like the butterfly hit onto the wall. “Ellen was dead two years now-the butterfly, the moth caught in a gale and blown against a wall and clinging there beating feebly, not with any particular stubborn clinging to life, not in particular pain since it was too light to have struck hard...” (Faulkner, 2013, p. 65) Ellen’s retreating to her private world and shut herself off from the outside

world was a way for her to escape the responsibility of confronting the misfortune and taking care of her daughter. What’s more, she left the burden of protecting her daughter to her sister Rosa who was 4 years younger than Judith. Just as Mr. Coldfield said “not that it would have been the crushing and crowning blow but that it would have been wasted on her since the clinging moth, even alive, would have been incapable now of feeling anymore of wind or violence.” (Faulkner, 2013, p. 65) In a marriage without love, Ellen became cold and selfish, just like a moth.

3. JUDITH’S TRAGEDY UNDER THE PATRIARCHAL CULTURE

3.1 Judith’s Marriage Being a Way to Reinforce the Reputation for the Family

In Judith’s marriage, Ellen played the patriarchal role to arrange her marriage. In fact, Bon never made a real proposal toward Judith, and the two persons never show any sign of falling in love. But Ellen bragged their engagement around the town and was busy with the preparation for the marriage. “Listening to Ellen, a stranger would have almost believed that the marriage, which subsequent events would indicate had not even been mentioned between the young people and parents, had been actually performed.” (Faulkner, 2013, p. 57) In Ellen’s eyes, Bon represented the wealth, privilege and upper class. This is the reason why she was anxious to declare this engagement. Even in Compson’s eyes, Bon was an elegant and prestigious man. “a young man of worldly elegance and assurance beyond his years, handsome, apparently wealthy...” (Faulkner, 2013, p. 56) “She spoke of Bon as if he were three inanimate objects in one, or perhaps one inanimate object for which she and her family would find three concordant uses: a garment which Judith might wear as she would a riding habit or a ball gown, a piece of furniture which would complement and complete the furnishing of her house and position, and a mentor and example to correct Henry’s provincial manners and speech and clothing.” (Faulkner, 2013, p. 57) To Ellen, the engagement to Bon can add honor to Judith, can further elevate the family’s status and add prestige to the family. Just as her father who took his daughter’s marriage as a trade code in the business, Ellen viewed Judith’s marriage as a way to reinforce the status of the family in the town. “To Ellen, Bon represents the crowning glory of her new-found social position. He would complete the family circle, both as husband to Judith and as mentor to Henry, bringing to Sutpen’s Hundred an elegance and sophistication which mahogany and crystal chandeliers were not sufficient to deliver.” (Ragan, 1987, p. 50)

3.2 Judith’s Marriage as a Way to Realize Bon’s Aim

According to Mr. Compson, Judith’s engagement to Bon helps realizing the union between Bon and Henry. There is a strange relationship between Bon and Henry. Henry was attracted by Bon’s grace and elegant behavior, and imitated Bon’s clothing, behavior and

manners. "Bon who for a year and a half now had been watching Henry ape his clothing and speech, who for a year and a half now had seen himself as the object of that complete and abnegate devotion which only a youth, never a woman, gives to another youth or a man." (Faulkner, 2013, p. 83) "It was because Bon not only loved Judith after his fashion but he loved Henry too and I believe in a deeper sense than merely after his fashion. Perhaps, in his fatalism, he loved Henry the better of the two, seeing perhaps in the sister merely the shadow, the woman vessel with which to consummate the love whose actual object was the youth..." (Faulkner, 2013, p. 84) "Henry's feeling toward Bon has an intensity suggestive of homoeroticism." (Kinney, 1996, p. 185) Both Henry and Bon loved each other, but there is an impassible gap between them, so Judith became the only bond that could connect them. The time spent together by Judith and Bon is very limited, it's impossible for Judith fell in love with Bon in a very short time. But it is the brother Henry induced her to love Bon, and by this he could unite with Bon through the body of his sister. "who for exactly a year now had seen the sister succumb to that same spell which the brother had already succumbed to, and this with no volition on the seducer's part..., as though it actually were the brother who had put the spell on the sister, seduced her to his own vicarious image which walked and breathed with Bon's body." (Faulkner, 2013, p. 83) If Judith married to Bon, that means their love was consummated through Judith who shared the same blood with Henry. Therefore, Judith in their eyes was just a vessel, but not a human being.

