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CONTENTS

Research on Intelligent Garbage Can Based on Internet of Things

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ABSTRACT: At present, with the continuous improvement in distributed energy utilisation technology and people's awareness of energy saving and environmental protection, this paper presents a design scheme of an intelligent garbage bin combined with solar street light, and gives the principle of the combination of solar street lamp and intelligent garbage can. The design scheme for intelligent trash, includes garbage box cover automatic switching function, automatic voice prompt function, automatic garbage compression, garbage trunkful detection function and dynamic information acquisition and transmission function. The three principles of the combination of the trash can and the street lamp are: minimise the impact of their own original functions; in line with the surrounding landscape features; use modular design with free separation from each other.
Keywords: Solar energy; Street lamp; Intelligent trash can; ZigBee; Energy saving

1.INTRODUCTION

With the development of distributed energy technology and people's increasing awareness of energy saving and emission reduction, solar lights, as a new energy-efficient lighting tool, are used widely in city lighting systems (Yin, 2014).

Although an indispensable part of city life, there are many problems with trash and its usage process, including the difficulty of cleaning, low space utilisation, poor cleanliness, and so on. That these phenomena exist, fundamentally speaking, is because of the low level of intelligent trash.

However, the cost of improving the intelligence level of the trash can is extremely high. The combination of solar street lamps and trash cans, to a certain extent, can alleviate the above problems. On the one hand, the battery supplying energy for solar street lights and trash cans not only makes full use of solar energy, but also saves the cost of laying out the power grid for the trash can, reducing the operational cost; on the other hand, it may also save the city's layout area of trash can and street lamps.

In China's current cities, there are very few intelligent garbage bins combined with solar street lights (Zicheng, 2013). However, solar street lights and intelligent trash cans are very common; in other words, from a technical point of view, there is no problem to realise this thing. In addition to the technical aspects of the problem, the design is also very important when trash and street lights are combined. In consideration of the function of the garbage can design, at the same time, a combination of these two methods should also be considered, paying attention to the coordination with the surrounding scenery, thus making people gain the feeling of beauty.

2.RESEARCH IDEAS

The research of this paper includes two parts: the research into the related function of the intelligent trash can, and the research into the method of combining the trash can and the street lamp. After considering the actual needs in real life, the combination of street-smart trash use should have five functions: automatic turning cover, automatic compression, voice prompt, garbage trunkful detection function, and dynamic collection and transfer function of information in the area.

For the combination of the trash can and the street lamp, this paper puts forward three principles: first, the minimum influence of their original function; two, the importance of keeping in line with the surrounding landscape features of artistic design; three, modular design, in that they can be freely separated from each other.

3.FUNCTION ANALYSIS OF INTELLIGENT GARBAGE CAN

As mentioned above, this paper argues that intelligent street trash should have five functions: automatic turning cover, automatic compression, voice prompt, garbage trunkful detection function, dynamic collection and transfer function of information in the area.

For the dustbin cover automatic switching function, this paper describes a control starting circuit switch through the infrared induction system, which causes the transmission mechanism to automatically flip. When people leave, with the help of the delay circuit, the trash can automatically close the cover. For automatic compression function, the compression mechanism is used to compress the garbage. For the voice prompt function, first with the programming module entry into the memory, and then in the process of running through the speaker to achieve voice functions. The trunkful detection function is implemented through the pressure sensor. When garbage is compressed, if the measured force acting on the pressure sensor reaches the maximum value set previously, the sensor will pressure signals to SCM, and then trash

flip mechanism to stop the operation (Qiang Zhou, 2016).

Finally, we consider the function of the dynamic acquisition and transmission of the information. It is achieved with the help of ZigBee technology. ZigBee is a new kind of wireless communication technology, which has the characteristics of close range, low difficulty, low cost, low power consumption and low speed. It is based on the wireless protocol of standard IEEE802.15.4, and can realise two-way communication by the mutual coordination between the wireless sensors. Through the use of ZigBee wireless sensor network technology, and using a series of sensors and chips to design the circuit, we can produce a smart garbage can (Wang, 2012; Hai Ma, 2010).

4.METHOD FOR REALISING INTELLIGENT GARBAGE CAN

4.1Function of automatic opening and closing cover for garbage box

After access to information, we use thermal infrared sensors to achieve garbage automatic flip function (Huabin Wang, 2012).

The principle is as follows: when people get close to the trash to throw rubbish, the thermal infrared human body sensor can feel the people around, triggering the CC2430 chip and CC2430 chip, and the I/O port will drive the motor. The thermal infrared sensor induction principle is shown in Figure 1.

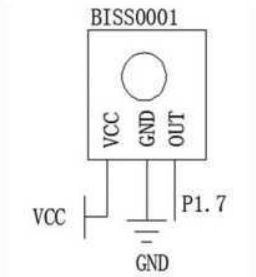

Figure 1. Schematic diagram of the infrared sensor circuit.

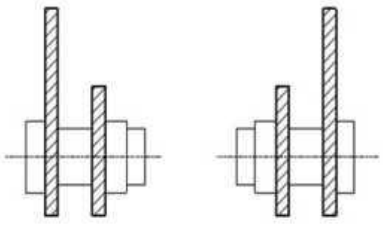

Figure 2. Trash liner structure.

4.2Automatic garbage compression function

The compression mechanism is connected to the garbage box cover ⼀ when the garbage can automatically closes the cover, it drives the compression mechanism to compress the garbage. At the same time, due to the fact that the garbage bag is not easily separated from the tank of trash, an adjustable capacity trash liner has been designed to solve the problem.

The following illustrates the adjustable capacity trash liner. Due to the squeeze pressure, the original loose garbage moves close together, leading to relatively large attraction between the molecules; hence it is not easy to take the trash bag from the trash. Therefore, the structure of the screw nut is used to fix the nut and the movable baffle plate around the barrel wall, and the volume of the garbage bin can be varied. When the garbage can has been filled, and the rubbish needs to be taken out of the trash can, we can rotate the bolt and change the trash volume slightly, so that the garbage bag and the liner can be easily separated (Zhao, 2012). The trash liner structure is shown in Figure 2.

4.3Voice prompt function

For the voice prompt module, this paper suggests using SYN6288 voice chip to achieve the conversion of text to speech.

4.4Trunkful detection induction

This function is divided into two modules, weight monitoring module and volume monitoring module. First, for the weight monitoring module, this paper recommends the use of the TYC901 weight sensor. However, because the signal transmitted by the weight sensor is generally weak, it needs the signal to use a differential amplification circuit to amplify the weight sensor. Then, the volume monitoring module. In this paper, the idea is to use the laser sensor and photosensitive resistance. The components of the laser sensor consist of a laser, a laser detector, and a measuring circuit. By detecting the voltage of the photosensitive resistance, and combining with the weight of the trash can, we can determine whether the trash can is full. The circuit schematic diagram of the laser sensor and the photosensitive resistance are shown in Figures 3 and 4 respectively.

4.5Dynamic collection and transfer function of information

The sensor nodes collect data through the integrated sensor module on a node, and these data are then transmitted over the network to the coordinator node. The coordinator node is responsible for collecting data transmitted over the network, and sending the data directly to the host computer

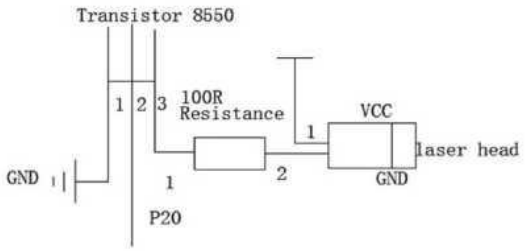

Figure 3. Schematic diagram of laser sensor circuit.

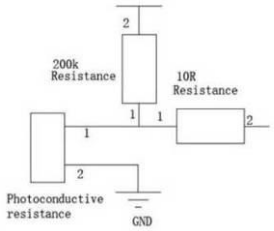

Figure 4. Circuit schematic diagram of photosensitive resistance.

through the serial port or through the network to achieve remote data transmission. Then the relevant departments can develop a simple data management centre software through the database technology. After receiving the data from the sensor network, the data centre is capable of completing the analysis and storage of the data (Hai Ma, 2010). After the data are processed by computer, the information platform will launch realtime information to the sanitation workers. With the help of this information, the sanitation workers can decide which trash needs cleaning up, and which does not need cleaning up, eliminating the trouble of performing a daily patrol and improving efficiency.

5.COMBINATION MODE OF GARBAGE CAN AND SOLAR ENERGY STREET LAMP

According to the actual situation in different countries, the garbage clean-up department and the road management department may not be the same. Therefore, the combination of the two may face a huge administrative reform. Besides, for the repair work of intelligent garbage cans or street lamps, because the work characteristic is different, the breakdown time is also very different; therefore, this article proposes three principles for combining them:First, the minimum influence of their original function;Two, in line with the surrounding landscape features of artistic design;Three, modular design, in that they can be freely separated from each other.

A simple sketch map is shown below:

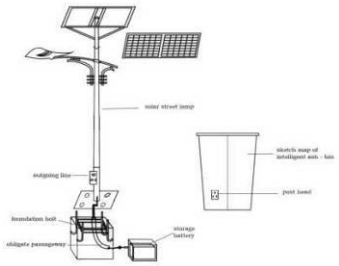

Figure 5. Schematic diagram of the combination of solar street lamp and intelligent garbage can.

6.CONCLUSION

It is an effective way of energy use to combine the intelligent garbage can with the solar street lamps, which can promote the progress of the social life. If the battery supplies energy for the solar street lights and the trash can at the same time, it not only makes full use of solar energy, but also saves the cost of laying out the power grid for the trash can and reduces the operation cost; on the other hand, it may also save city trash and street lamp layout area. Furthermore, through the ZigBee wireless communication technology, it can help improve the efficiency of street cleaning for cleaners, improve the efficiency of garbage disposal, and improve the efficiency of the urban operation. Therefore, this research is of value, and the intelligent garbage can combined with the solar street lamp has excellent development prospects.

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University of Science and Technology Liaoning plans to be the seventh phase of innovative entrepreneurship training program (No. 201710146000041)

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Application of Case Teaching Method in the Teaching of Digital Image Processing Course

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Abstract: According to the existence of strong theory, complex formula, and the mathematical derivation and simple examples are difficulty of combining theory with practice in digital image processing. The case teaching method is lead into the course. Classroom knowledge points are instructed through concrete case. From theory to simple example, then to practice to theory, the students can perform better. Compared with the traditional method by simple program demonstration, case teaching method lead scientific research or life problem into the curriculum. It stimulates the students' interest in learning, cultivates the students' ability of combining theory with practice, and improves the teaching effect.
Keywords: Case Teaching Method; Digital Image Processing; Teaching efficiency.

1. INTRODUCTION

Digital image processing is a very important specialized course. It is closely linked with practical application and it is one of the core courses in signal processing and analysis courses.[1-2] Understanding the various theories of image processing and practical application, is one of the most basic requirements for the electronic information professional students.[3] This course emphasizes the programming practice and the method of image processing applications, and requires a great deal of programming skills. MATLAB software makes many the programming is simple, and is suitable for the class of image processing algorithms for demonstration in class.[4-5] But the general classroom teaching and experimental teaching are mainly based on basic simulation, and lack of comprehensive application ability training. In order to strengthen students' ability of combining theory with practice, stimulate students' interest and improve their programming ability, specific research or life application cases are introduced to the class. Many cases can be used in practical teaching. This paper introduces digital watermarking as a typical case.

2. CASE TEACHING METHOD

Case-based instruction is designed to help students acquire knowledge deeply and allow them to take part in self-directed learning. The case teaching method here refers to the students and the teachers carry out a complete example of the teaching activities. The ability to solve problems be could be achieved by activities, using of existing knowledge and mastering new knowledge. The case usually refers to the actual engineering application or scientific research task. Case teaching includes case preparation, implementation and evaluation stages.

2.1 IDENTIFY CASE

The case selection will directly influence the whole process of teaching. Given the students' lack of social experience and engineering experience, the original project or the scientific research topic can not be directly used as a teaching case. It should be appropriately simplified and adapted to suit the situation for beginners. In practice, several projects were selected as teaching cases, such as digital watermarking, verification code identification, license plate recognition etc. Relatively simple algorithms are appropriate, which is not only easy to understand, but also allows students to expand in case studies.

2.2 Guidance From Teacher

Since students have less experience in design, some students don't even have done programming development subject, proper guidance from teacher is required in the implementation of the case project. Before the case is carried on, the preliminary demonstration is needed to make the student have a preliminary understanding and impression of the case. Teachers should use simple and concise examples to teach the course content of classroom content.

2.3 Case Discussion

After the case is completed, students are asked to describe the design process, the knowledge points involved and demonstrate the case projects. Different students' completion will have difference, some complete basic functions and some extend the functions. The completion, comparison and demonstration procedures will strengthen basic knowledge at the same time, exercise the students' ability of self-study and learn from each other.

3. CASE EXAMPLE

This paper take the current research hotspot digital watermarking as an example.[6-7] There are many algorithms for digital image watermarking. In combination with the discrete frequency domain transform in the theory course, a simple frequency domain watermarking algorithm using discrete cosine transform is selected. The main procedure is as follows:

(1) Watermark embedding

Watermark embedding algorithm can be described as follow:

Step1: The original carrier image I with the size of $M \times N$ is brightened with color space transformation before watermarked I_Y.

Step2: I_Y is decomposed with a one level lifting wavelet and obtained sub image I_L. The low pass sub image is divided into 8×8 sub blocks $I_{LB}(x, y)$, $x = 1, 2, \cdots M / 16; y = 1, 2, \cdots N / 16$.

Step3: The discrete cosine transform is employed to every sub block $D_{x,y}$ and its DC coefficients $d(x, y)$ are used to embed watermark information. The quantitative value $\delta(x, y)$ of each $d(x, y)$ is given by: $\delta(x, y) = \text{round}(d(x, y) / \beta)$, while round(·) is the round off function, and β is the predetermined quantization step. The original watermark image is denoted as W and the scrambled watermark image is denoted as W_a.

If $\text{mod}((\delta(x, y) + W_a(x, y)), 2) = 1$, then $\overline{d}(x, y) = \beta(\delta(x, y) - 1 / 2)$,

else $\overline{d}(x, y) = \beta(\delta(x, y) + 1 / 2)$.

Step4: The DC coefficients $d(x, y)$ are replaced by $\overline{d}(x, y)$ in each sub block. Then the modified sub blocks are obtained by inverse discrete cosine transform, and the low pass sub image is formed. The watermarked image is got by inverse wavelet transform. The image was lightened the color and saturation component to convert RGB space, then the process embedding finished.

(2) Watermark extraction

Watermark extraction is just the inverse process of the above embedding algorithm.

Step1: The original extraction image P' is brightened with color space transformation before embedded watermark, marked P_Y.

Step2: P_Y is decomposed with a one level lifting wavelet, and obtained subimage P'_L. The low pass subimage is divided into M×M sub blocks $P'_{LB}(x, y)$, $x = 1, 2, \cdots M / 16; y = 1, 2, \cdots N / 16$.

Step3: Calculated the quantitative value $\mu'(x, y) = floor(d'(x, y) / \beta)$, Corresponding watermark information was decided according to $\mu'(x, y)$. If it is odd, then $W'(x, y)$ is equal to 1, else is equal to 0.

Step4: The watermark W' is abstracted from W'_a by inverse scrambled according to the keys.

The original image frame and original watermark image are shown in Fig. 1. Watermarked image frame and extracted watermark image are shown in Fig. 2

Figure 1 Original carrier image and watermark

Figure 2 Watermarked image and extracted watermark

Futhermore, the test image could be attacked by common image processing operations such as added noise. The case can be demonstrated in the process of teaching earlier, and it can stimulate students' interest. As the course progresses, teacher can ask the students to gradually complete the theory and MATLAB programming. Image processing based on the actual case with the application of combined, improve the practice ability.

4. CONCLUSIONS

The case selected the current popular digital watermarking field, involving the digital image processing theory teaching chapters. It mainly includes image type and conversion, image basic operation, image frequency tranfromation, block processing,Image degradation and so on. It combines theory teaching with practice teaching effectively, and improves students' learning interest.

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Analysis on the Influence of Oil Level of Thrust and Lower Guide Bearing based on No. 9 Unit on Oil and Bearing Temperature in Xixiayuan Hydropower Station

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Abstract: Under the fixed conditions of the unit output and the cooling flow of the thrust and guide，through adjusting the oil level of the bearing oil groove of the thrust and guide bearing oil tank of No. 9 Unit, we observe the changes of oil and bearing temperature of the thrust and guide under the three working conditions of low oil level, designed oil level and high oil level. We record the data of oil and bearing temperature under the three conditions after the unit stable running to determine the reasonable running oil level, and analyze the influence of oil level of thrust and lower guide bearing on oil and bearing temperature according to the test data.
Key Words: Thrust bearing; Lower guide bearing; Oil level; Oil temperature; Bearing temperature; Influence

1.INTRODUCTION

Xixiayuan reregulating reservoir is the auxiliary projects of xiaolangdi project, which is 16 kilometers away from xiaolangdi project. Xixiayuan power plant has four 3.5 million Wazhou Kaplan turbine generator sets, with generator model SF-J35-80 / 10470, rated speed 75r / min. Four units are with three guide suspension structure, equipped with thrust bearings, guide bearings and lower guide bearing. Thrust bearing and lower guide bearing share a lower frame sump which has three sump cooler .Thrust bearing with spring support structure is composed by 16 flexible plastic tile sector, lower guide bearing with the support bolts guide support structure is composed by 22 Babbitt sector.

In recent years, the units Thrust bearing and lower guide bearing at high temperature has taken a good improvement by improving the cooling system. But thrust bearing is with Swinging Oil Phenomenon all the time, which causes the oil tank level drops and the temperature of thrust bearing and lower guide bearing Thrust tile and the shoe at a temperature gradually rise. It is dangerous to the safe operation of the equipment .In order to confirm the influence of the oil sump oil level on the bearing temperature, we need to take experiment and solve this problem by the experimental data.

2.GENERAL IDEA

Case No. 7 machine, In the unit rated output, water supply, cooling water flow and under the same environmental conditions, We were selected low oil level, the oil level design, high oil level three conditions. According to the test results, we further analyze the impact of the bearing and oil temperature in the difference oil level.

3.MEASURED DATA

3.1 when two adjacent bearing of the unit thrust the lower guide' s temperature reached trip level ,the Protector trip. Table 1 is the parameters of the thrust bearing temperature

Table 1 the parameters of the thrust bearing temperature

project	Thrust bearing	Lower guide bearing	Oil temperature
Alarm value(℃)	55	65	60
Trip value(℃)	60	75	\

3.2 Unit 9 of the oil level falls below the general oil level(less than design stationary oil line position 10mm). The No.9 unit start-up and network. When the temperature of the unit is stable, we need record down the data.

3.3 Unit 9 of the oil level is design stationary oil line position. The No.9 unit start-up and network. When the temperature of the unit is stable, we need record down the data.

3.4 Unit 9 of the oil level is higher than the general oil level(more than design stationary oil line position 5mm). The No.9 unit start-up and network. When the temperature of the unit is stable, we need record down the data.

Table 2 temperature of thrust and lower guide bearing measurement table

project	Measuring point1	Measuring point2	Measuring point3	Measuring point4	Measuring point5	Measuring point6	Measuring point7
Thrust bearing temperature(℃)	46.9	46.9	46.8	47.4	46.8	47.6	47.2
Lower guide bearing temperature(℃)	64.6	65.4	65	65.1	64.8	64.8	64.7
Oil temperature(℃)	42.3	42.8	\	\	\	\	\
Oil level(mm)	790	\	\	\	\	\	\

Table 3 temperature of thrust and lower guide bearing measurement table

project	Measuring point1	Measuring point2	Measuring point3	Measuring point4	Measuring point5	Measuring point6	Measuring point7

Thrust bearing temperature(℃)	46.2	46.1	46.3	46.8	45.1	46.5	46.8
Lower guide bearing temperature(℃)	59.5	59.4	57.6	58.5	58.6	58.1	59.5
Oil temperature(℃)	40.4	40.6	\	\	\	\	\
Oil level(mm)	800	\	\	\	\		\

Table 4 temperature of thrust and lower guide bearing measurement table

	Measuring point1	Measuring point2	Measuring point3	Measuring point4	Measuring point5	Measuring point6	Measuring point7
Thrust bearing temperature(℃)	47	46.7	46.3	47.1	47	46.9	47
Lower guide bearing temperature(℃)	59.1	59.3	57.9	59.1	57.8	58.7	60.5
Oil temperature(℃)	41	41.4	\	\	\	\	\
Oil level(mm)	805	\	\	\	\	\	\

4.DATA ANALYSIS

To find sump oil level impact of oil, bearing temperature, we take statistical analysis, curve comparison of two methods to analyze the measured data.

4.1 Statistical Analysis

Statistical analysis is to take maximum and minimum value that is involve seven thrust bearing temperature measurement ,seven lower guide bearing temperature measurement and two oil temperature measurement.

Table 5 Measurement Statistical analysis

Sump oil level	Thrust bearing temperature		Lower guide bearing temperature		Oil temperature	
	minimum	maximum	minimum	maximum	minimum	maximum
Lower oil level 790mm	46.8	47.6	64.6	65.4	42.3	42.8
Standard oil level 800mm	46.1	46.8	57.6	60.5	40.4	40.6
Higher oil level 805mm	46.3	47.1	57.8	59.3	41	41.4

Through analysis of the measured data, we can see that the lower guide bearing temperature has reached the alarm level in the case of lower sump oil level.

4.2 Curve Comparison

In the base of Statistical analysis, We draw the curve of thrust bearing temperature, lower guide bearing temperature, oil temperature in the three difference conditions .Then we analyzed the curve.

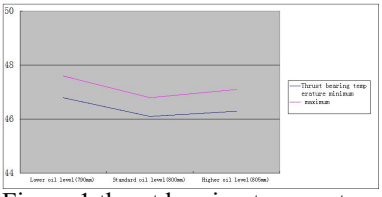

Figure 1 thrust bearing temperature curve

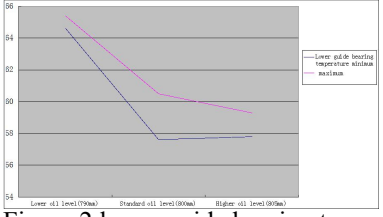

Figure 2 lower guide bearing temperature curve

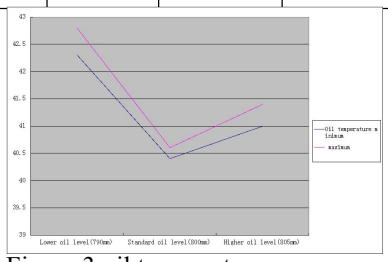

Figure 3 oil temperature curve

We can draw the conclusions on the curve, lower sump oil level have a great impact on oil temperature and bearing temperature. Thrust bearing temperature and oil temperature rose quickly in the case of low sump oil level. In the case of high sump oil level, the lower guide bearing temperature is less than standard oil level, but the oil temperature is little more than standard oil level. Comprehensive Analysis, the lower guide bearing temperature easily reaches the alarm value in the case of lower oil level. The bearing and oil temperature is within a reasonable range in the condition of standard oil level. The oil level will be a little higher than normal value. Therefore, the oil level should be maintained in the design of the oil level, Units can be safe and stable operation.

5.CONCLUSIONS

By the oil level test, we verify the sump oil level impact on oil and bearing temperature. It is good for the unit operation. We recognize the work of plant operation, to change the sake of discussion, remedial work of thinking, actively carry out extensive operational analysis, change our regulations from passive safety to active safety. Based on the equipment operating parameters track record, We analyze the trends, to discover security risks, and actively take scientific and reasonable measures to deal with the accidents nipped in the bud. We use human intervention and a way to predict in advance, which can avoid accidents and ensure the safe and stable operation of the device.

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Analysis of Electromagnetic Harmonic Movable Teeth Transmission System Mechanical Loss

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Abstract: In view of the characteristics of electromagnetic harmonic movable teeth transmission system, the calculation methods of mechanical loss in system have been also discussed in this paper based on basic assumptions. Moreover, the influence of changes of system parameters on mechanical loss has been analyzed. According to the analysis results, the numerical calculation model of the three-dimensional temperature field of system can be established. And the theoretical basis can be provided for the optimization design of electromagnetic harmonic movable teeth transmission system and the improvement of transmission efficiency of transmission system.
Keywords: electromagnetic harmonics; mechanical loss; structural parameters

1. INTRODUCTION

As electronic and control technology continues to penetrate the mechanical field, the generalized complex mechanical transmission has become a leading international subject in mechanical fields [1-4] for this concept is anti-tradition and could achieve the organic combination of mechanics, electricity and control. The electromagnetic harmonic movable tooth transmission system involved in this paper is a kind of organic combination of harmonic transmission technology, electromagnetic transmission technology, movable tooth transmission technology and control technology, that is, a new electromechanical integrated complex transmission system [5-6].

The electromagnetic harmonic movable tooth transmission motor is an electromagnetic -mechanical energy conversion device. Due to its long-term continuous operation, Loss is an essential part of the operation, lost energy has a great influence on the electromagnetic and its structure design. Such as, the lost energy is eventually converted to heat, so that the temperature of each part of the motor increases which has a direct impact on the life of all the insulating materials. Meanwhile, the viscosity of lubricating oil of the may decrease, which may damage the lubrication state between the movable tooth, center wheel and tooth holder, and ultimately limit the output of the system. And the electromagnetic harmonic transmission is operating in low speed, its running state corresponds to the operating state of starting or braking and the efficiency distribution has a great influence on the electromagnetic and its design and structure.

Therefore, the study of the losses of electromagnetic harmonic movable teeth transmission is of great significance to analyze the failure mechanism of electromagnetic harmonic movable teeth transmission system and improve the operating performance as well as effectively control the lubricating and the cooling.

In view of the operating characteristics of electromagnetic harmonic movable teeth transmission and the system conditions at different frequencies, the mechanical losses of electromagnetic harmonic movable teeth transmission have been discussed in this paper. At the same time, the influence principles of structural parameters on mechanical losses have been analyzed through taking the prototype as example, which provides a theoretical basis for the optimal design of system structure.

2. MECHANICAL LOSS ANALYSIS

Electromagnetic harmonic tooth transmission is an electromagnetic - mechanical energy conversion device. Energy loss in action is eventually converted to heat energy and it finally reaches steady state equilibrium by the heat exchange between the motor components with the environment. The loss of the electromagnetic harmonic tooth transmission is comprised of electromagnetic loss and mechanical loss. Mechanical loss is mainly analyzed in this paper.

1.1 The Power Loss of Engagement Pair

The analysis indicates that there is relative rolling motion between the movable tooth and flexible wheel, there is relative sliding between the movable tooth and the tooth carrier, and there are both relative rolling and relative sliding between the tooth and the center

wheel. P_1^i, P_2^i, P_3^i respectively refers to the power loss when the i th movable tooth contacts with the flexible wheel, the tooth carrier and the center wheel. The meshing power loss of a single tooth is

$$\begin{aligned} P_f^i &= P_1^i + P_2^i + P_3^i \\ P_1^i &= \omega_{1i} F'_{1if} f_{1i} \\ P_2^i &= V_{2i} F'_{2if} f_{2i} \\ P_3^i &= \omega_{3i} F'_{3if} f_{3i} \end{aligned} \tag{1}$$

in the formula, F'_{1if}, F'_{2if}, F'_{3if} means the friction between the movable tooth and theflexible wheel, tooth rack and center wheel; f_{1i} and f_{2i} is the friction coefficient of the movable tooth with the flexible wheel and tooth rack; ω_{1i} means the relative rolling angular velocity between the movable tooth and the flexible wheel; V_{2i} means the relative sliding angular velocity between the movable tooth and the tooth rack; ω_{3i} means the relative rolling-sliding angular velocity; f_{3i} means the rolling-sliding friction coefficient between the movable tooth and the flexible wheel.

The electromagnetic harmonic movable tooth transmission has multi-tooth engagement simultaneously; at any time, the friction power loss on each movable tooth is not the same, coupled with the input power, which is because there are always half of the movable teeth in two regions of engagement operating, so the power loss at any moment is shown as follows:

$$P_f = \sum_{i=m}^{n} P_f^i + \sum_{i=p}^{q} P_f^i \tag{2}$$

m, n and p, q respectively represents the number of movable tooth in two different regions of engagement.

1.2 The Power Loss of the Bearing

The power loss of a single bearing

$$P_{zc} = \pi n_z M_f / 30 \tag{3}$$

n_z is the rotation speed of the inner ring of the bearing; M_f is the friction torque of the bearing.

$$M_f = \begin{cases} 2Yf_1F_aD_m + 10^3 f_0 (\nu n_z)^{\frac{2}{3}} D_m^3 & \nu n_z \geq 2\times 10^{-3} \\ 2Yf_1F_aD_m + 16 f_0 D_m^3 & \nu n_z \geq 2\times 10^{-3} \end{cases}$$

Y and F_a respectively represents the axial coefficient and axial load of the bearing; ν is the kinematic viscosity of the lubricant; D_m is the average diameter of the bearing; f_0 and f_1 are the coefficients related to the bearing type and lubrication methods.

1.3 Power Loss Due to Oil Agitation

The power loss due to oil agitation mainly includes that of flexspline and movable tooth. For the spherical surface (radius of r' and the effective area A) rotating at the angular velocity of ω' in the viscous fluid medium (density ρ', kinematic viscosity ν and friction coefficient f'), the power loss due to oil agitation is shown as follows:

$$P_y = \frac{1}{8}\rho' f' A \omega'^3 r'^3 \tag{4}$$

In the above formula

$$f' = \begin{cases} 16/R_e & T_a < 41 \\ 3(R_e/2500)^{0.856}(16/R_e) & R_e \geq 2500 \\ 1.3(T_a/41)^{0.539}(16/R_e) & T_a \geq 41 \end{cases}$$

The Reynolds number $R_e = \omega' r C/\nu$, the Taylor number $T_a = R_e\sqrt{C/r'}$, C is the characteristic gap surrounding the ball surface.

The total losses of mechanical power is shown as follows

$$P = P_f + P_z + P_y \tag{5}$$

1.4 Rolling-Sliding Friction Coefficient

Based on the previous analysis, there are both rolling and sliding when the tooth contact with the center wheel, so the corresponding friction is referred to as rolling-sliding friction. The work done by the rolling friction, sliding friction and rolling-sliding friction is respectively shown as follows

$$w_1 = \mu_1 \cdot F_{3i} \cdot S_1 \tag{6}$$

$$w_2 = \mu_2 \cdot F_{3i} \cdot S_2 \tag{7}$$

$$w_3 = f_{3i} \cdot F_{3i} \cdot S_3 \tag{8}$$

μ_1 refers to the rolling friction coefficient; μ_2 is the sliding friction coefficient; f_{3i} is the rolling-sliding friction coefficient; F_{3i} is the positive pressure imposed on the movable tooth by the center wheel; S_1 refers to the arc length of engagement of movable tooth, that is, the rolling distance; S_2 refers to the sliding distance; S_3 refers to the arc length of engagement of center wheel, that is, the rolling-sliding distance.

The work done by the rolling-sliding friction is equal to the sum of the work done by rolling friction and sliding friction; therefore

$$f_{3i} \cdot S_3 = \mu_1 \cdot S_1 + \mu_2 \cdot S_2 \tag{9}$$

S_1 can be approximately calculated by the following formula

$$S_1 \approx r_b \varphi_v$$

r_b is the radius of the movable tooth; φ_v is the wrap angle of the centered tooth; z_z is the wave number of the centered tooth.

$$S_3 = (r + 2r_b)\varphi_2$$

r is the radius of flexspline.

$$S_3 = S_1 + S_2$$

Finally

$$f_{3i} = [(\mu_1 - \mu_2)r_b\varphi_v + \mu_2\varphi_2(r + 2r_b)]/(r + 2r_b)\varphi_2 \quad (10)$$

2. INFLUENCE FACTORS AND INFLUENCE PRINCIPLES OF MECHANICAL POWER LOSS

The mechanical power loss of electromagnetic harmonic movable teeth transmission is influenced by the teeth radius, the ratio of long shaft and short shaft of flexible gear after deformation, the transmission ratio and the lubrication effects, etc. In this paper, the change principles of the mechanical power loss affected by above factors have been analyzed and calculated. Some calculation results can be shown in Figure 1 to Figure 4.

In Figure 1 ~ Figure 4, it is found that:

(1) With the increase of teeth radius r_b, the friction losses between movable teeth and teeth rack and between center gear and flexible gear are both reduced. That is because the teeth radius is increased, the number of movable teeth is few and the friction pair is reduced with the certain whole size of system.

(2) With the increase of the ratio a/b between long shaft and short shaft of flexible gear after deformation, the friction losses between movable teeth and teeth rack and between center gear and flexible gear are both increased. That is because the increase of a/b represents the increase of radial deformation of flexible gear. If the radial deformation of flexible gear is increased, the force of flexible, center gear and teeth rack on movable teeth will be great. Therefore, the friction loss is great.

(3) With the increase of transmission ratio i, the friction losses between movable teeth and teeth rack and between center gear and flexible gear are both increased. That is because the transmission ratio is increased and the number of movable teeth is increased, the friction pair will be increased. Although force on each movable tooth is reduced, the friction loss produced by the increase of friction pair is not be offset.

(4) The influence of lubrication condition on the friction loss of electromagnetic harmonic movable teeth transmission is great. The friction loss of electromagnetic harmonic movable teeth transmission can be reduced by more than 95% through achieving the liquid lubrication. And the friction loss of harmonic movable teeth transmission can be reduced by 90% ~ 94% under boundary lubrication situation. The reason is that the friction coefficients between movable teeth and teeth rack and between center gear and flexible gear are low under liquid lubrication condition, which are generally between 0.001~ 0.008; in the boundary lubrication condition, the friction coefficients are generally between 0.03 ~ 0.1. Therefore, the good lubrication is very important to improve the working efficiency of electromagnetic harmonic movable teeth transmission system.

(5) The proportions of the three friction losses in overall friction losses are basically: the friction loss between movable teeth and center gear is the greatest, accounting for 40% ~ 50% of total friction losses, followed by the friction loss between movable teeth and teeth rack, which accounts for 30% ~ 50% of total friction loss; the friction loss between movable teeth and flexible gear is the smallest, accounting for 20% ~ 30% of total friction loss.

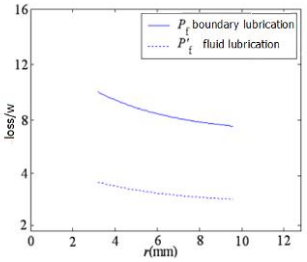


Figure 1 Variation of Loss with Movable Tooth Radius r_b

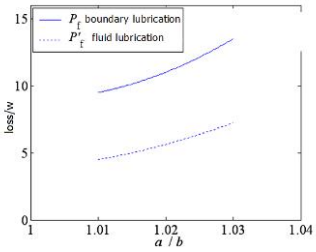


Figure 2 Variation of Loss with a/b

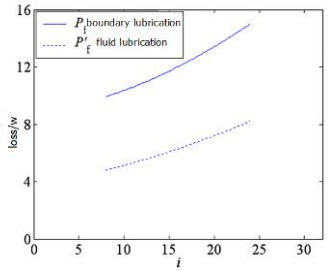
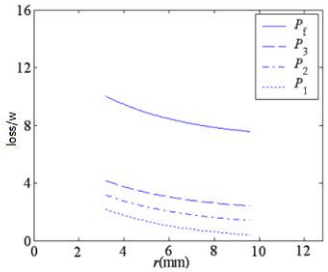
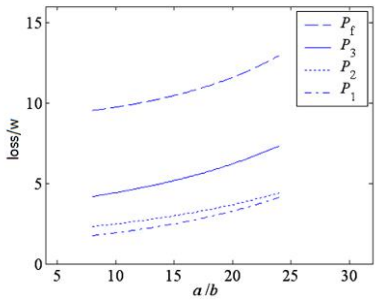


Figure 3 Variation of Loss with Transmission Ratio i

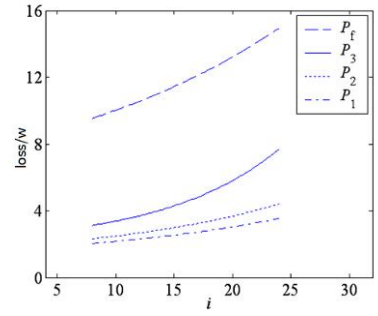


a) Relationship between Loss and Lubrication

Condition under Different r_b



b) Relationship between Loss and Lubrication Condition under Different a/b



c) Relationship between Loss and Lubrication Condition under Different i

Figure 4 Relationship Curve of Loss and Lubrication Status

3. CONCLUSION

The mechanical loss of electromagnetic harmonic movable teeth transmission has been studied and the influence principles of changes of system parameters on mechanical loss have been analyzed. The results show that: In order to reduce the loss of mechanical power, the diameter of movable teeth and flexible gear can be determined according to the proportions of friction losses between movable teeth and center gear, between movable teeth and teeth rack and between movable teeth and flexible gear. Under the certain radial displacement, it is required to reduce the friction pair and improve the lubrication efficiency.

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Researches on the Problems and the Effective Strategies of Periodical Management in Independent College Libraries

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Abstract: In the process of new educational reform, the independent college has grown and has become an indispensable part of unique characteristics. This paper mainly analyzes the current situation and importance of the journal work of independent college library.It finally puts forward the countermeasure of the work in independent college journal .
Keywords: Independent College Library; Periodical Management Effective

Independent College, as a relatively new type of teaching, is public private secondary school after the People's Republic of China Ministry of Education in 2003. The emergency of independent colleges breaks the school model of Simplification in traditional public schools. Independent colleges continue to expand their living space, improve their own quality of school, shape the characteristics of running schools, and commitment to cultivate the talents of applied talents. The library is an important part of the development process of the school, and it bears the task of college culture construction. Therefore the construction of the library is the focus of independent colleges. The relationship between the construction, management and the evaluation of the library is inseparable, and the journal is the first of the information source of the library literature information. It has many advantages,such as fast in speed, large in volume, and rich in content and so on,which is the most active document factors.

1. PROBLEMS IN THE MANAGEMENT OF JOURNALS

1.1 Inputs is Insufficient

The number of students in the independent college has been increasing and the number of students has been increasing. However, the funding of the periodicals is seriously insufficient, and the price of the journals has been increasing year by year. The situation of insufficient library resources has become more and more prominent. Under the double pressure, the concept of "the book after publication" makes the periodical funds can not be guaranteed, which leads directly to the reduction of the period of periodical purchase, which makes the journal lack of continuity and integrity seriously.It is not enough to meet the reading requirements of the teachers and students.

1.2 Journal Collection Management Is Not Good

At present, there are many serious problems, such as the damage of the periodicals and the loss of serious problems, which leads to lack of the continuity and completeness of the content of the current periodicals. The bookbinding and collection suffers from same situation. After the publication of outsourcing is sent to outsourcing business, the outsourcing business delays for a long time.It often needs half a year to do the binding back and forth, which affects the extent of the impact of the post, and the the normal usage of readers.It also reduces the value of using these journals greatly.

1.3 The Structure Of The Journal

At present, the library journals of independent colleges do not construct the core journals security system, and the structure is mostly unreasonable. For example, in the selection of paper journals, it is not suitable for scientific research. The key journals of various disciplines, especially new electronic journals, still lack, which needs to increase. The feedback channel to the reader is also very lacking,which can not keep abreast of the reader's reading tendency. Journal administrators in the journal subscription only takes into account the continuity of the journal and ignore the reader's needs.Satisfaction degree and demand of readers on the journal can not be resolved in a timely manner, leading to the low utilization of journals.

1.4 Periodical Borrowing Rate Is Low

The journals are divided into two main categories: professional journals and entertaining journals. Professional journals have a certain degree of professionalism, and teaching and research is the main position. Teaching and research work is inseparable from high-quality professional journals. Entertainment journals have a positive role in promoting students' knowledge and enriching campus life. From the actual situation of author's college , professional journals are significantly lower than the reading of entertaining journals, and entertainment journals are significantly lower than other books.Besides, the time that independent colleges are set up is short, which has also been in the adjustment phase.According to the college discipline, academic adjustment of the library on their own readers and the

size of the structure can not be completely fixed, so the journal order is also constantly adjusted , leading to entertaining journals gradually replaced by professional journals.Therefore professional journals idle rate is getting higher and higher, and the phenomenon that no one read a publication continuous climbing.

1.5 Reading Space Is Insufficient

Independent colleges are generally newly established campuses, and the campus is often built in the suburbs far from the urban area relatively.Living facilities surrounding the new campus have not improved, and the students' extracurricular life is relatively monotonous.Comparing the journal reading room to school Environment, students are more willing to study in the reading room.The periodical reading room is often full, especially in the evening or near the examination period, and the phenomenon that it is a difficult to find place or using book to occupy the place happens.

2. OPTIMIZE THE STRATEGY OF JOURNAL MANAGEMENT

2.1 strengthen the reader information survey to improve the order

As library journal managers, we must fully understand the professional settings and training objectives of our school. We should carefully analyze and understand the use of journals by readers, strengthen the links with the departments, keep abreast of the changes in the professional departments, and update the teaching content and research direction.The annual collection of the catalog should be issued to the various departments.We should ask the school leaders and scholars about the rationalization of the procurement of journals, and it will effectively improve the utilization of journals. It is worthwhile to measure whether a library's library is valuable or not, and whether the traditional resources and services provided by the library can be used for readers.So the the journal guidelines that library orders books should according to what the college teachers and students needs,instead what the library should be collected. The limited funds required to order readers to publish publications, meeting the needs of readers to study, broadening the vision of the needs ,and meeting the diverse needs of readers. From the traditional "to Tibet" gradually develops to "people-oriented", we carry out the application of human service concept, through a variety of forms of reasonable order, and fully improve the use of journals.Library resources can really play the value of knowledge.

2.2 Library Journal Resources Is Informational

With the development of science and technology, China has entered the era of network information. The traditional library service work has been unable to meet the needs of readers, which can not adapt to the development of today's society. Therefore, through the network of multimedia to collect information,it expands the amount of information library. The use of advanced electronic technology and expand the library of information sources innovates library services to work a new way. Through the network to integrate more information resources, it creates a diversified, multi-level comprehensive structure and characteristics of the library journal room, so that the library using advanced scientific means for the independent college teachers and students of the teaching, research provide more valuable periodical resources.

2.3 The Journal Publicity Should Be Strengthened

As the situation that the independent college school setting time is short, good style of study, deep campus culture has not yet formed, the college should strive to create a good campus culture atmosphere. The library is the forefront of campus culture construction, which should increase efforts to include journals, including the collection of effective publicity and guidance. Only the journal of the museum do somethings for a certain publicity, effectively improving the utilization of journals. The contents of the collection of journals, the main content, including the discovery of science and technology, scientific research.Other new results of the use of new media are more convenient and it is convenient timely and effective transmission of information, interactive adhesive more readers.So that readers can get the latest information in the latest news. It brings practical s help the new students to do a good job in the journal room reading guide service work.They are active and targeted for its knowledge into the ocean.It will use the fastest speed to pass journal information for their four yeAn independent college is an independent college organized by an undergraduate institution in conjunction with social funds. Independent colleges can take advantage of the unique relationship with the parent school, share resources with the parent school library resources, realize the complementary resources.It can agree with the common agreement and contract , meeting the growing demand for readers, and alleviating the shortage of library funding problems.

2.4 The Daily Management Of Journals Should Be Strengthened

The majority of teachers and students are the object of library journal service. The periodical reading room is a place for readers to enjoy. The good reading environment can relax the mind and mind of the reader, stimulate the interest and knowledge of the reader. The management of the journal is the main manifestation of the library service and the focus of the library journal work. Reasonable and scientific arrangement is the first impression that the reader enters the reading room of the journal. This requires the journal manager to formulate the strict management system and manage it strictly according

to the periodical management system. It is necessary to do a good job in reading and propagating, making routine inspections and reducing the damage and loss rate of journals. This problem directly affects the continuity and completeness of journals. Therefore, it is necessary to provide journal managers with the management and protection of journals.

3.THE CONSTRUCTION OF PERIODICAL MANAGEMENT PERSONNEL SHOULD BE STRENGTHENED

Journal management is not just a simple management of the order of journals, finishing journals, borrowing and returning. Journal managers play a guiding role on the reader. Blacksmith also need their own hard. Individuals have a high professional level ,and quality is the key to doing their jobs, journal management staff should be so. Journal management not only understands the most basic book classification in the new era of Internet environment under the diversification of the form. To know more access methods, it guides the paper periodicals,and guides the reader network resource retrieval, with more Strong hardware operation capability. In the work of journal managers to continue to strengthen self-learning, the library should often organize journal management training, visits, seminars and other ways to improve the management capacity of managers to meet the requirements of modern library librarians. Not only to do the traditional service, but also to achieve the traditional service to the network service requirements change from a single service to the multi-yuan service change. From massive service to active service, only their own continuous learning and innovation can meet information needs of teachers and students.

4. CONCLUSIONS

In short, the independent college library as the heart of the college, shoulder for the college teaching and research escort an important mission is an important part of book work,.It is access for college teachers and students to get information . In the grim new situation, the library must constantly improve and improve the journal management and service work.Only in the practice of innovation in the continuous discovery of problems and solve the problem, it will help the independent college library health and steady development.

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Research on Teachers Incentive Problems in Independent College

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Abstract: This paper analyzed and discussed the current teacher's motivation problems in independent college from the course teacher's incentive system. Setting a good incentive system could help to arouse teachers' enthusiasm, forming a good "study and competition" teaching style, but also could control and adjust the teachers' consciousness; encourage them to improve their business ability, and actively delve into developing new teaching method. Good incentive system can greatly improve school cohesion, and form a school spirit of "exploring, objective, pioneering and enterprising, innovative".
Keywords: Independent college; Teacher incentive; Job burnout; School management

1. INTRODUCTION

School's development cannot be separated from development of teachers, while development of teachers cannot leave with teachers' personal development. One important means to promote teachers' personal development is the incentive system. Studies have concluded that one person could only exert 30%-20% competences without an incentive system; while he could exert 90% -80% competences when get motivated appropriately. It is obviously that incentive plays a very important role on competency exertion and work performance.

There is a large deviation between incentive times and frequency. Differences on incentive object and salary incentive is too narrow; evaluation mechanism is inadequate which needs to be improved; teachers' training mechanism is relatively backward.

The incentive problems existing in independent college at current stage could be concluded as following:

1.1 Difference On Incentive Object

Based on information provided by some teachers in Guilin Z institute, teacher Zhang is an administrative teacher, whose annual income is ten thousands less than teacher Li, a course teacher who bares the same title with teacher Zhang. The reason is that schools and parents tend to pay more attention to education, and there are always various competitions each year on education, which provides more opportunities for course teachers to win bonus and honor. Compared with course teachers, administrative teachers normally get less attention and competition opportunities, said by teacher Li. He also pointed out that they have paid same labor, but get less paid; hence, he called for equal treatment without discrimination. The leadership in schools should try the utmost to be fair and just, so that everyone could get proportional "pains and gains".

1.2 Low Salary Incentive Intensity

In independent college, salary system pattern is always unitary, and low in intensity. Salary increase under rank wage structure system mainly depends on individual's professional title promotion, but not on improvement of personal ability. If a teacher has reached higher level on teaching ability, while his title could not be promoted, he still cannot get a higher salary. It also means that teachers have smaller salary gap with the same title, even if one has undertaken additional work, it seldom shows in salary. In addition, junior level titled teachers even if with higher ability, or undertakes more work than higher level titled teachers; they could not get as much paid as they done. This will lead to forming the feeling that what matters salary is one's title, but not how much you have done, so you only need to endeavor to achieve a higher tile when time comes.

1.3 Evaluation Mechanism Needs To Be Improved

At present, the teacher assessment mechanism in independent college is quite backward, and lack of scientificity. Evaluation on teachers is generally measured by students' evaluation and their own performance, while the result of evaluation is an important basis for promotion and title assessment. Teacher assessment is a comprehensive and dynamic management process, which involves a variety of factors including evaluation concept, evaluation methods, index system and evaluation results application. The current evaluation mechanism still exists some deficiencies:

1.3.1 It cannot classify the evaluation methods according to different subject category, post category, teachers rank and other specific circumstances, neither adopt assessment model of combining quantitative and qualitative; emphasis and comprehensive; annual and periodic, principle with flexibility.

1.3.2 It has not closely integrated assessment of professional ability and virtue when designing assessment criteria. Assessment criteria's scientificity for research evaluation, teaching assessment, academic work and social work evaluation remains to be discussed.

1.3.3 It is not comprehensive enough on dimension of assessment subject. A comprehensive assessment should be made from assessment of students, leading

group, parents, and teachers mutual evaluation, etc.

1.3.4 The characteristic and creativity of teachers' work determines not all work can be quantified. Teaching attitude, dedication spirit all need to be valued.

2.BACKWARD TEACHER TRAINING MECHANISM

Improvement of students' performance, not only requires students' own efforts, but also needs teachers' constantly updated professional knowledge and teaching skills, which requires teachers to constantly attend training to improve teaching level . Most independent college teachers at present stage, however, do not have a lot new knowledge and skills training opportunities, neither any in-service training opportunity. Constant reform of high education highlights the necessity to continue enriching teachers' professional knowledge and skills, which has brought a lot of pressure to teachers. They feel pressure, inability to teach new curriculum; achieve social expectations, parents expect and other high requirements. Survey found that 60% of the teachers in our school never go out training or study within two years, and even 20% of the teachers put forward that they have not received a training ever since work for more than 10 years. They feel outdated under the circumstances of nowadays when everything is updating so fast, while their level of knowledge stays in the previous stage, so they highly expect school leaders could proved more learning opportunities to more teachers.

3.REFORM PROPOSALS FOR TEACHERS INCENTIVE MECHANISM IN INDEPENDENT COLLEGE

3.1 teachers incentive mechanism survey result analysis

The survey takes teachers in Guilin Z college as investigation object. As a result, 65% of the teachers are not satisfied or takes a general comment with the current incentive mechanism, which means the incentive mechanism still exists some problems, and not satisfy every teacher. As for material rewards compensation, only 40% of teachers thought the salary system is reasonable, while there is still 60% of the teachers replied the current salary system has not reached their ideal state. In terms of emotional and spiritual motivation, it is lack of corresponding emotional stimulus, since most of teachers replied they have not received any encouragement and support from leadership; 87% of the teachers are burdening very heavy job stress. In terms of development incentives, a lot of teachers answered they can't see any space of promotion. Development incentives such as career planning and promotion space have not been emphasized.

The research found that many teachers pointed out that their work effort was not very matched with income; several surveyed teachers all answered that they have spent a lot of time and energy on work, but the salary got is still same. Comparing with other industry personnel, there is a big gap in income which makes them feel unfair. Because Guilin Z College is an independent college, the teaching body is relatively unstable. Many teachers feel puzzled for their promotion and realization of self-worth.

3.2 Reform Proposals For Teachers Incentive Mechanism In Independent College

3.2.1 incentive methods differentiation

Different incentives could be set up in Independent college according to different jobs. Take course teachers as an example, course teachers should be motivated based on student awards received, teaching effects, student assessment, parents evaluation, teachers mutual evaluation, competition awards teachers have achieved, published papers, variety of projects hosted.

3.2.2 take performance evaluation as basis, combine reward with punishment

Schools should set up different evaluation indexes, to measure performance of the work. Every semester, examination results could be published regularly so that teachers could know working gap and their own insufficiency, and catch up in future. In the process of school management, reward and punishment are equally important. Reward those with outstanding performance, while take appropriate penalty measures on those with unsatisfied performance. Realize more pay for more work through fair competition, and prompt those falling down on teachers work aware of crisis. Break the "communal pot" system, and avoid damaging the endeavor's desire to do better; avoid encourage laggards' lazy mood; Secondly, amply reward and heavy penalty. In addition each semester every school year, set up some excellent teachers as a learning example, to inspire other teachers more proactive in study, life and work. Use some typical people and things to create a typical demonstration effect.

4. SUMMARY

Only when the independent college builds a good teaching body, and grasps the teaching style, the study style could become better. Independent college leaders should apply different methods, appropriate incentives, and create all kinds of favorable conditions to inspire more and more teachers participate in teaching practice, enabling teachers to improve teaching level while finishing the teaching task. Improve teachers' treatment, and make everyone feel emotionally motivated; make them unite as one, and work together to build a college culture of "exploring, objective, pioneering and enterprising, innovative", so as to achieve the goal of improving school education quality. Therefore, studying incentive mechanism has certain practical value, which could help improve school management mechanism; promote teachers' own development, and school development.

As a conclusion, in real life, teachers have diverse,

flexible and changeable needs. Based on teachers in different levels and doing different jobs, different incentive methods should be applied. If indiscriminately adopt one unique model, incentives affect will be discounted, or even will be counterproductive. In practical work, school leaders need continually explore, and adjust measures to local conditions; take practice of seeking truth from facts; adhere to focus on a combination of variety of incentive methods, and flexible application of different incentive means, to truly achieve incentive effect, and build a new status for independent college.