While the engagement between Bon and Judith is not the product of love, as Kuaintin said "it's not loves." (Faulkner, 2013, p. 261) According to the conjecture of Shreve and Kuentin, Judith is more like a card than a lover in Bon's hand. This card might force Sutpen to accept him as his son or at least admit their father and son relationship. "But you must marry her? Do you have to do it?" and Bon would say, "He should have told me. He should have told me, myself, himself. I was fair and honorable with him. I waited. You know now why I waited. I have him every chance to tell me himself, but he didn't do it. If he had, I would have agreed and promised never to see her or you or him again. But he didn't tell me. I thought at first it was because he didn't know. Then I knew that he did know, and still I waited..." (Faulkner, 2013, p. 276) If Sutpen acknowledged this relationship, he would withdraw from the engagement with Judith on his own will. "In Shreve's mind, Bon desires getting Sutpen's recognition more than loving Judith." (Kinney, 1996, p. 188) Therefore, the engagement with Judith is like a stake taken by Bon to challenge Sutpen and prove his own identity. "If Sutpen would give any sign to acknowledge him, Bon could give up anything, including his engagement with Judith. This yearning, when

repeatedly frustrated by lack of any sign from Sutpen, turned to an obsession. Indeed, Bon's decision to return to Judith was an act of desperation to force Sutpen into recognizing him." (Kinney, 1996, p. 188)

3.3 Judith's Happiness Being Destroyed by Henry
Henry executed his father's will, played the patriarchal role in his sister's marriage and destroyed this engagement. Until the end of this novel, we discovered that the reason that Henry killed Bon is not because of the dread for incest, but because of Bon's black blood. "He must not marry her, Henry. His mother's father told me that her mother had been a Spanish woman. I believed him; it was not until after he was born that I found out that his mother was part negro." (Faulkner, 2013, p. 288) The conversation revealed that the essential reason that Sutpen refused to acknowledge Bon as his son and absolutely objected to the engagement is Bon's black identity. In order to prevent the miscegenation, Henry killed Bon and Judith's hope and happiness. Judith's fate was manipulated by her mother, brother and father.

Though Judith was stroked as panic and very painful, but she buried the pains in her heart and appeared to be calm. She knew there was something wrong between her father and Bon, after the conversation between her father and Henry, Bon left and Henry gave up his name and the property he would inherit to go with him. After Bon's leaving, Judith never asked her father for any reason and accepted it calmly. "I love, I will accept no substitute; something has happened between him and my father; if my father was right, I will never see him, again, if wrong be will come or send for me; if happy can be I will, if suffer I must I can." She didn't blame his father for disrupting their engagement, and calmly accepted the fact. "she made no effort to do anything else; her relations with her father had not altered one jot; to see them together, Bon might never existed—the same two calm impenetrable faced seen together in the carriage in town during the next few months after Ellen too to her bed..." (Faulkner, 2013, p. 95) Judith was a typical south lady who was compromised to the patriarchal society, obeyed her father and ready to suffer the calamity brought by fate. After the death of Bon, Judith also pretended to be calm and arranged the meal for her aunt Rosa, oversaw the ritual of Bon's bury and learned to keep the farm to support her and Clydie's life.

Judith's marriage became a tool for all the family members. Her mother viewed her marriage with Bon as a way to bring honor to the family, her brother Henry saw her marriage as a way for himself to consummate with Bon through his sister's body, Bon might took the marriage as a conspiracy to challenge Sutpen to confess their real relationship, but at last, in line with his father's will, Henry killed Bon for fear miscegenation might humiliate the whole family. All of them played the role of patriarchy and swayed their dominance on Judith.

4. DISILLUSIONMENT OF ROSA'S DREAM

Rosa was the most tragic woman in the novel. Rosa was also deeply influenced by the patriarchal society, and equated woman's value with the role as a wife and motherhood. She knew she was not attractive to the men, but she also aspired to have a romantic love and a chance to be a mother. "for whom shall say what gnarled forgotten root might not bloom yet with some globed concentrate more globed and concentrate and heady-perfect because the neglected root was planted warped and lay not dead but merely slept forgot?" (Faulkner, 2013, p. 114) Rosa compared herself with the gnarled root, though she was not beautiful, she still had the strong desire to bear children like a normal woman. Rosa placed her value in line with that of the patriarchal system, so when Sutpen came back from the war and proposed to her, she silently accepted this proposal. In fact, her agreement contradicted with her former attitude toward Sutpen. When she was very young, she was deeply influenced by her aunt who treated Sutpen as a demon. Though Rosa had a contempt and hatred toward him, she also showed respect for him when he came from the war. "despite what he might have been at one time and despite what she might have believed or even known about him, had fought for four honorable years for the soil and traditions of the land where she had been born. (and the man who had done that, villain dyed though he be, would have possessed in her eyes, even if only from association with them, the stature and shape of a hero too)" (Faulkner, 2013, p. 122) Living in the patriarchal society where honor, braveness and strength are the code of a hero, Rosa developed a respect for Sutpen, and that's one of the reason that she didn't decline his proposal. Since Rosa related her fulfillment with a marriage and the role as a mother, marrying Sutpen would be one approach to realize her value. The proposal made by Sutpen is presumptuous, without ritual and sincerity, and it is none less than an order from a ruler without any love. Just as Rosa said "it was not love." "an ukase, a decree, a serene and florid boast like a sentence not to be spoken and heard but to be read carved in the bland tone which pediments a forgotten and nameless effigy." (Faulkner, 2013, p. 131) But Rosa still acquiesced to his proposal and she innocently compared herself to the sun and believed the sunshine from her could help Sutpen crawled out of the swamp and darkness and provide him the air and light. "I was the sun... oh, furious mad man, I hold no substance that will fit your dream but I can give you airy space and scope for your delirium." (Faulkner, 2013, p. 135) Rosa naively thought the former devil had died, and the man she faced was an old man who was defeated by the war and by the life. She hoped she could fulfill her role as a woman through helping Sutpen reestablish his mason. She was immersed in this illusion that may be one way to relieve her from the loneliness spiritually and