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The Rotation System is An Effective Way to Cultivate The Compound Talents of Library

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Abstract: This paper discusses the necessity of the librarian's rotation system on the basis of the beneficial aspects of the library compound talents. It analyzes some problems in the rotation system from the attitude of the librarian to the rotation system, the cohesion of the library work and the cultivation of talents in the library. To solve some problems in the implementation process of the rotation and hillock system, we should do the ideological work, set up the rotation period, give full play to the librarian's specialty and establish the perfect appraisal mechanism.
Keywords: talents cultivation; rotation system; librarian

1. INTRODUCTION

The rotation system refers to a system of human resources management which is exchanged between different jobs at regular or irregular intervals. This system has been normalized and standardized in civil service personnel management, and has been vigorously promoted in some enterprise units. The effective construction of the personnel team is essential for the development of the unit. The traditional working mode of the library can not meet the needs of the information society, it must cultivate a team of compound talents with strong business ability, high comprehensive quality and adaptable to various job requirements. And the librarian rotation and post system is an effective way to improve the comprehensive quality of the librarians. However, there are some corresponding problems in the implementation process of the library, and the corresponding rectification is carried out according to the problems that appear. It is the key content of this paper to solve the problem, which makes the rotation system play a very important role in the library personnel training.

2.THE NECESSITY OF THE LIBRARIAN ROTATION SYSTEM

2.1 In Favor Of Arousing The Enthusiasm And Creativity Of Librarians

In the traditional model of library, librarian position is relatively fixed, some people for decades as a day to adhere to the same post, the repetitive operation of the machine, the idea is imprisoned, talent can not be released, over time to form inertia, depression, loss of work force, seriously affect the work of the librarian enthusiasm and creativity. This kind of situation more occurs in the circulation department, because the work content mostly is the shallow level books reorganizes, the shelves, the loan service, does not need to use too many mental work. From a psychological point of view, long-term engaged in fixed work easy to make people obsessed with the disease, the human potential will be closed, creativity will be banned, causing boredom and burnout, greatly reduce the enthusiasm of the work, and even suffer from work depression. Through the librarian rotation system can eliminate this phenomenon, the librarian assigned to the new work environment, thinking is stimulated by the new task of active state. So that librarians in the work to find the value of existence, and take the initiative to learn new knowledge and new skills, to stimulate the continuous search for enthusiasm, so high morale, full of vitality. So that the librarian find the value in the work, and take the initiative to learn new knowledge and new skills, inspire constant pursuit of enthusiasm.

2.2 To Enhance The Comprehensive Quality Of Librarians And To Shape The Compound Librarian

At present, the librarian's knowledge structure is uneven, and there are not many graduates of formal library. Public Library librarians have a higher standard of education, because librarians belong to institutions, and they can enter the library through examination of public institutions. But librarians still need to study the relevant knowledge if they are not professional. The academic level of university library librarians is low, most of them are undergraduates, junior college students or non formal diploma graduates. Graduate education is a rare product, and their library expertise is acquired in the workplace. If these librarians are engaged in fixed work for a long time, they know nothing about the work of other posts in the library, which leads to a narrow knowledge of the standards of a qualified librarian and will affect the service quality of the library. Especially in the age of intelligent knowledge updating, even the librarians who have major in library and information science can not satisfy the development of library business. The rotation system can make the librarians self-invested into the study, improve the knowledge structure and the work quality. Through job rotation, librarians can be familiar with the work flow and business characteristics of each post links, improve self learning ability and adaptability, to achieve the purpose of continuous education of librarians, so as to enhance the comprehensive service quality, the

ability to develop compound librarians.

2.3 Help To Strengthen Library Cohesion And Cultivate Team Cooperation Spirit

Because of the different responsibilities of libraries, librarians are responsible for different areas of the library and are busy with their jobs. Therefore, there are not many opportunities for communication between departments, leading to librarians who do not understand the business and specific work processes of other departments, resulting in inconsistent psychological and workload imbalance. After the implementation of rotation system, the librarians realized the work flow and the difficulty coefficient of different posts, deepened the understanding and mutual exchange between librarians. Librarians can also think and deal with problems from the point of view of libraries. And enhance the cooperation between the various departments, librarians, so as to improve the overall cohesion and combat effectiveness of the library.

2.4 Help To Discover Talent And Give Full Play To Personal Expertise

Working in a single position for a long time is not conducive to the comprehensive ability of librarians. It is possible for a librarian to be good at reading and training, while the actual arrangements in circulation for a simple and mechanical job, and it do not bring the librarian's expertise into play. This system can not play the role of their positions, which is a waste of talent. Librarians also want to realize their value in a position where they can display their talents. Through the rotation system, each librarian has the opportunity and platform to develop his or her own expertise. Judging from the performance of librarians in different positions, it is possible to determine which post is more capable of tapping the job potential of the librarian. The implementation of the rotation system has played a vital role in the discovery of library talent. Librarians can also realize self-worth in their work and realize the happiness and satisfaction of their careers, which can be said to save the librarian's outlook on life and values.

3. ANALYSIS OF THE EXISTING PROBLEMS IN ROTATION SYSTEM

3.1 Have A Negative Impact On Some Librarians

During the implementation of the librarian rotation system, the people who have the technical ability and the learning ability are rotated to the stronger positions of the technology to enhance the enthusiasm for learning and work. These people are actively involved in the rotation system. But for the post-rotation position is lower than the knowledge and skills mastered by oneself, it will lead to the decrease of librarian's enthusiasm and the waste of library talent resources. Some people prefer living a easy life to being busy with their jobs. Therefore, they are very resistant to the rotation system. They take negative attitude and emotion with them if they passively arranged in a new position. It means that they can not serve well for the communication between readers and departments which reducing the efficiency of the work. In order to promote the development of post rotation we need to do the librarian's ideological work.

3.2 Not Conducive To Job Cohesion

Librarians are required to take short pre-job training before the rotation. If the librarians were switched to high-tech jobs, then the short- training is probably not meet the needs of posts. When the new librarians have difficulty at work, they could consult last librarian about it. But last librarian has his own work to do so that he’s not available at any time. And some difficult librarians might mock the new staff. For the new librarians, there are work pressure and psychological pressure. The improper convergence of post in rotation system may be causing the delay of work and the decline of quality of service.

3.3 Not Conducive To The Cultivation Of Sophisticated Talent

The talent of library need to be engaged in his post for a long time, only the experienced can be competent for the job. Such a senior librarian has mastered a core technology in the library and has created an academic value in this field. It will interrupt his research in this post if he was rotated to a new post which means the loss of the library and the loss more the gain. When a young librarian is proficient in his work, it will interrupt his creation if his post is exchange. This kind of irregular rotation leads to the librarians not being able to study in some aspect and in-depth research, which is disadvantageous to the cultivation of talents in the library.

4.THOUGHTS ON IMPROVING THE MANAGEMENT OF THE ROTATION SYSTEM OF THE LIBRARY

4.1 Do The Ideological Work Of The Staff

The rotation system of the library is a reform measure. It is the reform that must inject new thought and idea. But not everybody could accept this measure. It is a great thing for people who have the courage to accept new things, thinking ahead and working positively. And the routinism are not willing to change. However, we can not force people into doing things they don't want to. Therefore, it is necessary to do the ideological work of the staff. Explain to the librarians that the reasons some of them participate in the rotation and others are not. Clear the plans and objectives of the rotations to all librarians. To make every librarian is an insider, each librarian is an indispensable part of the plan. Only mobilize the enthusiasm of the librarians can ensure the smooth implementation of the rotation system.

4.2 Establish A Reasonable Cycle Of Rotation

In order to ensure the stability and continuity of the library, there must be a very careful plan for the implementation of the rotation system. It can not be adjusted with the whole, should be phased, batch in a

certain range of implementation, first in the same level of post pilot, slowly extended to different departments at different levels of post implementation. Because different levels of different positions of rotation, librarians need pre-job "explicit knowledge" training, and accumulate "hidden knowledge" experience. Therefore, the rotation of different posts in the rotational cycle should be set according to post, not all job rotation cycle consistent, which requires flexible response. If the circulation positions are rotated, the rotation cycle can be set to six months or a year. Because the circulation job is relatively simple and repetitive, the librarian is easy to get started. The rotation cycle should be 2 or 3 years if the periodical department rotates. Because the periodicity of the journal is one year and one year later, the final period of the journal is about 1.5 years. In order to consider the skilled and sophisticated work of the post, at least two processes should be completed. If the rotation of editing posts is involved, the rotation cycle is generally set at 3-5 years. Because the editing work needs to make the accurate judgment to classification of Interdisciplinary. These all require long-term experience accumulation, otherwise cannot catalog knowledge. It needs to know more about the library, the ratio between the various types of books can not meet the needs of the post. As a result, the period of post-editing is longer. It cannot achieve the purpose of cultivating talents if the rotation time is shorter.

4.3 Give Full Play To Individual Expertise

The purpose of the rotation system is to find talent and appoint talents. In the process of rotation, the talent will be arranged in the appropriate post, so he can take advantage of the potential and become a pillar of the department. And he can not exchange job easily, otherwise cause the waste of talent resources and the decline of library service quality. For example, librarian, who is responsible for the library's readership, is a graduate of the journalism profession, which is suitable for doing activities. Librarian is interested in writing and like to get acquainted with well-known writers and invited some celebrities to give lectures. There is no one could replace his position because he does his work so well. Therefore, such a librarian is not suitable for rotation to other posts, let him in this position self-willed play expertise is the correct choice.

4.4 Perfecting Assessment And Evaluation Mechanism

The success of the rotation system depends on the degree of perfection of the evaluation mechanism. At present, the evaluation mechanism of the rotation system is gradually improving, in accordance with the principles of openness, fairness and impartiality. With a good system, we must conscientiously carry out and implement the system, the system can only be truly implemented in specific work. In the examination and evaluation, we should adhere to the combination of leadership and mass evaluation, combination of irregular and regular inspections, and the combination of material and spiritual incentives. We need to make the rules of each position, carry out the responsibility in the work, lest the division of labor is unclear, which leads to the decline of library service quality. Since China's reform and opening to the outside world, the peasants and the country have become rich. And the reform of library rotation system should follow the example of the reform and opening up.

5. CONCLUSION

The rotation system of the library is advantageous from the overall view, not only can discover and train the talented person, but also can make the best of the talent, makes the limited human resources do not waste. It can mobilize the enthusiasm of librarians and foster great working atmosphere. So as to improve the comprehensive quality of the staff. http: //fanyi.baidu.com/-zh/en/javascript:void(0); In order to play the role of rotation system, we need to continue to solve the problems arising in the process. It is necessary to ensure that the librarian's resources are not wasted and to ensure the growth of librarians. Make sure that there is no more libraries muddling along and not to destroy the principle of equality and voluntariness of librarians. So as to achieve the purpose of library compound talents training.

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The Paper Books and The Electronic Books Complement and Develop in Parallel in The Digital Era

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Abstract: As the arrival of the digital era, it brings a convenient electronic books for the majority of readers, and at the same time with the rapid growth of the electronic books , which has a certain impact on the paper books .This article start from the carrier's historical evolution of the books , including the bones, brochures, silk, paper, e-books and other books, which specific analysis the current advantages and disadvantages of the paper books and e-books, combining with the way how the readers to read today, this article will show us that the paper books and the electronic books interdependence, complement each other, and jointly carry the historical mission of heritage culture.
Keywords: paper books; electronic book; text carrier

1. INTRODUCTION

The text of the carrier has been lasted for thousands of years since the beginning of the paper, and the paper books carrying the generations' ideas and culture, which makes the readers satisfied with it, but with the economic development, social progress, and the advent of digital age, the appear of the electronic books has a great impact on the traditional paper books. The electronic books occupy a small space, easy to store and carry, so that the majority of readers like them. A lot of people say that paper books will be replaced by e-books in the future, although the paper books are facing pressure, they still struggling to continue to develop it, for paper books in the future can be replaced by electronic books, this rely on its millennium practice connotation. This article studies the advantages and disadvantages of paper books and e-books from the historical and cultural aspects of books, and exerts its advantages on the road of cultural communication and carries the mission of carrying culture.

2. THE HISTORICAL CULTURE STUDY OF THE BOOKS

2.1 The Evolution Of The Book Carrier

The original form of text is written in the form of bones, bronze, and the stone.The oracle records reflect the political and economic situation of the Shang Dynasty,and it mainly refers to the late period of the Shang Dynasty that the royal family engravedin the tortoise or animal bonesfor the purpose of divination and fortune, andthe content is generally the things that the divination askedor the results from the divination. After the perish of the Shang Dynasty and the rise of the Zhou Dynasty, the oracle also used for a period of time, which is the important data to study the Shang and Zhou Dynasties'social history. In the time of the Western Zhou Dynasty, in order to consolidate the regime, the ruling class was big praised Zude and engraved in mind in the bronze, and also engraved with the country's important instruments and treaties, because at that time the text is mainly engraved on bronze and other metal objects.

When it comes to the Eastern Zhou Dynasty, the text began to engraved in the books or above the slips. In the ancient era the book is used for writing, which is made of bamboo or wood, and the jian is a long bamboo chips. A couple of bamboo chips get together can become a book. According to archaeological discoveries, the book can be divided into jian, slips, gu (for the multi-faceted multi-prism stick), jian(the wood seal when transfer the documents and letters), peg(inscribed books and artifacts wide and short wood). The content is very extensive, including the official documents and files, private letters, book copy, calendar and volume, specifically for the funerary with the press. The slips are machined wood, after written the text it become the slips. The slips are generally used to write short essays, often one piece of slip with an article.

To the Zhou, Qin, Han era, the text carrier are bamboo slip and silk. But the high value of the silk, which is much less than the common use of the bamboo slips. The character silk, combine with the character "white" and "towel" that means "top cloth".The original meaning is the top silk cloth, white silk cloth. In ancient China the silk painting is the painting that painted on the silk and the silk book is a book that written on silk, at that time the aristocracy use the silk write and paint, but the folk still use bamboo.

In the Eastern Han Dynasty, based on the previous experience, Cai Lun created the "Cai Hou paper",the cost of paper is more economic than the silk,in the Han Dynasty Cai Lun invented the paper, but "the silk is expensive, the paper is cheap", people who use the paper, mostly can not afford to buy silk,however the general palace aristocracy is still used to use the silk. The invention of paper ended the history of ancient bamboo slips, which greatly promoted the

spread and development of the culture. The papermaking is the long-term experience accumulation of Chinese working people and the crystallization of wisdom,which is the sheet metal products used in writing, printing, painting or packaging and so on.

Nowadays, a new text carrier: the e-book appeared, is the form that use the electronic data to let the text, images, sound, animation and other forms of information stored in magnetic, optical, electrical and other non-printed paper carrier, then through the network communications, which is a kind of electronic information resources use the computer or terminal etc to show to us. Today is coexistence period that the text carrier form are the paper books and electronic books.

2.2 The Evolution Of Book Bindingform

Turtle Bone Books, which is the first binding form in China,at1500-1111 BC. From the Shang Dynasty to the early Western Zhou Dynasty it spend more than seven hundred years. The modern books called as "booklet,"that comes from it.

Booklet, 1770 BC - 221 years ago, the Spring and Autumn Warring States, also considered as the earliest binding form. Representative works: "Sunzi Bingfa", "Sun Bin Binfa".

Reel, the second century AD, at the Eastern Han Dynasty the Cai Lun invented the paper which is promoted the development of book binding technology. The design of the shaft is elegant,there are two kinds such as "bamboo" and "wood",and the axis is round,and the grade is distinguished by coral and red sandalwood and so on. Usually we use the ribbon tied to the scroll. We can read on the table or hang on the column. Representative works: "Diamond Sutra".

Whirlwind, the Tang Dynasty, which is also called as "dragon scales " and "rotating leaves". The method: use the long paper as the bottom, and mounted the first paper as the first volume, since the second leaves, from right to left to mounted on the bottom of the volume. Features: easy to read and help to protect the page. Representative works: "Tang Yun".

Folding, Vatican Clamp, the folding also known as "Zhe Zi". The front and back of the folding is mounted with the cardboard, stick with a layer of paper or fabric. Another way is to glue the book, and the books can not be opened only to read. The Vatican Clamp is a call that the ancient Chinese call the style of the Buddhist scriptures from India that use the Sanskrit written in the Beiduo leaves.

Butterfly, the end of the Song Dynasty and the early of the Yuan Dynasty, the page will be folded on the book, and install the paper book jacket into the cover, but it also can mounted with a layer of silk, damask and other fabrics. Spread out when reading it. Representative works: "Wen Yuan Ying Hua".

Backpack, contrary to formation of the butterfly, the version of the heart is outwards and the back opposite. Representative works: "Yongle ceremony", "Si Ku Quan Shu", "Yu Ji".

Line, the middle of the Ming Dynasty whichis the final form of the evolution of traditional Chinese books.The method is the same as the backpack, the heart is outwards, the back is opposite, the difference is to change the whole backpack paper for the two sheets before and after the cover, and the bag back change to halter.Wire-loaded book generally hit four holes, known as the "four eyes".The top and bottomoflarger book can hit one more “eye”.We can pastebookmark on the cover.

Paperback,we add the entire book cover to the book. There are two way to binding the book, such as a horse and a wire.

Hardcover, mainly in the book cover and book heart of the back, the corner on the shape of processing. Book heart processing can divided into roundback, square back, square angle and fillet.Cover processing has a entire cover, half cover, and also can hot stitching, pattern decoration on the cover.

Special, also known as luxury, refers to the use of high-quality materials, with a special process for processing a book binding method. For example, the cover of the special cover is often made of silk or sheepskin and other products, inlaid with gold, silver, precious stones, pressing a variety of patterns. Some roll gold or coloringin the head and the foot of the special;some also with the letter sets and so on. From the appearance of view, a special book is a beautiful art.

Therefore, the paper books after thousands of years of practice and evolution, has been meet the taste of the public reading, which can not be replaced by new things easily.

3. THE ADVANTAGES AND DISADVANTAGES OF PAPER BOOKS

3.1 The Advantages Of Paper Books

Paper books are more suitable for deep reading and thinking, and after thousands of years of continuation, the form and reading of the paper books are accepted by readers, people are more likely to focus on reading, keep thinking coherence, which can make people gradually into the depth of reading and thinking state. People do not need to rely on other reading carrier, no time limit and no space constraints, no age limit, from young children to the elderly are suitable for paper books, as long as they find the right sitting position, it gradually unknowingly to let the readers into the depth of reading, and enjoy the spiritual pleasure and accumulation knowledge from reading. Paper books easy to read and mark, has no damage to the eyesight, it is conducive to the readers’ memory, stimulate interest in reading, which is better than e-books.

The collection value of the paper books is high, which is conducive to the cultural heritage and protection, and the Chinese people have always attached importance to reading, "abdomen poetry

from China, reading rolls began to pass God", the reading has a certain cultural tradition. All kinds of library, reading college still retains a lot of classic books to heritage the history and culture. Now there are some books lovers, they change their own home into a private library, with a lot of masterpiece, which have been handed down from generation to generation, and after many years these books will become a collection of ancient books. Many ancient books can be spread in later generations that we should thanks to the archaeologists, because they find out the book that hidden in the underground thousands of years, and also let the ancient cultural ideas continue to spread in the world. The collection value of paper books and the cultural heritage value is far superior to the electronic books.

There have no age limit in reading the paper books, the ancients often said: “live to the old, learn the old,” moreover people from the day of birth, they began to enter the learning stage, all kinds of wall charts and cards continue to appear in our life, and from the steady sit they start to read books and cultivate reading habits. When people in period of the childhood and adolescence are not suitable for reading the e-book ,because the screen is great harmful to the eyes, so it is good for us to obtain knowledge from the paper books . Adults in the work and engaged in research, it’s more appropriate for them to get into the depth study, but in the spare time is more suitable for them to use the e-books to read. After the retirement of people, their eyesight become very weak,reading the e-bookis not appropriate, so in order to kill the time, reading the paper carrier of newspapers, magazines, books are more appropriate. Portrait of people's life,the paper books are always penetrate in our daily life, but the e-books only suitable for reading a small time in life.

2.2 The Disadvantages Of The Paper Books

The storage and custody of the paper books is not very convenient, and they need moisture, pest control, waterproof, fire, security and other matters, once they damaged or lost, they can not be offset,they are not the same as the e-books that at any time to download; And the storage space of paper books is too large, so they need large enough bookshelves, stacksand other facilities; In other words, whether on the purchase or management of the paper books,people need to invest a lot of money and manpower in it; but also limited by the out of print and publishing time and so on. What’s more the quality of paper book is too heavy for bulk movement and adjustment.

3. THE ADVANTAGES AND DISADVANTAGES OF ELECTRONIC BOOKS

3.1 The Advantages Of E-Books

The delivery speed of the e-book is very fast, and through the Internet can instantly display the books in front of the reader, which has no limit of time and space, once the e-book is published,the whole world can see it. The e-book occupy a small space, and has large storage capacity, and the book can be read more than one person, which is more easy to sharethe literature resources, at the same time, as long as the network is smooth, the e-book isservicing for 24 hours a day. E-book updates more timely that has short cycle, fast speed for publishing, revision and reprint etc. In addition to carrying the e-book text, the e-book also carrying a large number of audio, video and other graphic and audiovisual rich content.

4.2 The Disadvantages Of E-Books

The electronic books depend more on equipments, and it rely on computers, network environment and other equipments; the user's cultural quality requirements are higher that they need to master a certain computer operating basis and Internet operating ability; but the e-books have relative instability, once the network is interrupted, equipment damage and virus damage will not be able to recover, so the e-books should not be used as a permanent archive information; and the e-book browsing device relying on the screen, long-term reading is not good for health, but also has the users’ age restrictions, the elderly and children should not read e-books.

4.THE PAPER BOOKS AND ELECTRONIC BOOKS COMPLEMENTARY DEVELOPMENT

Only in the carrier, the paper books and e-books have some difference, there is no great difference in other place. Paper books and e-books have their own characteristics, the paper books have their own unique reading value and collection value, and the e-books have its search convenient and vivid content. Paper books are suitable for people of all ages to read in depth, without any restrictions. E-books have changed the reading habits of some people, and change the traditional way ofpaper reading to computer reading, mobile reading, palm reading, fast food reading and other shallow reading. Both the paper books and the electronic books are what readers need to read,the two can not be replace by each other, and the two will be organic integration, presenting the diversified, personalized and popular service forms of reading.

5. CONCLUSION

The paper books has been experienced thousands of years of evolution,and has the value and meaning of existence,which can not be easily replaced by a new text carrier,just like the emergence of instant noodles, although itcan bring people a convenient,but can not completely replace the staple food; the online education can obtain human knowledge, but it is only suitable for readers to self-study, it can not replace school education; the emerging e-book performance is good, and change people's reading habits,bringthe readers convenient and economical benefits, but it can never replace the historical significance of the inherent cultural heritage of paper books. But in the end which one is more superiority, with a poem can be clearly explained, the Song Dynasty poet Lu Meibo said in the "Xuemei"the plum is not so white

than the snow, but the snow has no aroma",so both have their own advantages. The paper books and e-books is the sameas the red plum and snow, although the text carrier is different, in fact each one has its own merits, and no absolute merits,the cultural power of text is eternal.

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Research on the Training Model of Independent College Students' Innovative Ability Under the New Media Perspectives -Taking Institute of Information Technology of Guilin University of Electronic Technology as an Example

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Abstract: Nowadays, the usage of new media has been deeply infiltrated into the college students group. Through the new media perspective, elaborating on the definition and application of new media, and by analyzing the advantages and disadvantages of the traditional training model, in this text we are going to discuss how to improve college students' innovation and entrepreneurship ability in this new learning environment and study the possibility of new training model implementation to help the college students to improve their double creativity imperceptibly.
Keywords: new media; innovation; entrepreneurial ability; training model

In the new period of social development, cannot do without the development of science and technology, the development of science and technology is the embodiment of innovation and entrepreneurship, college students has played a key role in the development and progress of society, the cultivation of talents is the social responsibility, with the education reform continuously updated, many novel full of vitality the breakthrough of the traditional mode of education can be said to be accompanied by new media change rapidly. As the development of the times, more and more people began to rely on this form. And the new media are imperceptible to our daily life and study.

1.WHY WE CHOOSE NEW MEDIA PERSPECTIVE

1.1 Definition Of New Media

The new media industry alliance Secretary General Wang Bin: "new media is based on digital information technology as the foundation, to interactive communication features, innovative forms of media. The magazine of WIRED define the new media as " communication for all, by all ".

We believe that the new media is to provide personalized content of mass media, is a disseminator and embracer mixed peer exchanges, and numerous exchanges with each other can also personalize communication media. For the definition of new media, scholars have various understanding, so far inconclusive. But obviously new media has become a "fast, wide, a form of media to spread" has been accepted.

New media is a new technical support system under the form of media, such as digital magazines, digital newspapers, digital broadcast, mobile phone SMS, mobile TV, network, desktop windows, digital television, digital film, touch media. Compared to newspapers, radio and television, outdoor, four traditional media, new media called "the fifth media" .

1.2 The Application Of The New Media Exactly Match Students' Needs

The rapid rise and development of new media, meet the needs of social law, especially relying on mobile phone and network platform instant occupied the students from both groups, show personalized, novel content or spread, let a person shine at the moment, the development of the new media hit from some kind of meaning to the students' pain points, will the application of our new media, the majority of students, acceptance is very high. Our new media platform is the mobile phone, network, digital TV / movies, desktop window, in the daily campus.

In cultural communication, these new media forms, rich in content, the majority of the students like a mobile phone or computer terminal attention straight up, especially live in various party events live, and daily values, campus culture activities and other aspects of the interaction has been widely used, the effect is good, based on this far-reaching influence. And we have tried to use new media to further develop the second class and three class, let the students not only in the traditional learning mode in the solid foundation, strengthening training and improving college students' innovation ability in the new media platform.

2.WHY SHOULD WE STRENGTHEN THE CULTIVATION OF COLLEGE STUDENTS'

INNOVATIVE ABILITY

The State Council has issued "guidance on the development of the public record > space propulsion and public entrepreneurship peoples innovation," on accelerating the development of the real economy multi-creation space transformation and upgrading guidance on (issued [2016]7), all kinds of public record space and incubator in conjunction with local governments, research institutions, large enterprises and other units actively explore the new development pattern. As everyone knows, students are the main force of the progress of the times, are the future pillars of the country, is the owner of the future of the country, to cultivate the ability of contemporary college students deeply influence the future development of the country, Premier Li Keqiang proposed to "public entrepreneurship, innovation, can Seeing that innovation and entrepreneurship have already risen to the level of the national education war, science and technology are the guarantee of productivity, while innovation is the source of scientific and technological progress.

The state of artificial intelligence, high-end talent construction, science and technology innovation base, intelligent education is also put on the national agenda 2017 in July 20th, the State Council issued "a new generation of artificial intelligence development plan > (of the [2017]35), which clearly pointed out that artificial intelligence has become a new focal point of international competition, should gradually carry out national intelligence education project.

Since our school attaches great importance to cultivate and improve the students' ability, cultivate good scientific literacy, scientific consciousness, creative thinking and innovation ability, especially the practice, it is firmly toward the applied undergraduate teaching forward. To enhance the students ability of innovation and entrepreneurship training application oriented university, is conducive to the improvement of College students' social competence. To promote the development of science and technology, is conducive to the progress of the society, from the angle of planning and occupation career development, pay attention to the cultivation of College Students' innovation ability, more conducive to the need to achieve self life values.

3. THE EXISTING SCHOOL TRAINING MODEL

3.1 Theoretical courses

At present, our school has opened the college students' innovation and entrepreneurship education guidance courses totaling 2.5 credits, 40 hours. The teaching mode of cramming teaching slides relative to traditional ". A class down, interactive and little students participation is not high, more students are not interested, in order to pass the exam, some examination content by rote. Students can not achieve consciously or active learning mode.

3.2 Practice Platform

Our college pays attention to the cultivation of innovation ability of college students from the University, the first grade year training (curriculum design), each Polytechnic (Arts) students must independently complete a practical project corresponding under the guidance of the teacher (work), through this training, to strengthen the training of innovation ability.

3.3 Brand Activities

In order to cultivate and exercise the students ability of innovation and entrepreneurship better, our school since 2004, has always insisted on Developing College Students' innovative electronic design contest, and set up the electronic innovation base, strengthen the cultivation of students' innovative ability through second third class, arrange professional teachers General guidance, special team combat, the more significant achievements, once into the National Undergraduate Electronic Design Contest. The other 5 independent colleges since 2013 to carry out employment brand activities [first] workplace activities, has been carried out for seventh years, a series of activities, the school hired a successful innovation and entrepreneurial success, well-known entrepreneurs to school Lectures, seminars, training. These brand activities carried out, so that students in innovation, entrepreneurship and employability has been greatly improved, but still limited, the audience is basically lower than 30% of students

3.4 Community Assistance

The establishment of the school student association, student organization registered in more than 50 organizations, covering industrial arts and law body. German art organizations to carry out activities, can help the school education of College Students' innovation and entrepreneurship training. However, according to the survey, students average every 100 people in a community, also said through participation in student organizations of students is limited. But there is a certain number of activities, can not be divorced from the time, location, degree of participation constraints.

3.5 Determination Of Credits

In order to encourage innovation and entrepreneurship students self-study, educational departments have special policy guidance, to study or to participate in innovation and entrepreneurship competition and made certain achievements, I applied for the school examination, can replace the corresponding professional credits, or to give increased Science grade and certain material rewards.

4. NEW MEDIA INTERVENTION TO HELP INNOVATIVE ENTREPRENEURIAL ABILITY TRAINING MODE

Given the dependence on new media and new media has a profound impact in the majority of students and students, we take advantage of this "small" mode of teaching, not affected by time, place, space limitations, the author thinks that we should make full use of the resources, change the traditional and

relatively traditional mode of education, to further strengthen the ability of innovation and entrepreneurship cultivation of college students. Through the preliminary exploration and tentative attempt, we decided in the training mode of the original micro model into general education. The specific measures are as follows:

4.1 Relying On New Media, Accurate Teaching Reform, Immersive Teaching

In the new media based on the means of interactive links, will deepen the reform of teaching innovation and entrepreneurship education, precise teaching reform, such as the school has tried to employment guidance curriculum reform, the effect is significant, the majority of students are welcome. The precise teaching reform for small class teaching, about the size of 20 people, 80 people can set the batch for example that can be set in four batches, each batch of 20 people, each group can be divided into two groups. AB in the course of employment guidance of job interview for example, small 20 people divided into two AB group, each group of 10 people, before class assignments, in-depth understanding of job related skills, content, first half A response. Group interview B group, as the company on behalf of the examiner, one by one, on-site guidance comment. The core point is to fully understand all the content, do the job in the process before class, classroom etiquette. Through site reviews, students memories, can learn skills accurately, better feedback the final results of the job candidates. In this innovative teaching mode to cultivate the similar ability of students' satisfaction in 99.9%, can be said to be very successful and effective!

4.2 Try The New Media Network Teaching And Identify The Corresponding Credits

Relying on the network platform, through a computer or mobile phone terminal (tablet) to carry out the network teaching, network teaching one can carry out real-time teaching and learning to answer immediately, timely release of the answer, can also interact. On the other hand by prerecorded video learning, after a certain period of participation in the examination standards can be found corresponding credit the key point is to build the platform. And educational departments identified for learning content, audit and management.

4.3 The Use Of New media Teaching, Lively And Easy To Understand

Innovation and entrepreneurship education in the traditional teacher education students mainly through textbooks and classroom. So a lot of innovation and entrepreneurship education content only through the text or oral way, vivid enough, no visual impact, unable to reach the ideal state. At the same time, the traditional teaching method is not conducive to mobilize the enthusiasm of students. The students attention degree is not so high, after the end of the classroom, teachers and students with little or no training, Andcan not be sustained and directly to the students innovation ability and guidance.

The wide application of new media technology, the change of innovation and entrepreneurship education teaching mode provides a new opportunity. Educators can use mathematical techniques, the integration of multimedia information through video, audio, innovation and entrepreneurship education to carry out various forms of image, put some theoretical concepts into the animation, books through multimedia to better show the course content, better establish the framework of the curriculum to students, at the same time through the video data to enable students to entrepreneurship education related content can have a more profound understanding.

The new media is very consistent with the needs and preferences of the students in a certain extent, can mobilize the enthusiasm and initiative of students, and between teachers and students can communicate through new media tools, real-time analysis of innovation and entrepreneurship policy, summed up the experience of innovation and entrepreneurship, this will enable students to develop their innovation ability unceasingly in the teaching experience.

4.4 Through The New Media Dissemination To Spread Innovation, Entrepreneurship, New Thinking

Carrying out innovation and entrepreneurship education in Colleges and universities, we should clearly recognize that we must attach great importance to the cultivation of students' innovative thinking and entrepreneurial spirit. In the new media spread rapidly today, innovation and entrepreneurship education of contemporary college students have the obvious characteristics of the new media. First, universities can strengthen the cultivation of innovative entrepreneurship education of students and the ability to pass new media, such as the WeChat, micro-blog, Tencent QQ, micro and carry on students' consciousness of innovation and entrepreneurship skills, publicity and training, regularly push the students loved the model of innovation and entrepreneurship, innovation and entrepreneurship during the education to the students throughout the entire university, establish communication platform, strengthen interaction Exchange, timely answer students' doubts, and pay attention to the students' messages and information. Collect and look for innovative and entrepreneurial talents, and provide positive help.

Secondly, the height of the development of new media, bring a lot of opportunities for innovation and entrepreneurship students. The school has been gradually building a new media center, to strengthen college students' understanding of the new media, make full use of new media to guide students to understand, new media, positive innovation in the field of new media business. We can obtain information through a variety of new media, national policy at the same time, can also set up such as art in

the field of new media planning company, actively carry out electronic commerce, will effectively combine the successful business development of new media and their own, to achieve double win.

In summary, the broad prospects for the future development of new media, cultivate college students' innovation ability based on the new media platform, imperceptibly, instilling the dissemination of knowledge, sharing case, access to business opportunities and relevant national policies, colleges and universities should actively change the new media technology applied to college students' innovation and entrepreneurship education, constantly thinking and practice, promoting innovation and entrepreneurship college students' ability of accurate and effective training.

4.5 Hand In Hand With The Joint Training Of Enterprises, Social Needs Of Talent

The development of the strategic transformation from the University applied for our school, bold innovation, the pursuit of excellence, to cultivate market demand precise docking talents. The school and a number of enterprises to establish joint training mode, that is to "3+1" or "3.5+0.5" mode, the students in the university to study for three years or three years and a half, the rest of the time to go to the enterprise in practice, one is to meet the needs of society, the social orientation of cultivating students' practical ability to work as a starting point. On the one hand, from the enterprise to reduce recruitment costs, can cultivate a loyal corporate culture through this mode, reliable employees are willing to dedicate to the construction enterprise, the enterprise personnel loss greatly Reduce the practice ability of students to get the market test fully. From nearly three years of cooperation enterprise feedback information, joint training mode to cultivate students' innovation and practice ability of the majority of enterprises praise, satisfaction 99%, student satisfaction 97%, the dual mode on both sides responsible. Next, the school will continue to expand the development of joint training mode with more training, practice experience, the ability of college students.

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A New Breakthrough of Library Reader Education in the Mobile Internet Environment

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Abstract: The reader education is indispensable service in every library. According to the abilities of the library, it is different in the depth of readers education. However, in today's Information Age, the reader's education must be given due attention to the enormous impact that the digital age brings to the library. This paper reaffirms the significance and characteristics of the readers 'education, and analyzes the educational needs of the library readers from the main contents and the main training objects of the readers' education in the university library. Besides, it uses the mobile Internet environment to break through the new educational form of the library readers according to the changing times and the needs of different levels of readers. The aim of it is to adapt to the needs of smart era of young avant-garde readers.

Keywords: Library; Reader Education; Training lecture

1. INTRODUCTION

With the popularity of mobile Internet, the library will develop the traditional literature resources to the digital, network direction, and use readers education and training as a new resource publicity means. In recent years, the major libraries compete to carry out the reader education and training.There are some libraries which make readers education and training as a continuous activities, such as "One Hour Series of Lectures" in Wuhan University of Technology; "Information Quality Education Online" in South China Polytechnic ;"Online Lecture Hall" in Hunan University; "Read the Big Vision" in Zhongnan University of Economics and Law and so on. Obviously, people have paid more and more attention to the education and training of readers in the Information Age. But it is not a direct continuation of the traditional way of educating readers. It is the preservation of the essence of traditional readers' education. At present, the most information dissemination platforms that readers use are WeChat, Microblogging and so on. Therefore, the reader's education in the library should change with the reader's hobbies and characteristics, which makes great use of electronic platforms in the library of reader education , such as WeChat, microblogging, micro-class and so on.

2.THE CONCEPT, MEANING AND CHARACTERISTICS OF LIBRARY READER EDUCATION AND TRAINING

1.1 The Concept Of Reader Education

Reader education is to help readers understand the literature, library collections and services.Besides, it masters the literature search and methods of using,enhancing intelligence awareness.It is good at expressing the information needs of the literature.With a variety of search tools and various channels,it can obtain literature and information. Reader education is a universal and practical comprehensive ability education.It is an important work that helps the library develop and utilize literature resources, and realize its educational function.

1.2 The Meaning Of Reader Education

For the library, the reader is the first service object, and the reader education and training is one of the key content of library services. The library invests a lot of money every year to purchase resources. If these resources do not get the effective use of the readers, it will lose the functions that the library should have. Therefore, the reader education and training is the best way to improve the efficiency of the library. Design the training content for different readers. New readers need to guide the library-based education, and shallow readers need to use the library awareness education and query ability education. Deep-seated readers need to retrieve the knowledge of education and network education. If there is no education and training for reader, then the reader can only get the library of explicit knowledge in the library.However, for the library of hidden knowledge (electronic resources) ,they are not be available. Therefore, the reader education and training has a very important significance for the practical value of the library.

1.3 Characteristics Of Reader Education

With the rapid development of science and technology, the library reader education has the characteristics of openness. The progress of science and technology promotes the continuous progress of library resources, service contents, service methods and means. The trend of information resources appears diversification and sharing .The library uses modern technology to realize the openness of readers' educational resources, playing full of Library 's Educational Function.

In the era of mobile Internet education, the library reader education has the characteristics of socialization. The traditional way of education in the library has been unable to meet the educational needs

of readers in the digital age. Under the premise of sophisticated traditional education, it seeks to change the way of readers 'education in cyberspace. It uses the many methods to meet the needs of different readers and to realize the diversification of library readers' education, such as sound, image and video.

With the advent of the digital age, the library reader education has the characteristics of diversification. Now all the libraries have built services to readers of the channel, such as a website, microblogging, WeChat and so on .The reader online education is not only limited to the local museum readers, and other city or remote readers can also access to library education resources freely.This Online education without the constraint of time and space can be obtained by the reader through the Internet tools. Therefore,t he library with the open Internet can make the reader education service for the whole society.

3. THE MAIN CONTENT OF LIBRARY READER EDUCATION AND TRAINING

3.1 How To Use The Commonly Database

Library of electronic resources are mainly some academic databases, such as: China Knowledge Network, Read the Show Knowledge Base, Super Digital Library, and a variety of foreign language data and so on.The total number can reach more than hundreds . According to the different capacity of each library, the purchase of Database types and the number are not the same.In short, these databases are academic collections. Through the reader education and training ,it allows readers to learn how to use.The library can improve the utilization of electronic resources , the reader's scientific research and open its academic vision.

3.2 Methods And Techniques Of Information Retrieval

Readers should know how to apply a variety of databases. Besides, they need to grasp information retrieval methods and effective technical means accurately and fast in the information age. In this case, it can ensure to obtain accurate information resources in the messy information flow, rather than appears so pale and weak. There are many impact factors of the information recall rate and accuracy. For example, a variety of search engines advanced retrieval methods, the use of Boolean logic operators, and the exact structure of the search, etc. Library readership training should be included in the training content, in order to train readers ability of obtaining useful information in real life and learning.

3.3 The Retrieval And Utilization Of Network Free Academic Resources

Academic databases brought by library are limited of using scope in the network. The general requirements is that the reader uses it on the museum or in the school. If they leave the scope of the database, it will not be able to use. In view of obtaining effective information resources on the open Internet, the library should give online academic resources retrieval freely and use it to impart to the reader. So that readers can see the teacher's teaching video in the process of self-study, which achieves a multiplier effect. For such readers, people can be recommended of many video websites, such as Muji Network, Love Course Network, Netease Cloud Class, National Map Open Class, Superstar Teacher Forum, and China University MOOC and so on .

3.4 Academic Writing And Academic Norms

Most of readers go to the library to check the information research , in order to write papers. But writing papers is not familiar and easy for everyone, it needs to be completed by following the certain requirements and rules .So the academic writing method is necessary to incorporate the contents of the reader's education and training. Readers feel difficult to control the academic information of reference in the process of querying information. With a little attention, it will lead to high repetition rate, and even infringement of copyright question. Therefore, Library should add to the contents of academic norms in the content of the training of academic papers writing .

4. THE MAIN OBJECT OF LIBRARY READER EDUCATION AND TRAINING

4.1 Training For Groups Of Undergraduates And Graduate Students

Undergraduates stage is an important stage of students' systematic learning, and it is the real stage of starting self-study ability. Students have just entered the university from high school, and access to a lot of books in many libraries. They may feel ignorant. At this time, they need to participate in the training of the using about library. They should master many abilities, such as, admission notes, book classification, collection distribution, and entry of electronic resources and so on before sophomore for undergraduate, which is the so-called the museum education for new students. Undergraduates entering the sophomore year and postgraduate students should develop their ability to retrieve information so that they can adapt to the requirements of the information society. Through the search of information, it taps the greatest potential and creativity of students and make them in invincible position of the social competition . Then the first task of cultivating talent falls on the library. Through the reader education and training methods, the library taught in the fishing method. Some people have said: "Half of the knowledge is to know where and how to get it." It is the problem that the library wants to solve by opening the information retrieval and using of courses. Library should pay great attention of he reader educations in this stage of, which can not be ignored. Undergraduates and graduate students are the largest beneficiary of education groups.

4.2 Training For Teachers And Administrators

Another group in the library education are teachers

and administrative staff, and this part of the people has not received systematic information retrieval training in the university stage. Now, they are often limited by information query when they participate in doing research and writing papers in the work .They only go to China Knowledge network to search information. The responsibility of the university library is to serve the study and research for the teachers and students. After understanding the situation of teachers and administrators, they should carry out effective training for this part of the reader , who need to develop the ability of searching scope and retrieval methods, and searching techniques.For example: Boolean logic Search, the Access of Using Information , and commonly used popular software. Besides, it also includes how to obtain valuable knowledge of the method from microblogging, WeChat, micro-class and other leisure platforms .

4.3 Training For Work-Study Students And Volunteer Groups

The number of library of the work-study classmates and library volunteers is very small, but it still plays the role of librarians. Their training can not be ignored. This part of the people should master the knowledge that undergraduate students should acquire , and people also should train their ability to serve the reader. Because they are an indispensable part of the library management, they assume the library reader service work. They are the hidden propaganda channel of library. In the campus life, these students inadvertently master the use of library skills to the people around through their own words and deeds, which is the library indirect education and training of readers.

4.4 Training For Librarian Groups

Librarians are the first-line staff of library services. The library's service ability depends on the skill level of the librarians. Therefore, in order to improve the service quality, the library should firstly improve the information literacy of providing information services. Librarians training content and the reader group is slightly different, and they need to master the use of library management system, interdisciplinary book classification processing, library special readers services and other skills. Therefore, the library can not ignore of the reader education and training the library staff training.

4. NEW BREAKTHROUGH OF LIBRARY READER EDUCATION AND TRAINING IN MOBILE INTERNET ENVIRONMENT

4.1 Using "Microblogging" Platform To Realize The New Form Of Reader 'S Education

Microblogging referred to micro-blog . In recent years, microblogging has become a public platform for the expansion of public space, and it is a new media form. As people use it as "fashion network toys". It also has information sharing and information dissemination within the Internet. Each user is the publisher of the information and the recipient of the information.Microblogging has the characteristics of fastness, practicality and convenience. The library can expand the scope of readers education and help readers use the museum's rich resources by the attraction and influence of microblogging.In the process, they can accept the influence and influence of library culture.In the library microblogging,they can publish the museum news, the museum important notice, lectures exhibition and database information.Besides, it also receives the reader's feedback. Problems can be timely feedback to the library, so library can make adjustment and the improvement of the rules and regulations.It facilitates the library to improve the capacity of information services.Through the microblogging platform ,it achieves a good interaction between the library and the reader.This new media form is the very favorable publicity platform for expanding the reader education work ,and it is the cultural transmission platform for micro-era library,which can not ignored .

4.2 Using The "Micro - Letter" Platform To Realize The New Form Of Reader 'S Education

WeChat is free applications, and it launched by Tencent on January 21,2011,following QQ Tencent. It is a smart terminal for instant messaging services. Nowadays ,WeChat and QQ are coexist, but the coverage of WeChat has been much more than Tencent QQ. Until 2016, WeChat has covered 94% of the country's smart phone, and it can be said the new platform of micro-era and another network of cultural communication. WeChat and QQ is different, and WeChat is micro-public platform. WeChat public platform mainly concerns real-time communication, messaging and material management. Users can group the public account fan management, real-time communication. It has many fuctions, such as the advanced features - edit mode and development model to automatically reply to user information. Most of the libraries have opened a WeChat public number. In WeChat, pepole can do many things like pushing information, searching resource ,doing personalized service and self-service and so on. As the number of information that public can release every day is limited in WeChat, so the library keeps a serious and cautious attitude in the information editor. The integrity and accuracy of public information in WeChat is can not done in microblogging information platform. The content of the reader's education and training is pushed out by the WeChat public number, which allows the reader to share and absorb the training content in time and expand the readers' benefit.

4.3 Using "Micro - Class" Platform To Realize The New Form Of Reader 'S Education

Micro-class is structured data resources that refers to the use of information technology in accordance with the law of cognition, showing fragmented learning content, process and expansion. It is more suitable for autonomous learning. Micro-class teaching has the

feature of a shorter time. The length is generally about 5-10 minutes, and the longest one should not exceed 20 minutes. The reader's training content recorded into such a micro-class, and you can achieve a certain ratings effect. Because the reader does not need to go to the designated place to receive education, they can watch online anytime and anywhere. Video viewing is more clear and acceptable. Video time is short, so the reader does not need to use a large time to learn. It just needs spare time to watch. This fragmented content is not limited to the learning community. Therefore, "micro-class" is different from other teaching resources, such as the traditional single resource type of teaching curriculum, teaching courseware, teaching design, teaching reflection and so on. On the basis of its inheritance and development of a new teaching resources, it is the beneficial transmission of education and training.

5. CONCLUSION

The purpose of library reader education is to spread culture and improve the information literacy of all people. In the Information Age, the library should face up the challenges brought by the Internet environment, making full use of the cultural communication function of the network communication platform. Besides,it can not only be confined to the media, such as the microblogging and WeChat and micro-class and so on. Follow-up research will be extended to other new areas of text, video and images. In short, it should expand the scope of education services for readers and it can not miss media on the Internet .Although the Internet brings library readers education about challenges, it also gives a great opportunity for the development.

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Design of the Somatosensory Control System Based on Kinect

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Abstract: With the rapid development of the computer technology, the interaction between human and computer has gradually become an important part of people's daily life. Gesture is a natural and intuitive way of interaction, and the meaning of the expression become rich and convenient, therefore, the gesture recognition is one of the most advanced and popular technologies in human-computer interaction technology.

This article presents a design project about the design of the somatosensory control system based on Kinect, the system uses Kinect somatosensory sensors to extract depth images of movements, and use the software of PC side to algorithms and obtain the joint skeleton tracking, then transformed the joint point into screen coordinates by skeletal space coordinate mapping, and simulation the mouse events to trigger the gesture events. At the same time, through the Arduino and then set the control object as RGB lights which can provide a new experience for the users.

Keywords: somatosensory; Kinect; Arduino; Bluetooth communication; RGB

1. INTRODUCTION

With the rapid development of computer technology, the interaction between human and computer has gradually become an important part of people's daily life. With the development of human-computer interaction, the human-computer interaction device is also in constant development, from the mouse, keyboard, touch screen to handle, the traditional human-computer interaction device has some limitations in natural and friendly aspects of use, so study the interactive technology of interpersonal communication habits, and establish a harmonious and natural human-computer interaction environment become a current development trend. In this article, the Kinect based somatosensory control system uses the somatosensory interaction technology. Through this system, users can use their body movements to control the surrounding devices, thus can bringing a new user experience.

1.1 The Introduction Of Somatosensory Control Technology In Practical Application

At present, the somatosensory interaction control technology has been applied in practical life, such as the application in operation room. Through the somatosensory technology can get rid of these limitations of interactive control, which can free the hands of the surgeon and the anesthesiologist, so that they can view the patients' lesion images in process of operation, and use gestures to amplification, narrow figure and read operation records. In sports competition the somatosensory control technology has also been applied. Nowadays in many competitive subjects, it widely use the motion capture technology which is similar to the "Hollywood", then combine with computer vision technology, and accurate tracking of athletes, in addition it can calculate the body trajectory, velocity, angle and acceleration, and movement trajectory and speed, so coaches can use the data give the guidance to the athletes in order to improve the level of training athletes. In addition, somatosensory interaction technology has also been applied in the clothing industry. As long as the customer standing in front of the "virtual mirror" use their gesture to choose, they can be able to"Preview" from the screen, which provides a new solution for online shopping that lack the sense of reality experience.

2. THE DESIGN AND SELECTION OF THE SYSTEM

2.1 The System Overall Design

Kinect based somatosensory control system mainly consists of four parts, which are Kinect somatosensory control software operated on the PC side, Bluetooth wireless transmitter host, Bluetooth wireless receiver and slave, RGB control circuit. Kinect Somatosensory sensor will be collected to the depth image data spread to Kinect control software that running on the PC side; The somatosensory control software get the processing of the algorithm, which will recognize the movement information then through the serial port to the Bluetooth wireless transmitting host; Bluetooth wireless transmitting host use the Bluetooth communication sends control information to the remote Bluetooth wireless slave receiver; The RGB control circuit control RGB lamp dimming by receiving the data transmitted from the slave. The overall design diagram of the system is shown in figure1.

2.2. The Option Of The System Design

2.2.1. the options of somatosensory sensor design

In the design of this control system, choose a appropriate core device has become the key to the successful completion of the design task, and as the core of the control system, the selection of the sense of body sensor is the most important. According to the requirements of the project design,we take the use of Kinect and Real Sense into priority

consideration, the two somatosensory sensor can meet the design requirements of the subject, but considering the cost, convenience and performance, and we finally chose the Kinect sensor.

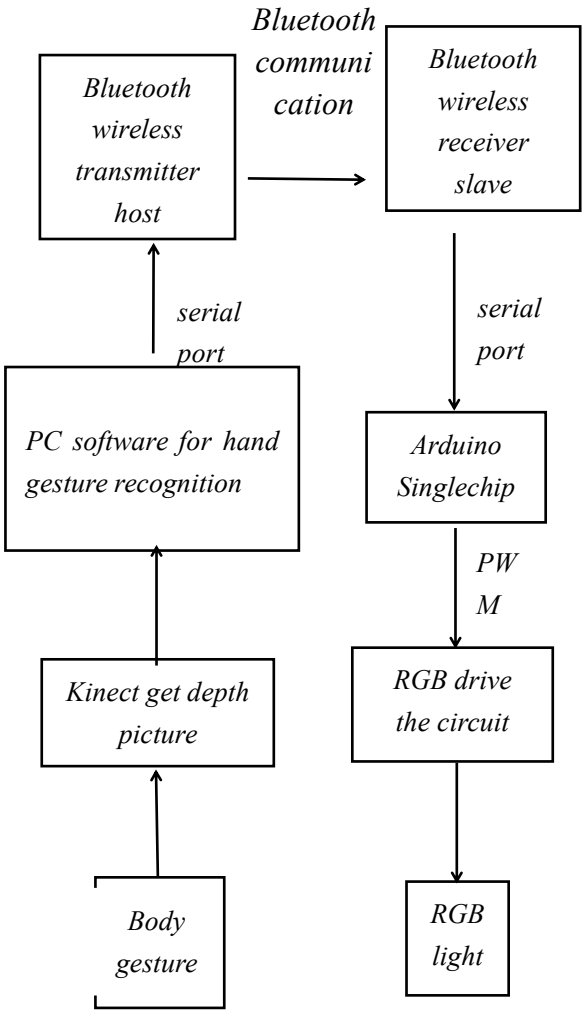

Figure 1 Overall design block diagram of the system

2.2.2. the options of the micro controller design

In this system, through controlling dimming of the RGB lamp to show the Kinect motion control of the equipment , but the RGB lamp dimming need the micro controller to control it, and the micro controller use the serial port to receive the information that from the Bluetooth slave, and then realize the specific control of RGB lamp.According to the design requirements of the micro controller, Arduino microcontroller is chosen to be the micro controller.

2.2.3. the options of the wireless communications design

In this article, because the PC software need to send the processed information to the micro controller remote software through the wireless transmission, but at first the information of the software should use the serial port send to wireless transmitting host, and through wireless communication the wireless transmitting host transmitted the data to the receiver slave, the data is large and the speed is fast, so choose the suitable scheme of wireless communication is particularly important, according to the requirements of the design of the wireless communication, finally, the BC04-B Bluetooth serial port host-slave module is used as the wireless communication scheme.

3. THE HARDWARE STRUCTURE DESIGN AND INTRODUCTION OF THE SYSTEM

3.1. The Arduio Circuit Design

Arduino is an open source single chip micro controller, it uses the AVR MCU of Atmel company, which adopted the software and hardware platform of open source code, and it build on Simple (simple output / input) sector panel, which is similar to Java, C language processing development environment. The micro control chip used in this design is the ATMEGA 328 chip in the Arduino series micro controller.

The design uses the input and output functions of the Arduino microcontroller I/O port ,the function of the serial communication, RX (No. 0), TX (1) ,pulse broadband modulation PWM (9, 10, 11) and other functions. Arduino microcontroller RX and TX serial communication interface, receiving the information from the Bluetooth communication slave, through the controller in the process, use the pulse broadband modulation of PWM (9, 10, 11) of the three port to send the PWM control signal to RGB, and control the RGB lights for dimming, the minimum system circuit of the Arduino shown in figure 2.