physically, until one day when Sutpen proposed the rude suggestion that if "they breed together for test and sample and if it was a boy, they would marry." (Faulkner, 2013, p. 143) Sutpen's suggestion revealed the patriarchal value that woman was just a tool for bearing the children. Rosa was shocked by this horrified suggestion, awakened from her dream, and left Sutpen and enclosed herself in her cottage for more than 40 years. Rosa's hopes and future were destroyed when Sutpen gave this filthy suggestion, and Rosa's dignity as a south lady was shattered. To some extent, Rosa's refusal of Sutpen showed her breaking away with the patriarchy for the first time, but her isolation from the community revealed that she tortured and punished herself in line with the value of patriarchal society [5-11].

5. CONCLUSION

The three women in Absalom, Absalom! were typical south ladies, who were bred in the patriarchal family, and their life is more or less determined by their father. Ellen's marriage became a trade between her father and Sutpen, though she led a wealthy life but spiritually barren, she didn't get love from Sutpen and died of lack of love. Judith didn't have any right to voice her true need, her engagement was arranged by her mother who played the role as the father, and her happiness were destroyed both by her father and brother who were against the miscegenation. Rosa's hope and life were destroyed when Sutpen proposed the horrifying suggestion to their marriage, and lived a lonely and miserable life by enclosing herself in the cottage the rest of her life. The patriarchal culture in south is just like a huge chain fastened to the women, determined their fate and tortured them spiritually and physically, and it's futile for them to shatter the fetter of the patriarchal culture though they had tried to break away from it just like Rosa.

REFERENCES

- [1] Aswell, Duncan, "The Puzzling Design of Absalom, Absalom!" The Kenyon Review, 1968, 30:67-84.
- [2] Bleikasten, Andre, "Sutpen as Patriarch // Arthur F. Kinney, ed. Critical Essays on William Faulkner." G.K. Hall & Co, 1996.
- [3] Brooks, Peter, "Incredulous Narration: Absalom, Absalom!": Comparative Literature, 1982, 34(3): 247-268.
- [4] Parker, Robert Dale. "The other coldfields: Gender, Commerce, and the Exchange of Bodies in Absalom, Absalom!"/ Arthur F. Kinney, ed. Critical Essays on William Faulkner. G.K. Hall & Co. 1996.
- [5] Edenfield, Olivia Carr. "Endure and Then Endure": Rosa Coldfield's Search for a Role in William Faulkner's "Absalom, Absalom!": The Southern Literary Journal, 1999, 32(1):57-68.
- [6] Faulkner, William. Absalom, Absalom. Beijing: Central Compilation Press, 2013.
- [7] Justus, James H. "The Epic design of Absalom, Absalom!": Texas Studies in Literature and Language,

1962, 4:157-176.

[8]Jun Liu, The Judith-Henry-Charles Triangle (1996): The Innermost Kernel of Faulkner's Civil War in the Heart. //Arthur F.Kinney, ed. Critical Essays on William Faulkner. G.K.Hall&Co, 1996.

[9]Lazure, Erica Plouffe, "A Literary Motherhood: Rosa Coldfield's Design in Absalom, Absalom!" The

Mississippi Quarterly, 2009, 62(3):479-496

[10]Ragan, David Paul, "William Faulkner's Absalom, Absalom!" a critical study. UMI Research Press, 1987.

[11]Rollyon, Jr., Carl E, "Absalom, Absalom! The Novel as Historiography." Literature and History, 1977, 5:42-54.