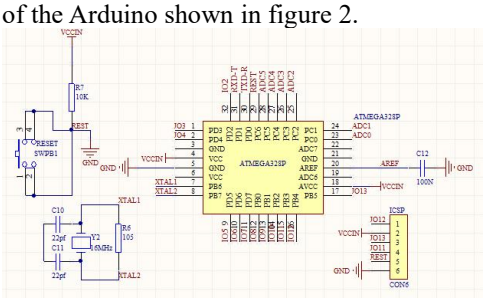

Figure 2 the minimum system circuit of the Arduino

3.2. The Kinect Hardware Structure And Principle Introduce

3.2.1. The Kinect hardware structure

The Kinect somatosensory sensor comes with an RGB camera, an infrared projector and an infrared camera, and a microphone array with sound source localization and environmental noise suppression. The core of the Kinect is the PS1080 system chip of Prime Sense company , and the infrared projectors and infrared cameras are connected through the chip. The PS1080 chip has a powerful parallel computing ability, can control near infrared light source, encode image, and project near infrared spectrum actively.

3.2.2. Introduction of depth image imaging principle

As for Kinect sensors, the recognition of human limb movements is based on skeleton tracking, whereas the skeletal images used for skeletal tracking are extracted from the depth image to discard the background image information. Therefore, acquiring depth data of the human is the basis that we can realize the movement recognition. Now there are

mainly two kinds of deep image imaging.

(1)One is based on time of flight: let the device emits pulsed light, then the receiving reflection light from the object in the launch site, measuring the time that the light from launch to return, calculating the distance,and obtaining the depth information. At present the ToF is the most accurate and feasible technology, but it costs a lot. The schematic diagram for ToF to obtain depth data is shown in figure 3-2.

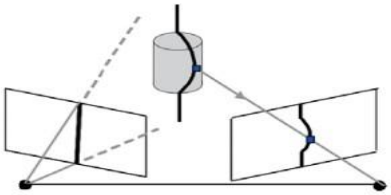

Figure 3 A schematic diagram of ToF to obtain depth date

the structure light measurement principle: the scanning principle of the structured light first let the structure light projected onto the object surface, and then use the camera to capture the reflected light, because the structure of light received pattern will influence by the object of 3D shape and deformation, thus to calculate the depth information of the object surface by the pattern in the camera position and the degree of deformation. The schematic diagram of structured light measurement is shown in figure 3-3.

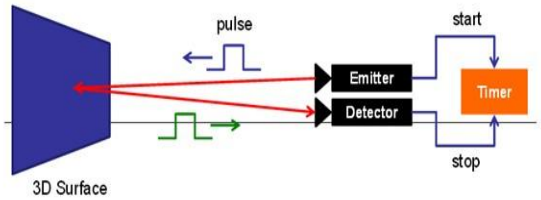

Figure 4 the schematic diagram of structured light measurement

In Kinect,we use a depth measurement technique called Light Coding, an encode the space to be measured by light sources which is one of the structural light measurements, but the depth calculation methods are different. The light source in Kinect is called “laser speckle”. These speckles are of highly random and vary patterns follow the distance varies. According to this characteristic, as long as we structured light in the measured space, thus the entire space will be marked on, and compared with the difference between the speckle pattern and the speckle pattern that has been marked, you can know the depth information of the object.

4.KINECT GESTURE RECOGNITION SOFTWARE DESIGN

In this design, the Kinect gesture recognition software can be divided into three parts: the gesture recognition algorithm, GUI interface and simulate mouse etc. The work structure of each part is shown in Figure 4-1.

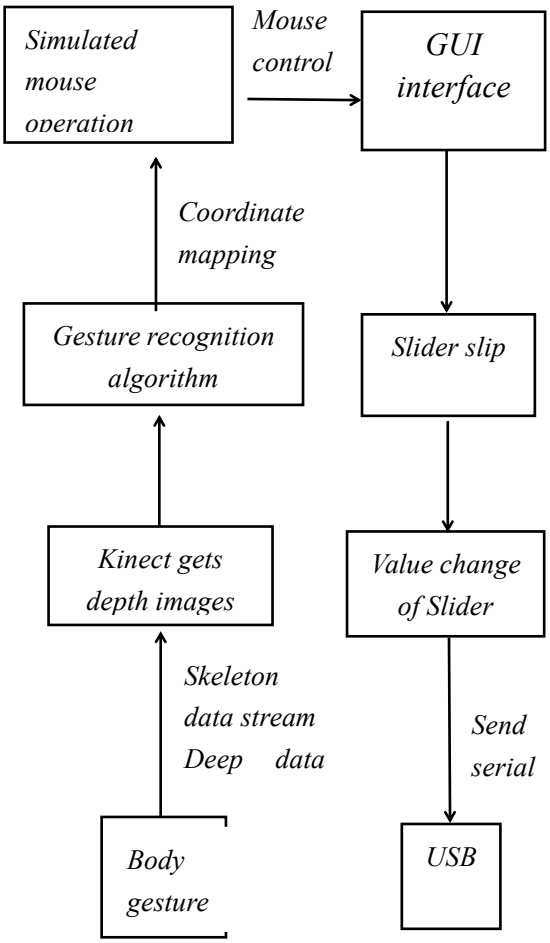

Figure 5 the work structure diagram of each part

4.1 GUI Interface Design

The development of the entire system software is using the WPF framework, where the interface can use the “cast control” or XAML markup language. Through send three color parameters to the Solid Color Brus to create an instance of this design, so as to realize the real-time change of the main background color. The code of this section is presented as follows:

This.Background=new Solid Color Brush (Color.From Rgb (), slider1.Value, byte (byte), slider2.Value, (byte) slider3.Value);

Xmlns:my="clr-namespace:Microsoft.Samples.Kinect.WpfViewers;

assembly=Microsoft.Samples.Kinect.WpfViewers"

<my:Kinect Depth Viewer "Canvas.Left= 220" Canvas.Top= "12" Name= "kinectDepthViewer1" Margin= "0,12804501" Foreground= "Light Gray" / >.

The final user interface is shown in figure 4-2.

4.2. The gesture recognition algorithm design

In Kinect applications, the algorithm of gesture recognition is the core of the whole application, and the good program structure is robust and maintainable. Therefore, in gesture recognition algorithm design, we adopted the modular design ideas, and divided the software design of this part into initialization subroutine, smoothing subroutine,

recent user access subroutine, gesture recognition subroutine, subroutine modules to simulate mouse and so on.

Figure 6 the user's interface

4.2.1. The initialization subroutine design

In the initialization subroutine of Kinect, it mainly includes the detection of Kinect device access, the acquisition of device objects, the setting of parameters, the opening of data stream, the registration of data flow events, and the start of Kinect device.

4.2.2. The smoothing subroutine design

In the program of skeletal tracking, it is necessary to take the occurrence of occasional hop jumps in the course of rapid movement of the user into consideration. For this joint jumping and shaking problem,we can set the smoothing parameter Transform Smooth Parameters, to standardize the joint skeleton coordinate, and the smoothing smoothing is designed based on the specific algorithm. The key code for smoothing is as follows:

Var TSP = new Transform Smooth Parameters{
Smoothing = 0.5f, Correction = 0.5f, Prediction = 0.5f, Jitter Radius = 0.05f,
Max Deviation Radius = 0.04f};
_kinect. Skeleton Stream. Enable (TSP);

4.2.3 the recent user access subroutine design

Kinect device itself has the characteristics of multi-user tracking, can detect 6 users, but at the same time it can only track the 2 users of Skeleton joint information.

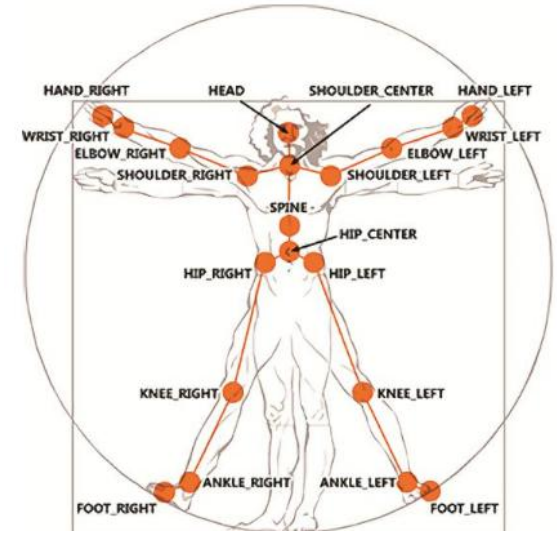

Figure 7 the match man sketch map with 20 skeleton joint points

4.2.4. The gesture recognition subroutine design

Before designing a gesture recognition program, you need to make sure the gesture, which is the gesture command. In the example of the Kinect's Joint Type the 20 different skeletal joints are defined, and a match person schematic with 20 skeletal joints as shown in figure 7. From the figure we can know that in the middle line of the skeletal has four points which is head, Shoulder Center, spin, Hip Center, and we finally choose the Head as the reference point of skeleton fulcrum.

4.2.5. The simulation mouse subroutine design

The key code for converting skeleton space coordinates into screen coordinates is presented as follows:

/ / get the width and height of the screen
Int screen Width = (int) System Parameters.Primary Screen Width;
Int screen Height = (int) System Parameters.Primary Screen Height

Let the hand skeleton coordinate mapping to the screen coordinates; So the hand only need to move in a limited range that can cover the entire screen area.

Float, pos X = hand.Scale To (screen Width, screen Height, 0.2f, 0.2f).Position.X;
Float, pos Y = hand.Scale To (screen Width, screen Height, 0.2f, 0.2f).Position.Y;

The key code for converting the screen coordinates to the absolute coordinates of the mouse is presented as follows:

Int x = Convert.ToInt32 (scaled Cursor Joint.Position.X);
Int y = Convert.ToInt32 (scaled Cursor Joint.Position.Y);
Int mouse X = Convert.ToInt32 (x * 65536 / screen Width);
Int mouse Y = Convert.ToInt32 (y * 65536 / screen Height);

After you get the absolute coordinates of the mouse, you can simulate the operation of the mouse, as for the simulation of the mouse in this design, we use the mode of the
P/Invoke to call Win32DLL to achieve the simulation of the mouse events.

5. THE SERIAL COMMUNICATION SOFTWARE DESIGN OF UPPER COMPUTER

In this design, after the Kinect gesture recognition program recognize the user's body movements, then control the mouse by simulating the mouse, and the mouse will control three RGB slide to slide, furthermore the three RGB value that the slide produced usually communication by the serial, which can sent the value to a computer that connected with the Bluetooth transmitter host machine. The property description of the Serial Port class is shown in table 1

Table 1 The property description of the Serial Port class

property	description
Baud Rate	Sets serial baud rate

Data Bits	Sets the standard data bit length for each byte
Encoding	Sets the byte encoding for text conversion before and after transmission
Is Open	This value indicates the open or closed state of the Serial Port object
Parity	Sets parity check protocol
Port Name	Gets or sets the communication port
Stop Bits	Sets the standard stop digit for each byte

The debugging of the system

In this design involves the hardware part, including the Arduino control circuit, the USB communication circuit, the Bluetooth circuit, the RGB drive circuit, because the design of the hardware is more dispersed, so when we debugging the hardware we use block debugging method to eliminates the interference of each module. In the whole somatosensory control system , which is more relatively difficult than the hardware design program, because it involves the Arduino control program and the PC gesture recognition software control program, furthermore the gesture recognition software can be divided into four parts: the gesture recognition algorithm, GUI interface, analog mouse and the PC serial communication etc.. The Kinect User Viewer control displays the user's depth image data in Kinect recognition range, if you can not see the image, it means the current Kinect does not track you. The Kinect User Viewer control debug screen shot as shown in figure 8.

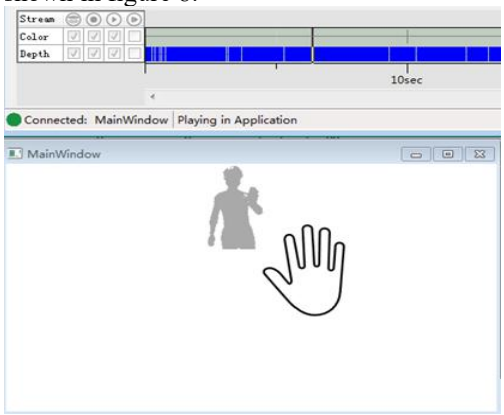

Figure 8 the Kinect User Viewer control debug screen shot

7. CONCLUSION

The Somatosensory control system has been achieved the recognition of human gestures, users can make body gestures, then get the depth image by somatosensory sensor extraction action, and the PC can get the control movements by the algorithm then get communication with the MCU, which can passed to the processing action to the MCU, so the MCU can achieve the control operation of the object, meanwhile it can support the individual somatosensory operation, and provide a new user experience. Of course, the somatosensory control system still has some imperfect place, in addition to add less human control commands, sometimes in the control of the mouse gestures, when you fast moving hand it will appear the mouse cursor "drift", the reason is that when the system handle sudden appearance of jumps for the joint is not so perfect, the gesture recognition algorithm still need to be improved. In addition that when use the gestures to control the RGB lights dimming, we found that the color of the RGB lighting system has some difference in the real time background color of this software, which shows that there is a certain gap between the RGB color and the theory color, so in follow-up program it need to solve the problem by setting the "color balance coefficient", and also need to constantly test the most suitable proportion coefficient.

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Design, Modeling and Simulation of 4-DOF Upper Limb Rehabilitation Exoskeleton Robot

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Abstract: In order to solve the disadvantages of traditional rehabilitation therapy for hemiplegia patients, a 4-DOF upper limb rehabilitation exoskeleton robot was designed. The exoskeleton consists of shoulder joint, elbow joint and wrist joint, which is driven by the linear actuator and a four bar mechanism, the hand structure is driven by under-actuated four bar mechanism. Flexible connection and protective structure was designed to ensure the safety of the patients. With the D-H parameter method, established the exoskeleton kinematic model and Jacobi matrix. The exoskeleton was simulated by dynamic simulation software Adams, and obtained the joint motion data of the arm and hand of the exoskeleton. The simulation analysis verified the rationality of structure design of the rehabilitation of upper limb rehabilitation exoskeleton robot, which provides a theoretical basis for the prototype experiment later.
Keywords: Upper limb rehabilitation; Exoskeleton; D-H parameter method; Adams simulation

1. INTRODUCTION

The rapid increase in the number of stroke and aging population brings great difficulties to society, family and personal life, it has been a major problem to solve the problem of arm movement for the society. The traditional rehabilitation therapy consists of physical therapy, occupational therapy and massage by the physical therapist, existing more malpractices such as it is difficult to cultivate trainers and numbers of trainers are low, for to train and low in quantity, and it is poor in efficiency and expansive in cost0. The exoskeleton can provide precise training repetitively for a long time for the patients, it can achieve training objectives and solved the malpractice of traditional rehabilitation therapy at the same time.

Exoskeleton technology has become the research hotspot at home and abroad in recent years and it is developing rapidly. In foreign countries, Perry in University of Washington developed 7-DOF upper arm rehabilitation robot CADEN-7. All the movement were driven by wire rope except the rotary movement of the upper and fore arms, and most of the actuators were located in the shoulders, which made the whole arm structure of exoskeleton be simple and dexterous, but the forward and reverse movement and the tensioning of the wirerope make the driver system complex0. The Carnegie Mellon university developed a hand rehabilitation robot driven by the electric motor actuator. It was driven by the screw and connecting rod and it was made by PVC, which reduced robot weight, but the restoration function of thumb were lost0. At home, Harbin Institute of Technology developed a 5-DOF upper limb exoskeleton robot. It was controlled by sEMG and it can achieve arms swap, single joint or multiple joints training. The wearability of finger rehabilitation exoskeleton designed by K.Y.Tong in Hong Kong Polytech University is better, but due to the joint rotation axis of four fingers was approximated as one, it can not achieve independence training of single finger0.

In order to help the patients with upper limb hemiplegia carry on the early rehabilitation training of the arm and hand, designed a 4-DOF Upper Limb Rehabilitation Exoskeleton, and kinematics modeling and simulation analysis of the upper limb rehabilitation exoskeleton were carried out.

2. PHYSCIAL DESIGN

The 4-DOF Upper Limb Rehabilitation Exoskeleton was designed based on Bionics and ergonomic principles, as shown in Fig. 1, it includes two parts, the arm and the hand. According to GB10000-88 “Human dimensions of Chinese adults”, the length of upper arm was designed as $l_1 = 310mm$, the length of fore arm was designed as $l_2 = 230mm$. In order to adapt different groups, the arm structure is designed to be adjustabled, adjustable extent is $\Delta l = 40mm$ 0. The arm has four degrees of freedom, they are flexion and extension of shoulder joint, abduction and adduction of shoulder joint, flexion and extension of elbow joint and flexion and extension of wrist joint , and joint range of motion is shown in Tab. 1. The hand thumb has two degrees of freedom, the abduction and adduction of palm finger joints and far knuckles, the other four fingers have three degrees of freedom, the abduction and adduction of palm finger joints, nearly knuckles and far knuckles.

The arm and the hand of the exoskeleton are all driven by motors, which have the advantages of simple structure, reliable movement and easy collection of data, it is convenient to be controlled. The arm adopts a four-bar linkage mechanism, which is driven by a linear actuator, compared with the electric rotating machinery, gear drive and the wire rope drive, it has advantages of small constraint of environmental factors and simple structure, it is also

convenient to be designed and installed, as shown in Fig. 2a. The finger metacarpophalangeal joint is driven by a four-bar linkage mechanism, and the proximal finger joint and distal finger joint are driven by an under-actuated four links. By adding torsion spring to the joint, the motion of human finger can be realized approximately, and the object can be better wrapped so as to achieve a stable and flexible prehension, as shown in Fig. 2b.

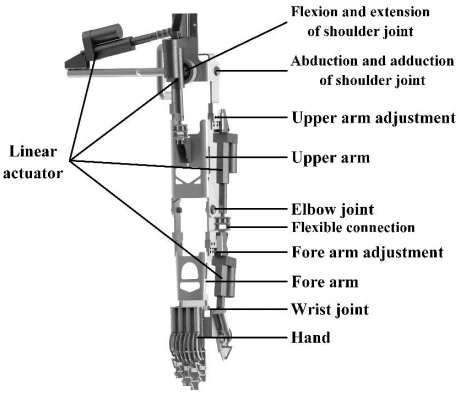

Figure 1 Structure of the 4-DOF Upper Limb Rehabilitation Exoskeleton

Table 1 Joint freedom and range of motion 0

Joint	Freedom	Actual range of motion /°	Achieve range of motion /°
Shoulder joint	1.flexion and extension	0~120	0~45
	2.abduction and adduction	0~105	0~45
Elbow joint	flexion and extension	0~150	0~105
Wrist joint	flexion and extension	0~30	0~15

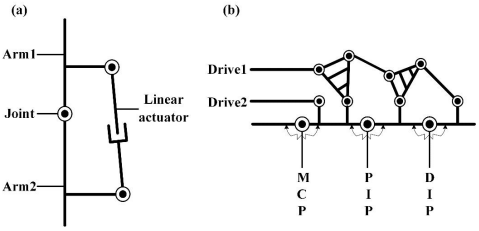

Figure 2 The drive of exoskeleton

The designed upper limb rehabilitation exoskeleton is mainly used for the treatment of paralysis patients. The patient has only a little control force over the limb, and their bodies are too weak to sustain heavy weight objects. The safety of the patient is very important, the exoskeleton should be lightweight and the connection and drive should be a certain flexibility. Therefore, lightweight, flexible, and protective measures are designed for the exoskeleton.

(1)Lightweight design. On the one hand, to meet the strength requirements and reduce the weight of the exoskeleton, the material of exoskeleton is aluminum alloy material, on the other hand, topological optimization of the designed structure is carried out to obtain the best material layout plan to save material and reduce the weight of the exoskeleton.

(2)Flexible design. flexible connection is placed between the linear actuator and the arm, it can reduce the vibration when transfers power, ensure stability when starts and brakes, at the same time, increase the passive degree of freedom to give patients a certain flexibility of space0, as shown in Fig. 3.

Figure 3 Flexible connection

(3)Safeguard procedures include mechanical protection and control protection. The mechanical protection measures are the inhibiting devices for arm joints and finger joints what will limit the rotation angle of the joint in the range, as shown in Fig. 4. The control protection measures limit the movement of the linear actuator of the joint, and set the scram button for patients to stop training in case of emergency.

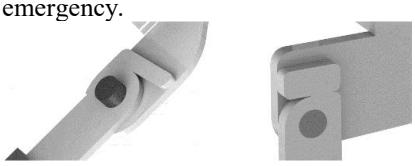

Figure 4 Limit device of the joint

3. KINEMATIC ANALYSIS

The robot kinematics is to establish the position relation between the end effector and the joint relative to the coordinate system. According to the established equation of location relation, it can perform forward and inverse operations quickly by the procedure, control joint movement and the position of end effector, so that the exoskeleton movement could be intercoordination and approach more to the Human joint movement , achieving better training effect. The D-H coordinate system is the forward kinematics analysis method of robot, θ_{n} is the corner from x_{n-1} to x_{n} around the $z_{\mathrm{n-1}}$, d_{n} is the distance from $x_{\mathrm{n-1}}$ to x_{n} along $z_{\mathrm{n-1}}$, l_{n} is the distance from $z_{\mathrm{n-1}}$ to z_{n} along $x_{\mathrm{n-1}}$, α_{n} is the corner from $z_{\mathrm{n-1}}$ to z_{n} around the x_{n} 0.

Build coordinate system of the exoskeleton based on exoskeleton modeling and D-H linkage coordinate system, as shown in Fig. 5. According to the D-H linkage coordinate system, ensure each parameter, as shown in Tab. 2.

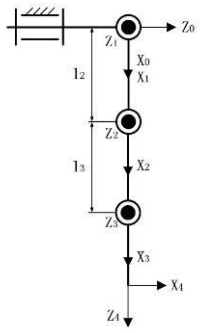

Figure 5 D-H linkage coordinate system of the exoskeleton

Table 2 Parameters of D-H linkage coordinate system

n	θ_n	d_n	l_n	α_n
1	θ_1	0	0	90°
2	θ_2	0	l_2	0
3	θ_3	0	l_3	0
4	θ_4	0	0	90°

T_{n+1}^{n} can describe the homogeneous transformation between relative translation and rotation of D-H linkage coordinate system. There is a conversion relationship between the parameters of coordinate system and the transformation matrix T_{n+1}^{n}, as shown in Type (1).

$$T_{n+1}^{n} = Rot(z,\theta_{n+1}) \times Trans(0,0,d_{n+1}) \times Trans(l_{n+1},0,0) \times Rot(x,\alpha_{n+1})$$

$$\begin{bmatrix} c\theta_{n+1} & -s\theta_{n+1}c\alpha_{n+1} & s\theta_{n+1}s\alpha_{n+1} & l_{n+1}c\theta_{n+1} \\ s\theta_{n+1} & c\theta_{n+1}c\alpha_{n+1} & -c\theta_{n+1}s\alpha_{n+1} & l_{n+1}s\theta_{n+1} \\ 0 & s\alpha_{n+1} & c\alpha_{n+1} & d_{n+1} \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (1)$$

In the type, $c\theta_{n+1} = \cos\theta_{n+1}$, $s\theta_{n+1} = \sin\theta_{n+1}$, $c\alpha_{n+1} = \cos\alpha_{n+1}$, $s\alpha_{n+1} = \sin\alpha_{n+1}$.

Every transform matrix from n to n+1 can be calculated according to the transformation type:

$$T_{n+1}^{n} = \begin{bmatrix} c_1 & 0 & s_1 & 0 \\ s_1 & 0 & -c_1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (2)$$

$$T_{n+1}^{n} = \begin{bmatrix} c_2 & -s_2 & 0 & l_2c_2 \\ s_2 & c_2 & 0 & l_2s_2 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (3)$$

$$T_{n+1}^{n} = \begin{bmatrix} c_3 & -s_3 & 0 & l_3c_3 \\ s_3 & c_3 & 0 & l_3s_3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (4)$$

$$T_{n+1}^{n} = \begin{bmatrix} c_4 & 0 & s_4 & 0 \\ s_4 & 0 & -c_4 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (5)$$

The transformation matrix of the end hand coordinate relative to the base coordinate system is represented by T_4^0. There is a conversion relationship between T_4^0 and T_{n+1}^{n}, as shown in Type (6).

$$T_4^0 = T_1^0 T_2^1 T_3^2 T_4^3 \quad (6)$$

We can get:

$$T_4^0 = \begin{bmatrix} c_1c_{234} & s_1 & c_1s_{234} & c_1 \cdot (l_2c_2 + l_3c_{23}) \\ s_1c_{234} & -c_1 & s_1s_{234} & s_1 \cdot (l_2c_2 + l_3c_{23}) \\ s_{234} & 0 & -c_{234} & c_2s_2 + l_3s_{23} \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (7)$$

Robot Jacobi $J(q)$, as shown in Type (8), reveals the mapping relation between the operation space and the joint space, as shown in Type (9). It also represents the transfer relationship of the force between the two spaces. It provides a convenient method for determining the static joint torque of robot and the conversion of speed, acceleration and static conversion between different coordinate systems.

$${}^{T}J(q) = \begin{bmatrix} v_x & v_y & v_z & w_x & w_y & w_z \end{bmatrix} \quad (8)$$

$$v = J(q) \cdot \dot{q} \quad (9)$$

$\begin{bmatrix} v_x & v_y & v_z \end{bmatrix}^T$ of Robot Jacobi $J(q)$ represents the transmission ratio of the hand line speed v to the joint line speed, $\begin{bmatrix} w_x & w_y & w_z \end{bmatrix}^T$ represents the transmission ratio of the hand angular velocity ω to the joint angular velocity.

The first column of $J(q)$ corresponds to T_4^1 and we can obtain Type (10) by it:

$${}^{T}J_1(q) = \begin{bmatrix} l_2s_{34} + l_3s_4 & 0 & -l_2c_{34} - l_3c_4 & 0 & 1 & 0 \end{bmatrix} \quad (10)$$

The second column of $J(q)$ corresponds to T_4^2 and we can obtain Type (11) by it:

$${}^{T}J_2(q) = \begin{bmatrix} l_3s_4 & 0 & -l_3c_4 & 0 & 1 & 0 \end{bmatrix} \quad (11)$$

The third column of $J(q)$ corresponds to T_4^3 and we can obtain Type (12) by it:

$${}^{T}J_3(q) = \begin{bmatrix} 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \quad (12)$$

The fourth column of $J(q)$ corresponds to T_4^4 and we can obtain Type (13) by it:

$${}^{T}J_4(q) = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \quad (13)$$

The Jacobi matrix $J(q)$ of exoskeleton can be obtained, as shown in Type (14):

$$J(q)=\begin{bmatrix} l_2 s_{34}+l_3 s_4 & l_3 s_4 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -l_2 c_{34}-l_3 c_4 & -l_3 c_4 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (14)$$

4. SIMULATION ANALYSIS

A three dimensional model of the upper limb rehabilitation exoskeleton was established by using SolidWorks, then imported it into the Adams through a seamless interface between SolidWorks and Adams. Added human arm model and coupled the human arm model with the exoskeleton model. Set material and quality attributes, added Joint rotation pair and linear motor moving pair, added drive for linear actuator. Thus the virtual prototype of the upper limb rehabilitation exoskeleton had been established, then carried out the simulation, handled the curves in the post-processing module and collected the experimental data 0.

Added drive for the arm linear actuator, the driving function was $step(time,0,t,0,x)$, completed the movement of arm lifting and releasing. During the two movements, the motor was uniformly accelerated to a fixed speed and then uniformly slowed down to stop, collected the trajectory of the arm, as shown in Figure 6, 0 ~ 5s is the time interval of arm lifting, and the 5 ~ 10 s is the time interval of arm releasing. The diagram of angle, angular velocity and moment is shown in Fig. 7, Fig. 8, and Fig. 9.

Figure 6 The trajectory of the exoskeleton simulation

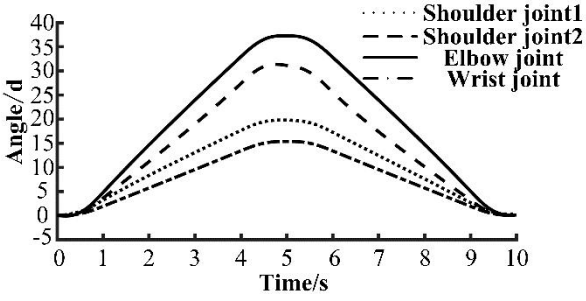

Figure 7 The diagram of joint motion angle

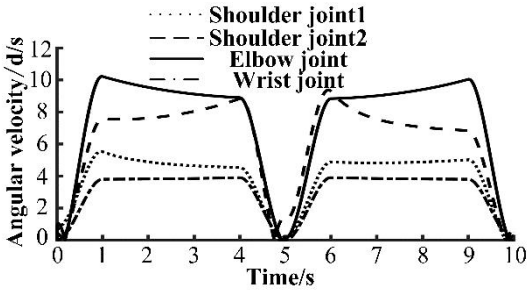

Figure 8 The diagram of joint motion angular velocity

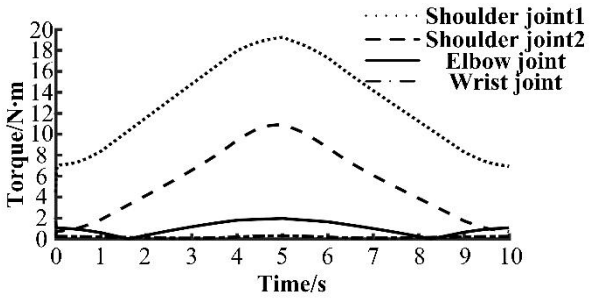

Figure 9 The diagram of joint motion moment

As you can see in Figure 7 and Figure 8, the exoskeleton arm joint has good flexibility in the course of movement, and the actuator has no running dead center. When the linear motor reaches the steady speed at 1~4 s and 6~9 s, the angular velocity curve of each joint shows approximately linear, operates smooth and steady. At the same time, the flexible connection plays a buffer role when it starts and brakes. As you can see in Figure 9, the joint torque increases with the arm lifting, decreases with arm releasing, the shoulder joint extension has the largest torque, but it is within the torque range of the linear actuator.

Added drive for the hand linear actuator, the driving function was $step(time,0,t,0,x)$, completed the action of fist clenching and loosing. During the two movements, the motor uniformly accelerated to a fixed speed and then uniformly slowed down to stop. The fingers have similar structure, collected joint angle, angular velocity of the middle finger joint, as shown in Fig. 10, Fig. 11. 0~5s is the action of hand clenching, and the 5~10s is the action of hand loosing.

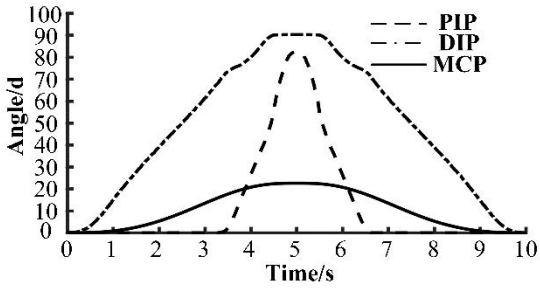

Figure 10 The diagram of hand motion angle

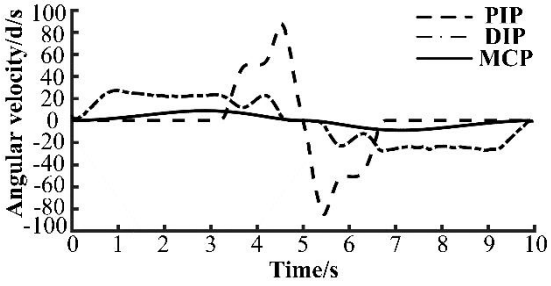

Figure 11.The diagram of hand motion angular velocity

As we can see in Figure 10 and Figure 11, the motion of the hand joint is smooth, and the action of clenching hand and loosing hand have a certain symmetry, but the linearity of the angular velocity curve is poor. In the action of hand clenching in 0~5s, the metacarpophalangeal joints and distal finger joints begin to move first, and the proximal finger joints begin to move after 3.4s. Because the metacarpophalangeal joint is driven by a single linear actuator and a four-bar mechanism, the distal finger joint and the proximal finger joint are driven by another linear actuator and an under-actuated four bar mechanism. When the distal joint moves to a certain angle, the torque of the proximal finger joint can overcome the torsion of the torsional spring and then begin to move.

5. CONCLUSIONS

In order to help the upper limb hemiplegia patients carry on the early rehabilitation training, designed a 4-DOF upper limb rehabilitation exoskeleton robot, put through a course of rehabilitation exercises on arm and hand. The arm is driven by a linear motor and four-bar mechanism, the hand is driven by a linear motor and under-actuated four-bar mechanism. Flexible connection and structure protection device is designed. Established the exoskeleton kinematic model and Jacobi matrix by using the D-H parameter method. The exoskeleton was simulated by Adams, the results showed that the exoskeleton movements were submissive, smooth and had good consistency with human movement, verified the rationality of the exoskeleton.

ACKNOWLEDGMENT

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The Analysis of Constant Current Charging on Supercapacitor

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Abstract: Supercapacitor charging voltage changes linearly: the initial stage of charge, the supercapacitor voltage rises quickly, the middle of change is relatively flat, after the rise again accelerated phase voltage fluctuations in charge of the initial and end of charge; charge currentthe larger the full charge time is short, to verify the characteristics of high current fast charge of the supercapacitor.
Keywords: Supercapacitor; constant current charging; ESR

1. INTRODUCTION

Long life characteristics of the supercapacitor has high energy density and high power density. Supercapacitor also has a wide operating temperature, high reliability and fast cycle charge and discharge, and long discharge characteristics, it widely used as computer backup power supply,solar charger, alarm devices, home appliances, camera flash and aircraft ignition devices.Especially the development and the application in the field of electric vehicles has attracted extensive attention of the world[1-3].

2. ANALYSIS OF THE EQUIVALENT SERIES RESISTANCE OF THE CHARGING PROCESS

The supercapacitor has high energy density, high power density and long life characteristics , it also has a wide operating temperature, high reliability and fast cycle charge and discharge, and long discharge characteristics, widely used as computer backup,power supply,solar charger, alarm devices, home appliances, camera flash and aircraft ignition devices, especially the development and application in the field of electric vehicles has attracted extensive attention of the world's[4].

The principle of supercapacitor energy storage is based on the electrical double layer structure of porous materials. From the analysis of impedance angle,supercapacitor can be equivalent for a general R-C circuit with reference to S.A.Hashmi's simulation circuit. The equivalent model of the supercapacitor as shown in Figure 1.

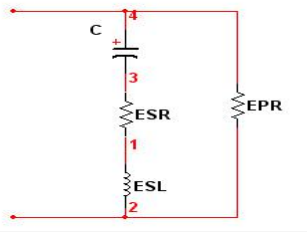

Figure 1 Equivalent model of supercapacitor

The main factor which limited the application of the supercapacitor is the capacitor's equivalent series resistance ESR too large, it effects the current output capacity. The electric double layer capacitor ESR is an important indicator to reflect its performance. In Fig 1,EPR is the equivalent parallel resistance, the symbol “C” is the equivalent capacitance, ESR is the equivalent series resistance, ESL is the capacitance inductance. Most of the time EPR is very big,it can reach several tens thousands of ohms,and it mainly affects the leakage current of the supercapacitor who affect the performance of long term energy storage. ESL is the perceptual components of capacitor which is related to working frequency[5]. When the electrode charged to a constant potential for long enough, the capacitor starts to discharge the electrode potential will be a sudden drop.

When the supercapacitor is in the constant current charge-discharge process, the size or direction of the current in the end of the charging process and the discharging process, changes can be measured with the current capacitor equivalent series resistance. At normal room temperature, we use capacitance of 500F,set 2.7V as the upper limit voltage of the supercapacitor,and set 1.35v as the lower limit voltage.The supercapacitor was charged with different constant current ,such as I=20A,50A,100A.

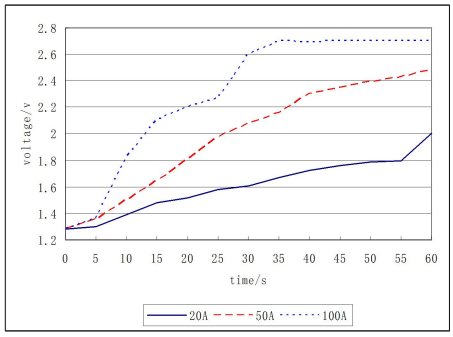

Figure 2 Voltage change of supercapacitor chared with constant current

Fig 2 shows the process of voltage changes of charging the supercapacitor. It has a sinuate margin at the beginning and the end of charging process.The charging voltage of Super capacitor change linearly at the beggining.The voltage changes quickly in the initial stage, and change gently in the middle,in the end it changes much quickly again.This proved that:The time of supercapacitor charging finished become shorter when charging current get larger. It is

mainly affected by the impact of the charging current and the equivalent series resistance. The effects of the two factors make the effective storage energy of supercapacitor changes, with the increase of charging current it leads to lower effective energy storage.

3.THE ANALYSIS OF CAPACITY CHARACTERISTICS

According to the principle of supercapacitor's capacitance:

$$I = C\frac{dV_c}{dt} \quad (1)$$

dV_c -voltage variation caused by capacitor's discharging; dt -time variation of discharging. We can obtain the formula 2 from the formula (1):

$$C = \frac{I \times (t_2 - t_1)}{U_1 - U_2} \quad (2)$$

The changed voltage formula of supercapacitor:

$$dV = I\frac{dt}{C} + I_g R_{ES} \quad (3)$$

R_{ES} is the equivalent series resistance.We can obtain the formula(4) by converting fomula 3.

$$C = \frac{I_g dt}{dV - I_g R_{ES}} \quad (4)$$

We charged the same supercapacitor with the current of 10A, 20A, 40A, 50A, 70A, 90A, 100A,also measured the capatances in the experiments.The result shown in Fig 3.

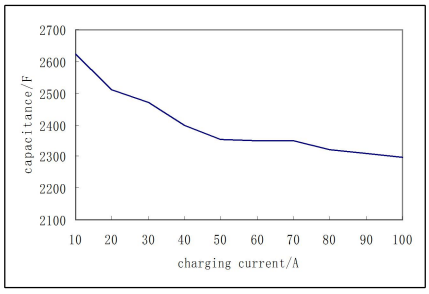

Figure 3 Changes of capacitance charging with constant current

The stored charge capacitance C and the carbon material surface properties are closely related to the porous carbon electrode surface area and micro pore size distribution is an important factor of the impact the electric double layer capacity of the supercapacitor [6-7].The effective capacity and the conversion efficiency of supercapacitor are affected by the effective resistance and the charging or discharging current.The capatance is small with large charging current.

4. THE ANALYSIS OF CHARGING EFFICIENCY

In certain circumstances we shall select the constant power supply for charging. The advantage of constant-power charging just because it can't affect other circuit and it also have constant input power. In the charging mode the charging voltage and current changed with time changes.

$$P = i^2(t) \times R + U_C(T) \times i(t) \quad (5)$$

We can calculate the current:

$$i(t) = \frac{-U_C(t) + \sqrt{U_C^2(t) + 4R_S \times P}}{2R_S} \quad (6)$$

For the convenience of calculation, the super capacitor terminal voltage of U_{C0} to $U_C(T)$ is divided into parts, which considers each equal parts of current is constant, set the appropriate step size, and then calculated through the differential,we can get the constant-power efficiency formula(7) of constant power for charging:

$$\eta = \frac{\frac{1}{2}C(U_C^2(T) - U_{C0}^2)}{P \times t} \quad (7)$$

Analysis of Formula(7) can be obtained that the most charge energy is consumed in the resistance of Rs at the beginning, with the increase of the voltage across the capacitor and the decreases of charging current, the energy consumed by heat also decreased, the charging efficiency gradually improved, at the end it reach more than 88%. The constant-power charging applicated in the photovoltaic power generation.

Combination of the above theoretical analysis,it is easy to find that there is great correlation of supercapacitor charging method and charging efficiency, which has much relationship with the supercapacitor.The efficiency of constant-current charging is very high, but by the late voltage of both ends of the capacitor is too large, the efficiency of the constant voltage charging become too lower at this time. The control circuit of constant-power charging complicated, so we can take way of combined charging.It takes a large charging current mode when the super capacitor terminal voltage become lower, with increasing charging terminal voltage change for decreasing current or constant voltage mode, so the charging more fully.

5. CONCLUSION

The supercapacitor's method of charging by the constant current regulator, and the results show that:

(1) From the impedance point of view, the basic features of the equivalent circuit can describe the supercapacitor;

(2) Constant current charging the whole story stage voltage fluctuations, voltage fluctuations by the charging current and equivalent series resistance, thus affecting the supercapacitor storage energy; Capacity of the supercapacitor decreases with increasing charging current;

(3) Supercapacitor storage energy and charge current fitting function: f (x) = 0.01x2-1.82x. Small degree of constant current charging, the energy reserves value obtained is relatively stable, high-current charging at

the same time, the supercapacitor storage energy have greater restrictions;

(4) When the charging current is smaller, the charging efficiency is relatively smaller. Moderate charging current corresponding to the higher charging efficiency, increases to a certain level of points when the charge current, charge efficiency decreased;

(5) In the choice of the supercapacitor charging current, it should be considered supercapacitor charging time, the storage of energy and charging efficiency and other factors in order to meet the actual needs of users and achieve the optimal configuration of the supercapacitors.

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Movement Analysis and Simulation of Exoskeleton Gait Simulator for Lower Limb Rehabilitation Training

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Abstract: In order to help patients with lower extremity dysfunction to regain motor ability as soon as possible, assist the patients in walking rehabilitation training, designed an exoskeleton gait simulator for lower limb rehabilitation training. Analyzed kinematics of the polygonal effect of the driving chain and the traction chain, obtained the relationship expression between the traction chain velocity and its no-uniform coefficient. Used ADAMS to simulate the movement process and stress of conveying chain, received angular speed, angular acceleration, torque of the two chain wheels and variation rules of the velocity and acceleration of the traction chain. The simulation results show that the exoskeleton gait simulator for lower limb rehabilitation training can meet the recovery requirements of patients with lower limb dysfunction, which establish the foundation for further experimental research.
Keywords: lower extremity rehabilitation; exoskeleton; gait simulation; motion simulation

1. INTRODUCTION

The lower limb movement disorder is the most common symptom of stroke patients to face. Since the 1990 s, lower limb rehabilitation training robot began to be used and popularize in rehabilitation training process of stroke patients, With the development of the concept of stroke rehabilitation and engineering technology, the structure and function of the lower limb rehabilitation training equipment are also constantly promoting[1]. Stroke rehabilitation walking training robots are currently developing with the help of mechanical traction system and weight reduction training system[2]. Most of the mechanical traction systems are leg-driven exoskeletons for lower extremity or pedal-driven robots, foreign products are in the majority of we use, such as Lokomat in Switzerland, lokohelp and Autoambulator in the United States[3], Gait Trainer in Germany and so on. There are also projects and products of the rehabilitation training for the lower limbs in China, but most of them are stay in scientific research test phase, the scientific research institutes which can be representative are Tsinghua University, Zhejiang University, Chinese Academy Of Sciences, Shandong University Of Technology and so on[4-8], Above rehabilitation systems either have complex control systems and high cost, or have simple structure but low security and poor treatment effect, Aiming at the above problems, this paper developed a new type of weight reduction exoskeleton gait simulator for the lower limb rehabilitation training, which makes the rehabilitation training effect more remarkable.

2. EXOSKELETON PRINCIPLE

2.1 Gait Analysis

Normal gait refers to the human body that in the control of central nervous system, through a series of actions of the lower limb joints such as the pelvic joints, hip hip joint, knee joint, ankle joint and toe joint to implement, it has a certain reliability, coordination, rhythm, periodic, direction and individual differences. In the continuous gait process, the movement of the lower limbs in each gait period is basically uniform. Refer to the movement and position of the foot, a normal gait cycle refers to the time from the heel strike to the next heel strike of the same side. consisting of the supporting phase (about 60%) and the oscillating phase (about 40%), the supporting phase includes five periods: foot strike, toe-off of opposite side, heel strike of opposite side, heel-off, foot strike of opposite side; The oscillating phase includes three periods: the beginning of the swing, the middle of the swing and the end of the swing[9]. The diagram of of the gait cycle is shown in Fig. 1.

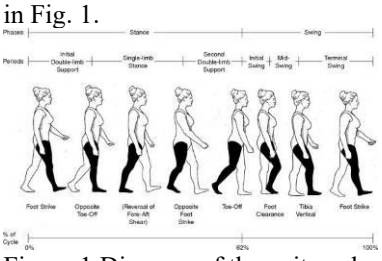

Figure 1 Diagram of the gait cycle

2.2 Working Principle Of The Exoskeleton Gait Simulator For Lower Limb Rehabilitation Training

The model of exoskeleton gait simulator for lower limb rehabilitation training is showed in Fig. 2. During working hours, start the three-phase asynchronous motor, the motor will transfer the power to the belt roller through belt driving, the friction wheel will be driven under the action of the friction force and the chain wheel coaxial with the

friction wheel will also be driven, through chain drive, the power will be transferred to the traction chain which is in the gait simulator. In this way, the pedal which is connected with the traction chain will be moved, and then realize the passive motion of the patients.

The footwork simulator is composed of inner plate, pedal axle, outer plate and support frame , the dimensions of the inner plate and the outer plate correspond to the postural posturing requirements, inner plate and outer plate have guide rails, so that the bearing connected with pedal coupling is inlaid in the guide rails, It can be used to disperse pressure and slow down the vibration of traction chain and driving traction.

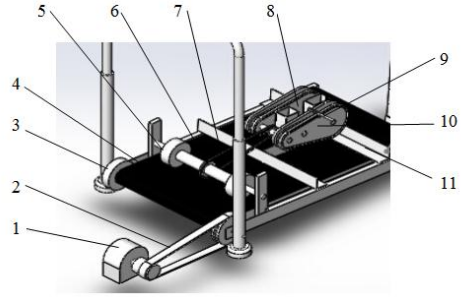

Figure 2 Structure diagram of gait simulator

1-three-phase asynchronous motor 2-belt 3-roller 4-conveyor belt 5-friction gear 6-chain wheel 7-double hinged chain 8-inner plate 9-pedal axle 10-shell plating 11- strut support

3.MOTION ANALYSIS OF EXOSKELETON GAIT SIMULATION

3.1 Kinematics Model Of Exoskeleton Gait Simulator

During working hours, the traction chain in the gait simulator moved coupled with the double hinged chain, the chain speed of the traction chain changes periodically during the movement. The velocity analysis of gait simulator is shown in Fig. 3. The reference circle radius of the small chain wheel is r, the number of teeth is z, the chain wheel acceleration is ω and the phase angle of hinge point between the chains is β at meshing chain wheel. According to the velocity decomposition relationship in Fig. 3, the linear velocity of the traction chain satisfies the following formula (1):

$$\begin{cases} v = \omega r = \dfrac{P\omega}{2\sin(\frac{\pi}{2})} \\ v_x = \omega r\cos\beta = \dfrac{P\omega\cos\beta}{2\sin(\frac{\pi}{2})}(z \geq 2) \\ v_y = \omega r\sin\beta = \dfrac{P\omega\sin\beta}{2\sin(\frac{\pi}{2})} \end{cases} \tag{1}$$

In the formula (1), v-linear velocity of traction chain (*m/s*); v_x-direction velocity of the traction chain (*m/s*); v_y-vertical direction velocity of traction chain (*m/s*); P-pitch of the conveyor chain wheel (*m*).

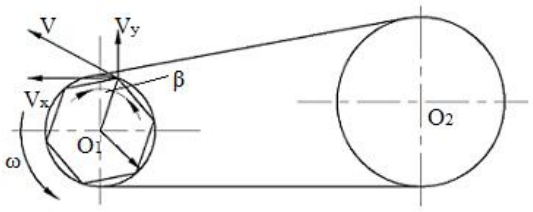

Figure 3 Velocity relationship of gait simulator

It can be seen from formula (1) :when the number of teeth z and the traction chain drive chain wheel speed ω remain constant that the linear velocity of the traction chain increases with the increase of the pitch. Because the phase angle β changes, when the active chain wheel speed remains constant, the movement speed of the traction chain also changes, namely, the linear velocity of horizontal or vertical direction changes according to the cyclical trend, and when rotate one chain link, the speed cycle of the traction chain changes once repeatedly. When the number of teeth z remains constant and the smaller the pitch of the traction chain is, the larger the phase angle of the drag chain is, and the smaller the variation range of traction chain speed is. Concluded by chain transmission principle: direction velocity of the traction chain v_x mainly influences movement speed of center distance orientation, the direction movement stationarity of the traction chain and the degree of tension between chains. The vertical direction velocity of traction chain v_y causes the chain to move up and down, produces vibration and noise, which has a great influence on the momentum and impact load of the traction chain. The non-uniformity coefficient K of the instantaneous velocity of the chain is used to show the variation degree of the traction chain speed and the inhomogeneity of instantaneous velocity:

$$K = \frac{V_{\max} - V_{\min}}{V_m} \tag{2}$$

In the formula (2), K-non-uniformity coefficient; v_m-average linear speed of traction chain (*m/s*)

$$\begin{aligned} &\beta = \pm\frac{\pi}{2}, v_x = \omega r\cos\frac{\pi}{2}, v_y = \pm\omega\sin\frac{\pi}{2} \\ &\beta = 0, v_x = \omega r, v_y = 0 \\ &K_x = \frac{\omega r(1-\cos\frac{\pi}{2})}{\omega r(1+\cos\frac{\pi}{2})} = \frac{}{}\Big/_{2} \\ &\frac{2(1-\cos\frac{\pi}{2})}{(1+\cos\frac{\pi}{2})} = 2\tan^2(\frac{\pi}{2z})(z \geq 2) \end{aligned} \tag{3}$$

As shown in formula (3), the non-uniformity coefficient of the horizontal direction velocity of traction chain satisfies the relationship, the variation curve of the non-uniformity coefficient of different teeth can be made, as shown in Fig. 4.

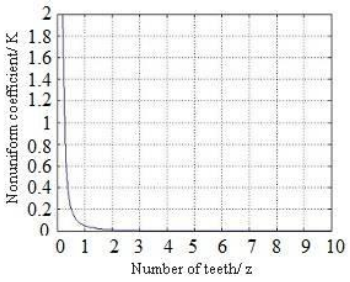

Figure 4 The relationship between the non-uniformity coefficient of chain speed and teeth number of chain wheel

It can be seen from Fig. 4, when the pitch of the chain wheel remains constant, the more the number of teeth of the chain wheel is, the smaller the non-uniformity coefficient of traction chain speed is, and the gait simulator will operate more stable. When the teeth number of chain wheel is greater than 10, the non-uniformity coefficient K will be less than 0.05, which can be controlled within the range of error in the design of medical rehabilitation training equipment. It can be seen from the formula (1) that when the rotate speed of driving chain wheel ω D:\Users\Administrator\AppData\Local\Youdao\Dict\7.2.0.0703\resultui\dict\ and the pitch of traction chain P remain constant, the speed of the traction chain increases with the increase of the number of teeth, and the maximum velocity of the vertical direction and horizontal direction increase with the increase of the teeth number of the conveyor chain.

Similarly, the acceleration of the traction chain is:

$$a_x = \frac{dv_x}{dt} = \frac{d}{dt}\omega r\cos\beta = -\omega^2 r\sin\beta = -\frac{P\omega^2\sin\beta}{2\sin\frac{\pi}{2}}(z \geq 2) \quad (4)$$

$$a_y = \frac{dv_y}{dt} = \omega^2 r\sin\beta = \frac{P\omega^2\sin\beta}{2\sin\frac{\pi}{2}}$$

In the formula (4), a_x- direction acceleration of the traction chain (m/s^2); a_y- vertical direction acceleration of the traction chain (m/s^2).

$$\beta = \pm\frac{\pi}{2}, a_x = \mp\omega^2 r\sin\frac{\pi}{2}, a_y = \omega^2 r\cos\frac{\pi}{2} \quad (5)$$

$$\beta = 0, a_x = 0, a_y = \omega^2 r$$

When the number of teeth remains constant, the greater the pitch of chain is, the greater variation range of acceleration of the traction chain is. The dynamic load of the traction chain is affected by the chain quality, acceleration and the number of teeth of chain wheel during process of periodicity transformation of velocity of chain and angular velocity of driven chain wheel. The dynamic load formula shows that the dynamic load is in direct proportion to the quadratic of the velocity of chain wheel and the pitch of the chain wheel. Therefore, the rotate speed of the chain wheel is the main factor to affect the stability of chain operation.

Motion Simulation Analysis

3.2.1 modeling and pre-processing

Use Machinery of ADAMS to establish the model, as shown in Fig. 5, add quality, kinematic pair, contact, and load. The material property of the established model is steel, set the center-of-mass coordinate of front and rear wheel of the driving chain and the traction chain, these chain wheels move in a circle refer to the ground [10]. The driving chain and the traction chain are driven by their chain wheels respectively, and the contact pairs are added between the traction chain and their two chain wheels and the driving chain and their two chain wheels. stiffness coefficient is 100000 *N/mm*, damping coefficient is 10 *N/(m/s)*, depth of penetration is 0.1 *mm*, static friction coefficient is 0.3, dynamic friction factor is 0.1; At the same time, add contact pair between the driving chain and the traction chain. static friction factor is 0.12, dynamic friction factor is 0.1; Apply a speed-type drive at the center of the driving chain wheel[11].

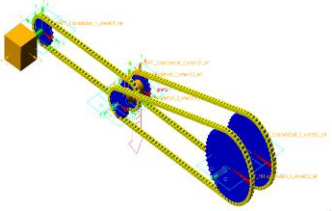

Figure 5 Simulation model

3.2.2 simulation analysis

Enable the gravity, set the simulation time as 2.0 *s*, the simulation step as 3000 steps and select the I3 solver to solve [12]. Use postprocessor of ADAMS to acquire the curves of the contact force, velocity, acceleration, torque of hauling chain and its chain wheels.

Due to the polygonal effect of the driving chain and the traction chain transmission, the force when the traction chain and the chain wheel have just been in contact is larger, and the contiguous part can produce a larger shock. The variation curve of the contact force of traction chain is shown in Fig. 6.

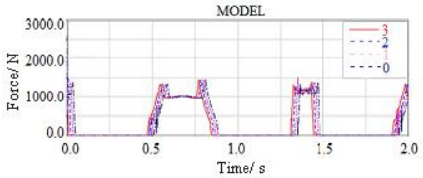

Figure 6 The variation curve of the contact force of traction chain

The velocity of the chain moves at different speeds in the process of transmission, sometimes quickly, sometimes slowly. Because of the friction between the chain wheel and the chain, there is a certain movement difference between the two chain wheels. The angular velocity, angular acceleration and torque of the driving and driven chain wheel of the hauling chain are obtained, as shown in Fig. 7-Fig. 9.

Because of the consistency of driving wheel and driven wheel of the driving chain, the angular velocity of driving wheel floats up and down at 1500

deg/s, angular acceleration is about 0 ° / s^2, maximum torque of driving wheel is 6250 *Nm*, average torque is 1000 *Nm* as soon as it is stable. Due to the impact of the start-up shock, the angular velocity of the driven wheel shows a trend of stabilize after the first fluctuate, which fluctuates at a small amplitude at the 500 *deg/s*, angular acceleration of the driven wheel is about 1.5×10^9 *deg/s*^{2} , and then it goes to zero and tend to be stable. Since the rotation torque of driven wheel is far less than the active wheel, when the active wheel torque is a little larger, the movement of the driven wheel is stable relative to the active wheel, and slipping phenomenon exists between driving chain wheel and driven chain, also exists between traction chain wheel and traction chain, which remits the difference of tight side load between the driving chain and the traction chain and improved the service life of the gait simulator.

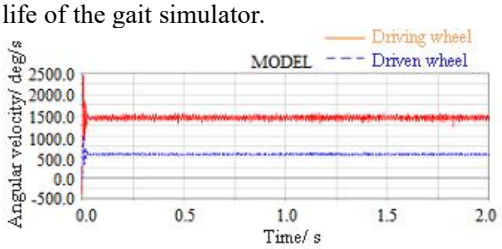

Figure 7 The variation curve of angular velocity

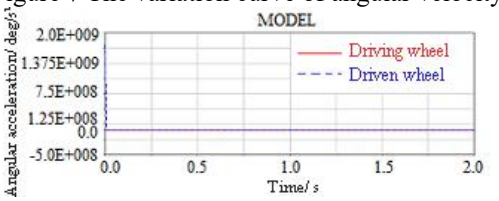

Figure 8 The variation curve of angular acceleration

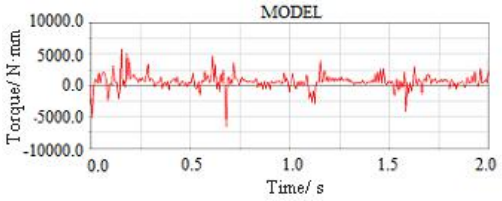

Figure 9 The variation curve of torque

4.CONCLUSIONS

(1)This paper analyzed the polygon effect of traction chain and obtained the relationship between the velocity and acceleration of the traction chain and the parameters of the driving chain wheel. The more the number of teeth of chain wheel has, the smaller the no-uniform coefficient of drag chain speed and the more stable exoskeleton gait simulator for lower limb rehabilitation training will be. According to the normal gait parameters, the number of teeth is 19 and 48 respectively, and the size parameter of the hauling chain is 10 *A*.

(2)This paper analyzed motor process and force of hauling chain and variation rules of angular velocity, angular acceleration and torque of the two chain wheels. In the first 0.025 *s*, the fluctuation of angular velocity and the contact force between the chain and active chain wheel are larger, the movement of driven chain wheel is stable relative to the active chain wheel.

(3)This paper analyzed the speed and acceleration of the pedal axle of the gait simulator and confirmed the running speed of the driving chain was about 1 *m/s*.

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Design and Impletation of Windows Host Monitor Management System

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Abstract: The host monitor management system can manage all kinds of state monitoring of the host system. It is a self-defense based on host firewall and intrusion detection system. According to the real-time monitoring of the host resources, services and processes, the security status of the host is analyzed by identifying normal and abnormal operations, so as to facilitate timely response to various security problems. In view of the fact that the system of host monitor management in the market is less and most of them have platform compatibility, this paper presents the design and implementation of a universal monitoring and management system for Windows host. First of all, This paper analyzes and illustrates the overall architecture of the system, the functions and interface design. Secondly, the key technologies and the main functions of the system are given. Finally, the host status of the system was tested, such as monitoring the client process, boot startup items, hardware detection, network connection etc. Test results show that the system implements the functions of host process monitoring, boot startup monitoring, hardware information detection, network link status and so on, which plays a role in monitoring and management of Windows host.
Keywords: computer monitor, client, hardware information, process monitoring

1. INTRODUCTION

With the development of computers in recent years, for individuals, large enterprises , companies, the normal life and office, the use of computer host demand and dependency gradually increased. Computer host security has become increasingly concerned about the content for people. When using the computer host, how to monitor and detect the use of computer resources, services, hardware information, network connection, process management, start up item management, timely identification of system behavior, to prevent illegal operation, is one of the important content [1] of computer host security.

Widows host monitoring and management system can easily view the host of the relevant information, the host system resources and real-time use of the situation. Which could avoid the user who do not understand computer host information making the wrong operation caused the system crisis. At the same time, some monitoring and management system operation is too complicated, inconvenient to use, and the interface switch messy, which resulting inefficient to use. The system is the use of C # programming language, in the. NET framework for the design of the host monitoring and management system. It has a visual interface friendly, good reliability characteristics. This paper presents a Windows-based host monitoring and management system design and implementation. The system is divided into six parts. process control, boot entry, network connection, hardware information, system resources and service. Each part is covered with sub-function module. It has a full-featured, simple operation, suitable for a variety of people use the characteristics.

2. SYSTEM DESIGN

2.1 Requirement Analysis

With the widespread use of computers, the corresponding computer host security issues are increasingly widespread concern. When the information sources and security are unknown, real-time monitoring of the host of the indicators are very necessary. Windows host monitoring and management system is a tool used to monitor the host-related information software. It must be able to real-time monitoring of the host's basic information, network information and other system resources information. Taking into account the ease of use and efficiency, the system requires simple operation , simple interface, and a quick mode of operation [2]. The basic functions of the system must include the process monitoring, boot start item management, network connection, hardware information, system resources, and service testing. It should also be able to provide at any time convenient to call the host interface internal information such as CMD interface, a registry interface.

2.2 Function Design

The system is a Windows based host monitoring management system. It can achieve the host in the process, network, resources, services, real-time monitoring and management. It is a kind of protection system which is man-made control on the firewall [3]. The main function design is divided into six parts, process control module, boot start module, network connection module, hardware information module, system resource module and service module. Each part contains several small parts. At the same

time to meet the different levels (here refers to the different understanding of the host information) human needs, it can show detailed in each section, such as name, process type, resource value, service types. Windows host monitoring and management system as a whole function of the design shown in Fig. 1.

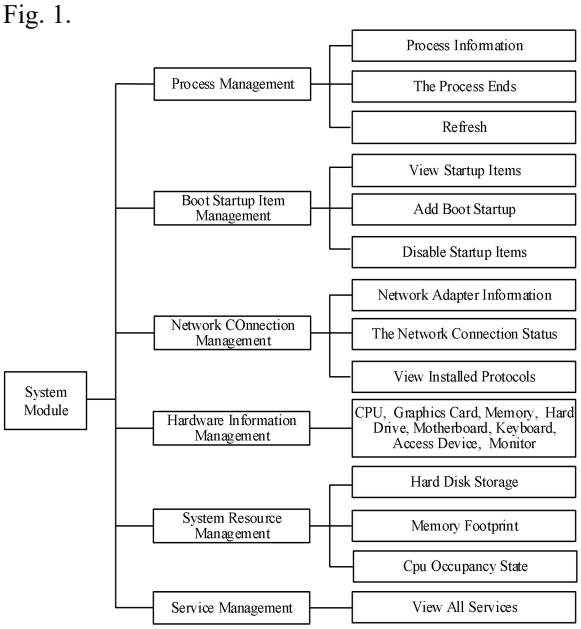

Figure 1 System overall design architecture

(1) Process management module. Process control management module includes process information, the end of the process and refresh the process of three small modules. It is used to display the user's current use of the host's real-time process, display process details, path, ID and so on. At the same time the user can open the process of the location of the operation, and can be updated to get the latest process running information.

(2) Boot start item management module. Boot start item management module, is an important function of the program. It contains view boot start up, add boot startup, prohibit boot startup three small pieces and it is mainly used to check the host boot startup, show the name of the boot startup, and boot startup installation location. At the same time the user can also add a startup item. When adding, the system will pop up sub-interface, start the start of the item to find and add.

(3) Network connection management module. The network connection module is mainly used to view the information about the network connection of the host, including the information of the network adapter, the network connection status and the network protocol information that has been installed.

(4) Hardware information management module: Hardware information module is mainly on the host hardware information detecting initial monitoring, including CPU, video card, motherboard, hard disk, and displays the detailed information to the user. Users can use this information to determine whether the use of hardware anomalies.

(5) System resource management module. System resource module is mainly to detect the host system resource information, including hard disk storage, memory footprint, and CPU real-time occupation of the state to detect.

(6) Service management module. Service management module is mainly to detect the host currently provides services and display service name, ID and other information. Click the View Local Services All Services button to show local services and related information to users.

2.3 Interface Design

System interface design Innovative introduction of the tree structure, and the interface of the different functions of modular, segmentation. Connected by a linear main interface, the menu tree is formed. At the same time using such a design structure, reflecting the friendly, beautiful, simple operation features. Users can operate without specifying the instructions. Interface design is divided into six modules, namely process control module, boot entry management module, network connection module, a hardware module information, system resources module and a service module. The display is shown in Fig. 2.

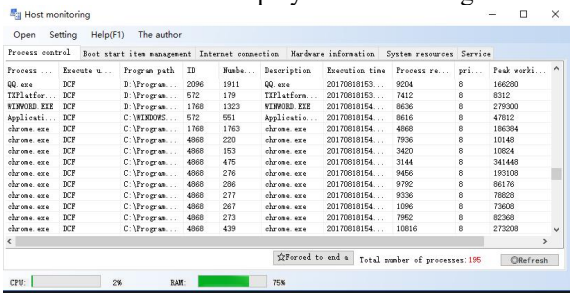

Figure 2 Interface design display

3. KEY TECHNOLOGIES

3.1 Monitoring And Testing

Hardware and process detection technology mainly uses Management Object Searcher class get method and Management-Object class.

(1) The Management Object Searcher class is a collection of managed objects based on the established query. This class is used to retrieve the more commonly used classes for management information. Management Object Searcher in this system is used to enumerate all network adapters, disk drive processes, and more managed objects in the system. At the same time it can be used to query network connections and services. The Get method of the Management Object Searcher class is used to call the specified WMI query and return the result set [4-6]. The syntax is as follows:

Public ManagementObjectCollection Get()

Parameter Description.

Return Value. A Management Object Collection that contains the object that matches the specified query.

(2) The Management Object class is a WMI instance, and this time using the Item property of the class.

In system design, many detection modules are used in this technology, such as CPU information detection, a

variety of hardware, memory, network connection status detection display etc. Before using this class, user needs to introduce the corresponding namespace, that is, using System.Management. At the same time the display function could be added to the click event of the button, and using the click event to implement the specific function. Others hardware information could be designed through this method,such as graphics, memory, hard drive, motherboard keyboard and other equipment.

3.2 Menu Design

In the overall system design, the design of menu window is very important. Adding Toolbar, firstly, the menu Strip control need be added in the design interface, and the name of each menu be designed. Then, to carry out specific functional design in each menu. Finally, the design of right shortcut menu needs add Context Menu Strip control and the corresponding code, so that the corresponding click event to trigger, to achieve the required functionality.

(1) Menu Strip control. This is a menu in a common window that presents the functionality to the user by listing and displaying the subject grouping. The Menu Strip control supports multi-document interface (MDI) and menu merging, tool-tips and spills [7]. Users can enhance the usability and readability of menus by adding access keys, shortcut keys, check marks, images and divider. Create customizable menus that support advanced user interface and layout functions, such as text and image sorting and alignment, drag and drop operations, MDI, overflow, and other menus for accessing menu commands. Support the typical appearance and behavior of the operating system for all containers and included items for event consistency processing. It is handled in the same way as other controls.

(2) Context Menu Strip control. The ContextMenuStrip class represents a shortcut menu that is displayed when a user clicks the right mouse button on a control or a specific area in a form. Shortcut menus are typically used to combine different menu items from a Menu Strip of a form, making it easy for users to use in a given application context.

3.3 Progress Bar Design

In the system, the real-time progress bar display is a key element. First it need have a timer to determine the time interval departure time, that is, how long to trigger the progress of the refresh. At the same time there is a counter, the value of the occupancy rate to count. Finally, the progress of the bar itself, the three components together to complete the real-time on the occupancy rate of the progress of the design. The specific method is to add the timer component, the progress bar components, namely the progress Bar control and the performance Counter component [8]. Under the tick event of the timer, add the appropriate code.

(1) Timer component. The purpose of the timer is to trigger a specified event at a specific time interval. The timer controls the time progress of these events. The user can see the control in the user interface edit window, which is not visible when the program is running. The user can not manipulate it with the mouse or keyboard while the program is running.

(2) Progress Bar control. Progress Bar is the progress bar in the Windows system, mainly used to show the progress of some operations, or the progress of the custom counter display control view.

(3) Performance Counter components. Performance Counter is a Windows NT performance counter component. It is the namespace System.Diagnostics, where the assembly is System (in system.dll). when use the performance Counter, it is necessary to using namespace of using System.Diagnostics.

4. SYSTEM TEST

Host monitoring and management system and system settings part of the basic functions have been achieved. After testing, syetem can initially host the relevant hardware and network information to monitor and detect. The system provides detailed information, so that users can real-time control and understanding of the host information. The system implements the first stage function that can be run and can detect the monitoring host information. And during operation, it will not appear flash, the program crashes, information is not displayed etc. The test results are shown in Tab 1.

Table 1 System main function test

Module	Function	State
Process Control	The Process Displays	Achieve
	Process Refresh	Achieve
Boot Start Item	View Startup Items	Achieve
	Add A Startup Item	Achieve
Internet Connection	Network Adapter Information Display	Achieve
	Network Connection Status Monitoring	Achieve
	View Installed Network Protocols	Achieve
	Number Of Adapters Displayed	Achieve
Hardware Information	CPU Information Display	Achieve
	Graphics Information Display	Achieve
	Memory Information Display	Achieve
	Hard Disk Information Display	Achieve
	Motherboard Information Display	Achieve

	Keyboard Information Display	Achieve
	Mouse Information Display	Achieve
	Display Information Display	Achieve
System Resources	Hard Disk Storage Information Display	Achieve
	CPU Real-Time Occupancy Status	Achieve
	Memory Real-Time Display	Achieve
Service	View All Local Services	Achieve

5. SUMMARIZE

Based on windows host monitoring management system, it includs the host process control, startup item management, network information, network real-time traffic monitoring, the host various hardware information detection system resource, hard disk storage, CPU and memory occupancy rate of the real-time detection and display. System can initially meet the user on the host detection and management of the basic needs. For the windows host monitoring management, it can have a deeper system upgrades and network upgrades. it will build the appropriate network database for the system connection, and form a large-scale host monitoring system network for the comprehensive information aggregated. The information will be detected, and there will be more detailed data provided and information display.

ACKNOWLEDGEMENTS

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RAYINVR's GUI with GTK+

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Abstract: A graphical user interface coded with GTK+ for Rayinvr's program about traveltime inversion for 2-D crustal velocity structure. It's used to edit rayinvr models and as a dynamic viewer for ray tracing and can be extended to be a viewer for some ray tracing results from other software. It is written and runs on Fedora linux distribution.
Keywords: traveltime; rayinvr; GTK+

1. INTRODUCTION

The traveltime inversion program by Zelt and Smith (1992) is still used in wide angle seismic data.

Rayinvr program was mainly written in Fortran. It's model files are defined in a stricted formatted ASCII file, which is time-consuming to read and edit them. Zelt (2004a) published a program vmed, which is also written is Fortran and it does not display traced rays and arrivals. Rayinvr can output a static display for a dated X edition.

RayGUI provided by Song and ten Brink (2004), combines editing of models and displaying of ray tracing results. It cannot import rayinvr formatted models and additional configuration is needed.

PRay (2015) combines the capabilities of vmed and RayGUI. It depends on Perl and Tk graphic modules and provides a more convenient control interface for moeling wide angle seismic data.

The Rayinvr 's GUI with GTK+ is written in GTK+, which is a excellent and mainstream multi-platform toolkit for creating graphical userinterfaces. It combines the capabilities of beforementioned program: graphical model editing and display of ray tracing results while retaining the original formats of rayinvr. It provides a more flexible and mainstream graphical control interface.

The main program is based on the newest GTK+ 3 platform, and written and tested in Fedora linux distribution (2017, version 26), which is a "bleeding edge" linux distribution and have some latest software and supports the new Wayland display protocol.

2. PROGRAM FEATURES

The aim is to make user's life easier. All source information is imported from original rayinvr files and no extra configuration is requested. The main program creates a viewer window. It can observed and analyze the target model and results which can be arbitrarily scaled. This enables the user to investigate different parts of the models in detail at any time. Traced rays as well as observed and theoretical arrivals and the RMS can all displayed. It allows users to edit velocity and depth nodes using the mouse and keyboard or any one of them solely.

All the features of editing and displaying models is given. It's written in the mainstream graphical toolkit and it is very efficient as it is a compiled executable program which has the most updated GTK+ backend.

During the inversion picked arrivals often have to be reviewed in the original data files again. There are some special programs to do it. So the main program only accepted the ASCII file of the picked arrivals which there are some open source and free programs , such sed, gnu awk, etc, are good at providing.

The main program also can save different models files with version number and some optional comment. This is especially useful after the model is inverted some times. The users can review different model versions and models can be compared quickly.

A graphical model editor for the rayinvr configuration file is provided and the display can be arbitrary scaled, which is useful when some nodes is very far or close distance. Of course the ASCII rayinvr configuration file can be provided for the program and displayed.

The main program either provides publication-ready graphics or can write traced rays and travel times in ASCII text file, which can meet some user are used to coding with GMT. The graphics can be rendered by Wayland because GTK+ already has a functional Wayland backend which is an one big promotion on graphics quality.

The GUI based on GTK+ is more efficient and fast on modern linux distribution with new Xorg version and can be run on the upcoming Wayland.

GTK+ has been developed for over a decade to be able to deliver the enticing features and superb performance and has a comprehensive collection of core widgets and interfaces for use. And most importantly, GTK+ has adopted the LGPL license, which is a less-restrictive license in the family of GNU licenses. LGPL allows you to freely get, modify and distribute any software it covers, as long as you make your modifications free, as well.

The rayinvr source code can be slightly modified to accommodate the graphical toolkit. But before the author's agree, these code can not be open to the public.

3. SUMMARY

The GUI proveds a user-friendly, efficient and mainstream auxiliary interactive interface for

rayinvr. It is freely available. It make modelling of seismic refraction data with rayinvr easier. Because of GTK+'s features, it means that main program also have some updated feature: efficient and portable, which reduces editing of rayinvr files to a minimum and allows users to add their own codes. It can also be used for tomography models. It's dynamic viewing and editing abilities is useful.

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Crustal Structure Across the Southewest Longmenshan Fault Zone from Seismic Wide Angle Reflection/Refraction Profile

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Abstract: The Lushan Eathquake, which epicenter and focal depth were at 30.308° N, 102.888° E, and 14.0 km, is the latest intense earthquake occurring in the southwest section of the Longmenshan fault zone after the Ms 8.0 Wenchuan earthquake. According to the emergency field observations, the slip distribution of the Lushan earthquake was concentrated at the hypocenter, and did not rupture to the surface (Chen et al, 2013). The focal mechanism using the Cut and Paste algorithm showed this event occurred on a high dip-angle fault, but its dip angle is not steep enough to rupture the surface. All these research is not independent on the heterogeneous crust structure of the Longmenshan fault zone. A 450 km-long wide-angle reflection/refraction profile executed during September and October 2013. This experiment has provided the best opportunities to obtain better knowledge of seismic structure and properties of crust and uppermost mantle beneath the Southwest Longmenshan fault zone. This seismic profile extends from the west Sichuan Plain, through the Longmenshan Fault zone, and into the west Sichuan Plateau. We observed clear Pg/Sg, refraction Phase from the upper crust, Pi1/Pi2/Pi3, reflection/refraction Phase from intra-crust, PmP/SmS, reflection from the Moho boundary, and the Pn phase, refraction Phase from uppermost mantle. We present a hybrid tomographic and layered velocity model of the crust and uppermost mantle along the profile. The final velocity model reveals large variations both in structure and velocity, and is demonstrated that a particular model has minimum structure. The model shows the crustal thickness of the region is very variable. The Moho topography varies more than 10km in the southwest Longmenshan fault zone. In particular, the crust appears the thicken in the western Sichuan plateau, where the crust consists of average thick upper-mid crust and thicker lower crust. We also observe the presence of one low velocity layer or anomalous body in the middle crust in the western Sichuan plateau, which may suggest the general presence of partial melting in the crust. Our model is in favor of models of control of the evolution by lower crustal flow in this region of the southeastern Bayan Har block.

Keywords: Crustal Structure; Longmenshan Fault Zone; Seismic Wide Angle Reflection/Refraction Profile

1. INTRODUCTION

On April 20 th, 2013, an earthquake of magnitude Ms 7.0 occurred at Lushan of Sichuan on the southern segment of the Longmenshan fault zone. According to the scientific research plan of Lushan earthquake responsored by China Earthquake Administration, an active source deep seismic comprehensive profiling of wide angle reflection/refraction, which was 450km, was set up along Leshan-Lushan-Xiaojin.

2.GEOLOGIC STRUCTURE

The seismic profile presented here (Fig. 1) on southeast of the Longmenshan fault zone. The Longmenshan is divided into southern, central and northern segments on the basis of lithological differences, nappe structure and fault activity differences. The southern segment is typically characterized by outcrops of the Baoxing and Wulong basement complexes and klippes at the leading edge of the nappe. The Gengda-Longdong, Yanjing-Wulong and Dachuan-Shuangshi faults developed from west to east. The Xinkaidian and Dayi faults are located between the Dachuan-Shuangshi Fault and the Sichuan Basin. The Xinkaidian Fault intermittently extends along the anticlinal axis of Luoshenggang. A small part of the Dayi Fault extends to the surface, visible only as scattered outcrops between the eastern Mengshan Mountain and the Sichuan Basin. It is almost completely overlain by the Quaternary deposits. These faults (NE trend, NW dip) from an imbricated thrust system which is ultimately incorporated into a horizontal detachment layer some 20km below the surface. This is attributed to the tectonic deformation produced by the eastward overthrusting of upper crustal material at the eastern margin of the Qinhai-Tibetan Plateau.

3. SEISMIC DATA

3.1. Seismic data acquisition and processing

The 450 km reflection/refraction wide-angle profile presented here accomplished 8 seismic wave explosions of active explosive source. A total of 268 portable three-component digital seismic stations were installed along the profile. A 1-10 Hz bandpass filter was applied to the data. On all record sections, the acquired P-wave data have a hight signal-to-noise ration.

3.2. Correlation of phases

The P-wave phases referred to as P_g, P_2, P_3, P_4, P_mP and P_n were identified from the reduced P-wave record sections.

The first arrival of P_g is a diving wave within the sedimentary layer or the crystalline upper crust. Reflections from the top of the crystalline basement, cannot be identified. The phases P_2, P_3, and P_4 are reflections from intracrustal layers. All theses phases have low energy, which indicates that there is a lack of strong, laterally consistent compositional layering in the crust.

P_mP is a strong reflection from the Moho and can be traced on the record sections for all shot points in an offset range of 100-200km. This lateral variability observed in the relections is an indication of lateral variations in crustal velocities, particularly in the lower crust.

P_n is the refracted wave through the upper mantle. This event can only recognized on some shot. This indicates the lack of a significant lateral variation in P-wave velocity within the uppermost mantle of the area.

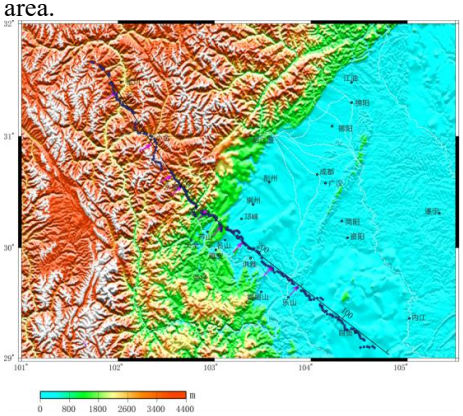

Fig 1 Topographic map of the study area with profile

3.3. Modeling

The first step in our analysis was to get a reliable velocity model of upper crust. Usually, the seismic velocity structure of the upper crust has comparatively large lateral variations, so it desireable to determine its structure in some detail. However this objective is not feasible by applying the standard Rayinvr program (Zelt and Smith, 1992) to the P_g data due to the small number of grid points in the rayinvr model. For this reason, we can first obain P-wave velocities above the crystalline basement using P_g data. We initially assume a laterally homogeneous layered medium and invert the picked time-offset curves to derive one-dimensional velocity structures for all shots. These starting 1-D velocity models are sufficient to the perform an inversion for the 2-D velocity structure. Then it would be possible to determine a velocity model of the whole crust operating solely with the rayinvr technique from the beginning.

Velocity discontinuities across layer boundaries and vertical velocity gradients are thereafter adjusted by forward modlling to allow the best possible match with the obserbed amplitudes and travel times. Thus, travel time inversion and waveform modelling were alternated for each crustal layer until the best match to both data types (travel times and waveforms) was achieved.

The accuracy of the final crustal velocity model depends on the correct identification of the various phases, the density of rays, the shot point interval, and the reveiver density. Seismic velocity determinations generally have lower errors than depth determinations. For the seismic data compiled here, seismic velocities are accurate to within 3% . All boundary depths, including the Moho, are accurate to within 10%of the stated depth.

4. DISCUSSION

The imaging results were combined with the other researchers' opinion to comprehensively study the causes of the deep seismogenic environment in the southeastern section of the Longmenshan fault zone and explore the formation of the Lushan earthquake. The results has shown that there are obvious differences in velocity structure distribution between the southern and northen sections of the Longmenshan fault zone. The epicenter of the Lushan earthquake s located near the boundary of the high and low-velocity anomalies and favorable for a high-velocity section. The development of high velocity solid medium favor the accumulation and release of strain energy. Low-velocity anomoalies are distributed underneath are the seismogenic origin.

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A study on the improved algorithm of ASMC in the proportional flow control

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Abstract: Traditional proportional electromagnetic valve based on PID has the slow speed for the dynamic response, which affect the system's rapidity. In this paper, we apply the improved adaptive sliding mode control (ASMC) algorithm to the flow control system to solve the issue. The improved ASMC algorithm uses attenuation function on the traditional algorithm of adaptive sliding mode surface to reduce or eliminate the influence of sliding mode control segment on the adaptive process. This algorithm makes the system have strong robustness to the uncertainty and doesn't need to know the upper bound of the system parameter uncertainties in advance. According to the improved ASMC algorithm and proportional electromagnetic valve mathematical model, we designs the sliding mode controller and do simulation research on its control characteristics in this paper. The simulation results show that the improved ASMC algorithm has obvious improvement in response speed, setting time, overshoot, stable precision, robustness and the modeling method compared with PID control algorithm, which can be used in engineering application.

Keywords: Proportional electromagnetic valve; PID control; The improved ASMC; Response speed; Robustness; Overshoot

1. INTRODUCTION

The proportional electromagnetic valve, which adjusts medium parameters such as flow and pressure, are widely used in the equipment of combustion system, auto transmission, irrigation, engineering machinery and medical instruments[1,2]. Because of the good linear of the proportional valve in the main working range, simple PID control algorithm could meet the basic requirements when control performance requirement is not high [3]. However, with increasing requirements on the control precision, rapidity and stability, the modern industry is in urgent need for superior performance controller. Optimizing the electromagnetic valve structure and improving the control algorithm can improve the control performance. The application of sliding mode control (SMC) algorithm is widely used and it can be used to solve lots of control problems [4]. Because of the strong robustness of the external disturbance and uncertainty, SMC algorithm has been deeply studied in the nonlinear control system in recent years.

Sliding mode control algorithm concerns nonlinear control system and the structure of the system is not fixed. So the structure of the system can force the system run accordance with the designed sliding mode state trajectory according to the current state of the system's dynamic changes, for example, the deviation [5,6]. The traditional sliding mode control algorithm consists of two parts: one is the continuous control part on the outside of the switching surface; the other is located in the discontinuous control part on the switching surface. Due to inertia affect, the moving point on the sliding mode surface can't move to the origin place smoothly and completely according to the designed trajectory. When the moving point in state space approaching the switching surface with limited speed, high frequency passes through the switching surface repeatedly and forms chattering, which is the biggest obstacle of the sliding mode algorithm application. ASMC is the dynamic combination of sliding mode variable structure control and adaptive control and a new mode control strategy to solve problem of the parameter uncertainty or time-varying parameters of the system control [7]. A dynamic adaptive variable structure controller was designed for nonlinear system of linearization and realized nonlinear system robust control of uncertainty and unknown disturbance according to literature [8]. In order to solve the problem of unlimited increasing estimated parameter in the adaptive sliding mode control, the literature [9] gave a new parameter adaptive estimation method, which guaranteed the rationality of the variable structure control gain. To reduce chartering and solve the tracking problem of nonlinear system, they combined sliding mode control (SMC) and adaptive algorithm and proposed the method of adaptive sliding mode control (ASMC), which updated control law switching gain parameters in real time through adaptive law [10].

An important defect of the adaptive sliding mode control (ASMC) algorithm indicated by literature [11] is when the system initial error is big and the switching gain increases rapidly, leading to drastically chattering. In order to solve the defect of ASMC algorithm, the literature [11] proposed an improved algorithm of ASMC. To figure out the negative affect on the system's rapidity caused by the proportional electromagnetic valve dynamic slow response speed of the PID control, this paper gives solution that applying the adaptive sliding mode control (ASMC) algorithm to the proportional electromagnetic valve flow control.

2. SYSTEM MODELING

(1)Proportional electromagnetic valve structure

Proportional electromagnetic valve is crucial to the performance of the system, therefore, the research on proportional electromagnetic valve is of great significance [12-14]. Proportional electromagnetic valve is mainly composed of 1 –seat, 2 - static iron core, 3 - moving iron core, 4 – spring and 5 – coil. Proportional valve structure is shown in figure 1.

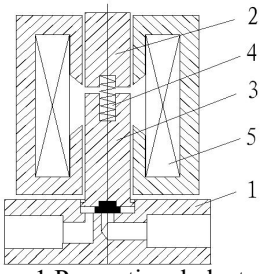


Figure 1 Proportional electromagnetic valve structure

(2)Proportional electromagnetic valve technical parameters

Table 1 Proportional Electromagnetic Valve Technical Parameters

Category	Technical parameters
The rated voltage (V)	DC24
Rated current (A)	0.5
Pressure (MP)	0.45
Maximum flow (L)	2.7
Armature resistance	46.25
Core trip (mm)	0.8
Inductance (H)	0.623
Spring coefficient (N/mm)	10.6

(3)Balance equation of valve core force

The stress on the valve core in the motion process is complex. According to the proportional solenoid valve structure, it mainly includes spring force, friction force and damping force, fluid power, hydraulic resistance and inertia force, etc. The force varies with working environment. This paper discusses three forces of electromagnetic force, spring force and damping force for the purpose of simplifying the equation of motion. The following is the valve core stress model. The condition of moving iron core stress is shown in figure 2.

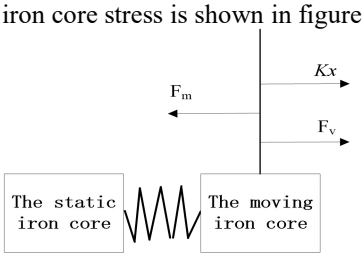


Figure 2 Moving iron core stress

The equation of motion of valve core according to Newton's second law [15] is:

$$m\frac{d^2x_1(t)}{dt^2}+b\frac{dx_1(t)}{dt}+Kx_1(t)=K_m i=F_m \tag{1}$$

In the equation: m—Quality of moving iron core [kg]; F_m—The electromagnetic [N]; F_v—Damping force; b—Damping coefficient [N/(mm/s)]; K_m-- Magnetic coefficient;

k—Spring stiffness [N/mm]; x—Displacement of the spring [mm](Displacement of moving iron core).

Where, $m=0.015kg,\quad b=0.1\mathrm{N}/(\mathrm{mm}/\mathrm{s})$

$K_m=14,\quad K=10.6N/mm$

Transform equation (1) into the equation of state:

$$\begin{cases}\dot{x}_1=\dfrac{dx_1}{dt}=x_2\\ \dot{x}_2=\dfrac{dx_2}{dt}=\dfrac{1}{m}[F_m-Kx_1-bx_2]\end{cases} \tag{2}$$

Simplify

$$\begin{cases}\dot{x}_1=x_2\\ \dot{x}_2=-Bx_2-Dx_1+u\end{cases} \tag{3}$$

Where

$$u=\frac{1}{m}F_m,B=\frac{1}{m}b,D=\frac{1}{m}K$$

$$u=\frac{1}{m}F_m,B=\frac{1}{m}b=6.667,D=\frac{1}{m}K=706.667$$

(4)Valve core displacement - flow mathematical model

The electromagnetic valve flow characteristics flowing through liquid water can be represented as:

$$Q=C_dWx\sqrt{\frac{2p}{\rho}} \tag{4}$$

In the equation: C_d—Flow coefficient; W—Valve port area of gradient; x— Valve opening; ρ—Gas density; p—The valve input-output pressure difference.

Because $C_dW\sqrt{\frac{2p}{\rho}}$ is a fixed constant, the displacement - flow mathematical model can be approximated as:

$$Q=Q_m x \tag{5}$$

In the equation: Q_m is for constant, equation(5)holds on condition that the fluid is liquid water.

(5)Transfer function of current-valve core displacement

$$G_3(s)=\frac{X_1(s)}{I(s)}=\frac{K_m}{ms^2+bs+K}=\frac{\frac{K_m}{K}}{\frac{m}{K}s^2+\frac{b}{K}s+1} \tag{6}$$

$$=\frac{1.94}{0.001415s^2+0.00943396s+1}$$

3. THE IMPROVED ASMC CONTROLLER

The improved ASCM can not only make any point in the system quickly converges into the switching surface in a limited time, but also has strong switching gain parameter adaptive function, which avoids unnecessary discontinuous switching when the switching gain in the system is uncertain. Furthermore, it settles down the excessive adaptive problem of traditional adaptive sliding mode control on the switching gain.

(1)Traditional adaptive sliding mode control algorithm

Use the valve core position error e and velocity error $\dot{e}$ of the input and output in the system as state

variables. Valve core displacement is transformed by displacement - flow mathematical model. Namely, the error state equation can be defined as:

$$\begin{cases} e = r - x_1 \\ \dot{e} = \dot{r} - \dot{x}_1 = \dot{r} - x_2 \end{cases} \tag{7}$$

In the equation: e -- Valve core position error; $\dot{e}$ -- Velocity error; r -- The valve core expected position; x_1 -- The valve core actual position; x_2 -- Valve core displacement speed.

To ensure the phase trajectory of the system state reach switching line s within the limited time, switch function should meet the requirement of the Lyapunov function, that's:

$$\begin{cases} V = \frac{1}{2}S^2 \\ \dot{V} < 0 \end{cases} \tag{8}$$

The sliding mode function is designed as follows:

$$s = ce + \dot{e} = c(r - x_1) + \dot{r} - x_2 \tag{9}$$

In the equation: c >0,

The sliding mode function (9) derivative available:

$$\dot{s} = c(\dot{r} - x_2) + \ddot{r} - \dot{x}_2 \tag{10}$$

By equation (8) (9) (10) available:

$$\begin{aligned} \dot{V} = s\dot{s} &= \left[c(r - x_1) - x_2\right] * \left[c(\dot{r} - \dot{x}_1) - \dot{x}_2\right] \\ &= -\left[c(r - x_1) - x_2\right] * \left[cx_2 + \dot{x}_2\right] < 0 \end{aligned} \tag{11}$$

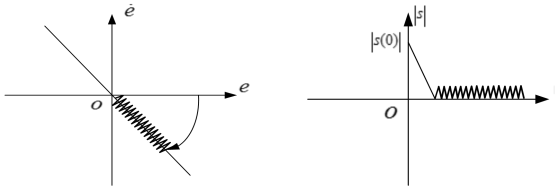
If so, the system is stable. For enhancing the quality of normal movement, we adopt Gao Weibing's exponential reaching law on the reaching mode:

$$\dot{s} = -qs - \varepsilon \operatorname{sgn} s, \varepsilon > 0, k > 0 \tag{12}$$

When state moving point is away from the switching surface, reaching speed depends mainly on $-qs$. When reaching nearby the switching surface and s becoming small, the reaching speed is mainly determined by $-\varepsilon \operatorname{sgn} s$. System control law is calculated as follow according to literature [16]:

$$u = c(\dot{r} - x_2) + \ddot{r} + Bx_2 + Dx_1 + qs + \varepsilon \operatorname{sgn} s \tag{13}$$

In the equation: $\delta_{\max}$ is maximum external disturbances; $\varepsilon > \delta_{\max}$ is switching gain; $\operatorname{sgn}(\cdot)$ is vector function. System phase track is shown as follow:



(a)The phase trajectory (b)The sliding mode function

Figure 3 Traditional algorithms of ASCM system phase trajectory and the sliding mode function

From the equation (13) it can be seen that the traditional sliding mode switching gain ε depends on the unknown parameters $\delta_{\max}$. In order to remove this limitation, based on the literature [11] adaptive sliding mode control algorithm is designed as:

$$\begin{cases} u = c(\dot{r} - x_2) + \ddot{r} + Bx_2 + Dx_1 + qs + \mu \operatorname{sgn} s \\ \mu = h\int_0^t \|s\|_1 \, d\tau \end{cases} \tag{14}$$

In the equation: μ to $\delta_{\max}$ is estimated value; $h > 0$ is the adaptive gain; $\|s\|_1$ is 1 norm for the vector s and a measure of the system state deviation degree of the switching surface.

By the equation (14) μ, traditional ASCM algorithm does not need the upper bound of the external disturbances in advance(namely $\delta_{\max}$), but the system state deviation degree of the switching surface is used to estimate the error of the external disturbances. It can be concluded by the equation $\mu = h\int_0^t \|s\|_1 \, d\tau$ integral action of switching gain adaptive law begins from time $t = 0$. Therefore, when the system initial state point is far from the switching surface, with 1 norm of s and the effect of integral, μ will increase sharply at initial time, leading to the excessive adaptation of traditional algorithms of ASCM on upper bound of perturbation, and the overlarge switching gain causing drastically chattering.

(2)The improved adaptive sliding mode control algorithm

In order to solve the excessive adaptive problem of the traditional algorithm of ASMC on switching gain, the improved ASMC algorithm increases a decay function on traditional adaptive sliding mode surface to reduce or eliminate the influence of the adaptive sliding mode control reaching segment on adaptive process. Based on the literature [11] sliding mode function (9) is revised as follow:

$$s(t) = c\left[e - f(t)\rho\right] + \dot{e} \tag{15}$$

In the equation: $0 \le f(t) \le 1$ is smooth and strictly monotone decreasing function; $\rho, \xi \in R^3$ is the parameters related to the initial system state, fulfilled:

$$\rho = e(0) \tag{16}$$

It can be concluded by the equation (15), by adding a decay function $f(t)$ the initial system value can decrease into a small one. After solving the excessive adaptive problem of the traditional ASMC algorithm on switching gain, the switching gain becomes closer to the actual situation. Suppose that $f(t) = e^{-ct}$, the equation (15) is:

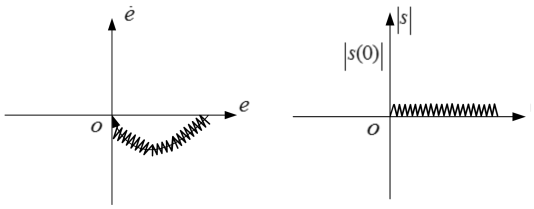
$$s(t) = c\left[e - e^{-ct}\rho\right] + \dot{e} \tag{17}$$

Derivative of equation (17) available:

$$\dot{s}(t) = c(\dot{r} - x_2 + c\rho e^{-ct}) + \ddot{r} - \dot{x}_2 \tag{18}$$

United vertical (3) (5) (12) (17) (18) the system control law is calculated as follows:

$$\begin{aligned} u = c(\dot{r} - x_2) + c^2\rho e^{-ct} + \ddot{r} + \\ Bx_2 + Dx_1 + qs + \varepsilon \operatorname{sgn} s(t) \end{aligned} \tag{19}$$



(a)The phase trajectory (b)The sliding mode function

Figure 4 The improved ASCM algorithm system phase trajectory and the sliding mode function

Based on the sliding mode function (19), the improved ASCM algorithm is designed as follow:

$$\begin{cases} u = c(\dot{r} - x_2) + + c^2 \rho e^{-ct} + \ddot{r} + \\ \quad Bx_2 + Dx_1 + qs + \mu \operatorname{sgn} s \end{cases} \tag{20}$$

$$\mu = h\int_0^t \|s\|_1 \, d\tau \tag{21}$$

In the equation:

$D = 706.667,\ B = 6.667,\ q = 40,\ c = 5$

Analyzing of the adaptive law (21), when the switching gain $s(t) \neq 0$, switching gain μ will increase continuously to $\mu > \delta_{\max}$ (namely to meet the equation (17) slide reaching condition), and the sliding mode motion will occur in a limited time. Due to the attenuation function, the excessive adaptive problem of switching gain at initial time is solved.

4. FLOW CONTROL SYSTEM STRUCTURE DIAGRAM

A given signal by system is valve core displacement. Flow feedback signal transforms flow-valve core displacement model into displacement feedback signal. This system adopts double closed loop control, that's current loop and flow loop. Current regulator uses PI adjustment, because as long as you select the appropriate PI controller parameters can adjust current loop to the typical system I [17,18] and reduce overshoot of the current volume in the dynamic process to meet the tracking performance.

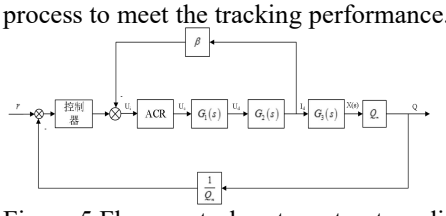


Figure 5 Flow control system structure diagram

In the diagram: $W_{ACR}(s) = \dfrac{K_i(T_i s + 1)}{T_i s}$ is current regulator transfer function; $G_1(s) = \dfrac{K_s}{T_s s + 1}$ is transfer function of PI regulator; $G_2(s) = \dfrac{1/R}{T_l s + 1}$ is transfer function of electromagnetic valve voltage balance equation; $Q_m = 3.375$ is displacement – flow mathematical model coefficient; $G_3(s)$ is current - valve core displacement transfer function.

5. SIMULATION ANALYSIS

(1)The improved ASCM algorithm simulation

According to the established sliding mode algorithm model, driver model, electromagnetic valve mathematical model and flow control system diagram, the Simulink model is shown in figure 6 after editing in the Matlab software.

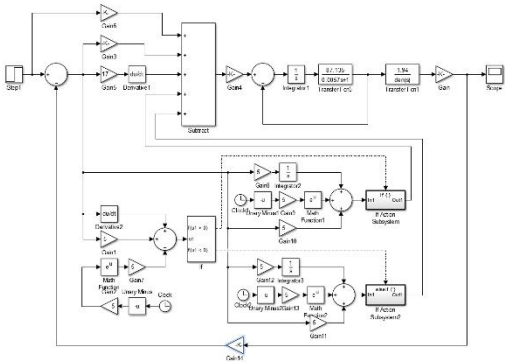


Figure 6 the Simulink modal based on the improved ASCM controller

Suppose the parameter of the improved ASCM controller $\rho = 1, h = 1$. Simulation result is shown in figure 7

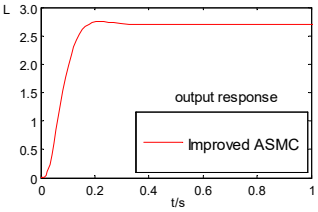


Figure 7 simulation results of the improved ASCM control flow

(2)Simulation of PID algorithm

Initial PID parameters: K_p =20, T_i =0.1, T_d =1.84. Simulink modal is shown in figure 8, output response is shown in figure 9:

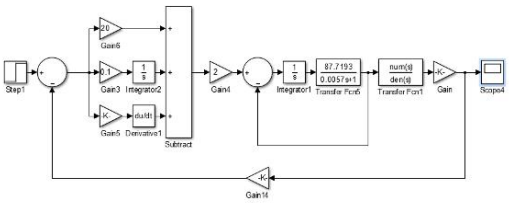


Figure 8 Simulink modal based on PID controller

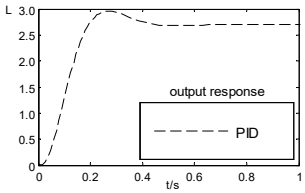


Figure 9 simulation results of PID control flow

(3)Contrast of simulation results of two kinds of control algorithms

Two kinds of algorithm simulation results under the same condition are shown in figure 10. It can be concluded that compared with the original PID control, the improved ASCM control has better control effect, fast response and no overshoot. Setting

time and overshoot are measures of performance of the control method and the calculation results are shown in table 2.

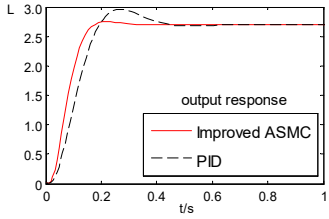


Figure 10 two kinds of control algorithm flow simulation results

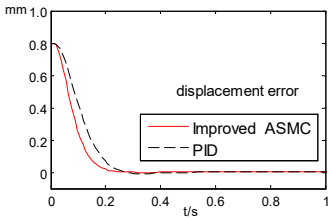


Figure 11 Two kinds of valve core displacement error control algorithm simulation results

Table 1 Performance Indicators

Performance	PID	Improved ASMC
Setting time	0.68s	0.23s
Overshoot	9.7%	0.76%

6. CONCLUSION

This paper shows the design process of algorithm with the example of flow proportional control. compared with the PID algorithm, the improved ASCM control has the same characteristics of strong adaptability, high control accuracy, the advantages of robustness and fast response speed as well as simple modeling. The simulation results show that the ASCM algorithm has good control effect in proportional flow control system.

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(Research on adaptive fuzzy control of mobile robot based on terminal sliding mode).

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Architecture of Remote Intelligent Measuring and Control System on Precision Agriculture Based on Internet of Things

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Abstract: Precision agriculture is the development direction of the future. In recent years, the combination of new technology and modern agriculture in 4G, Internet of Things and other fields has promoted the improvement of agricultural production efficiency and the change of production mode. Firstly, this paper discusses the demand and characteristics of remote measuring and control technology in precision agriculture, and the application of Internet of Things technology. Secondly, an intelligent remote measuring and control system architecture based on Internet of Things is proposed, and the function of the system is described in detail. Finally, the research goal of next step is proposed.
Keywords: Internet of Things; Precision agriculture; Remote measuring and Control; System architecture

1. INTRODUCTION

In the time of increasing demand for food, precision agriculture provides higher yields with a lower input cost and leads to a reduction in environmental pollution and labor. Modern day food production and precision agriculture are expected to dramatically increase the usage of the latest computer and electronic technologies[1]. In accordance to this, decision support systems have been developed in the last decades in order to provide expert knowledge needed for farmers in their agricultural management. It consists of a system for monitoring basic parameters in the vineyard such as air, soil, plants, pests, and diseases and software tools that analyze these data providing alerts and decision support information.

Precision agriculture is actually one of the best industries for the Internet of Things. The IoT is in the process of greatly advancing the modern farming technique known as precision agriculture, or the use of collective data, including predictive weather analytic, to procure a greater harvest, to make use of data in real-time to enhance their business[2]. By pairing the IoT with precision agriculture, control centers collect and process accurate and continuous data to make the best decisions with regard to planting, fertilizing and harvesting crops.The sensors used in agricultural processes are placed throughout the fields to measure the temperature and humidity of the soil and the surrounding air[3]. This gives instantaneous data on the local weather conditions that are affecting the seeds and plants. Precision agriculture pairs this sensor-based data with images of the cornfields that are taken using satellite imagery and robotic drones.

This paper describes an architecture of remote intelligent measuring and control IoT-enabled platform aimed at the use for precision agriculture. The paper is organized as follows: after the Introduction section, Section 2 provides context and motivation by illustrating the remote measuring control and Internet of Things technology. Section 3 describes derivation of the platform architecture and its implementation IoT-enabled. Finally, the conclusions and references are provided at the end.

2.REMOTE MEASURING CONTROL AND INTERNET OF THINGS TECHNOLOGY

2.1 Remote measuring control technology

Remote measuring and control technology is widely used in modern science and technology, especially in precision farming. In agricultural production, especially in farming and aquaculture, the most important thing affecting production is the production environment[4]. For example, soil-based farming, soil temperature and humidity, air temperature and humidity and other environmental parameters play a key role in crop growth, therefore, timely, fast and easy to understand the crop growth environment, to grasp the crop growth and make the right prejudgment has a very important significance. In traditional agricultural operations, people usually use the experience to determine the crop growth environment, or use a simple, independent instrument to measure, this approach often requires people to the field to obtain data, with a certain degree of delay. For large-scale cultivation, this approach requires a lot of manpower and material resources, production efficiency is difficult to improve, remote monitoring and control technology is generated in this demand.

Remote measuring and control refers to the use of Internet of Things and mobile communication technology, in the agricultural production site to

install information collection terminals and the implementation of terminals, and then these terminals connected to the network through the centralized system platform, the user through the display terminal can remotely monitor the collection terminal information, or remote control of the implementation of the terminal. Remote monitoring and control technology allows users through a display terminal to quickly understand the status of the production site, and make the appropriate treatment. There are a number of cases of remote measuring and control technology applications, greenhouse, greenhouses, granaries, fishponds, forests and other remote monitoring and control in agriculture has a wide range of application prospects, as shown in figure 1.

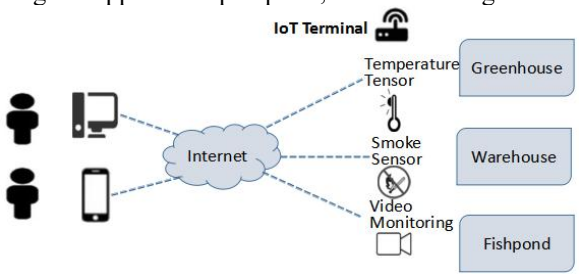

Figure 1 Remote measuring and control in the Intelligent agriculture

2.2 Internet of Things technology

In recent years, the development of information and communication technology resulted in the emergence of an important concepts that affect the world around us: Internet-of-Things. Its concepts are expected to be put to use in agriculture on a much larger scale in the near future. The IoT is a network of physical objects instrumented with embedded electronics, sensors, software, and networking connectivity enabling these objects to collect and exchange data. The IoT equips objects of interest to be sensed and controlled remotely over existing and future network infrastructure, which creates various opportunities to integrate physical objects with computer-based systems. The main goals of IoT include improved efficiency, accuracy, economic gains, and better quality of life.

2.3 Internet of Things technology in agricultural remote measuring and control

IoT in agriculture is very much dominated by Asian scientists, especially from China[5]. Precision agriculture end-user applications include smart irrigation, smart soil fertilization, smart pest control and plant disease forecasting and detection[6]. For these use scenarios, the parameters of interest include temperature, pressure, relative humidity, soil humidity, leaf wetness, UV radiation, etc. The periodicity for the most use cases is identified to be at one hour, but for some, the data needs to be collected every 15 min. For research purposes, the periodicity may as low as 1 min. In order to prototype such applications, the platform shall provide means for quick configuration and setup of continuous data collection and interfacing to analytic tools. Some applications may need inclusion of digital media such as digital images from camera nodes[7]. Designing and implementing computer and electronics systems, especially IoT, in the domains of precision agriculture and ecological monitoring can be challenging.

3.INTELLIGENT AGRICULTURE REMOTE MEASURING AND CONTROL TECHNOLOGY

3.1 System function analysis

The functions of intelligent remote Measuring and control system on precision agriculture should have five main component/ as the following.

(1)Real-time monitoring of production environment. The function include the installation of sensors and controllers equipment in the actual production environment, connection these terminals to the internet using the Internet of Things technology , and the terminal device could real-time interactive perception of data and control data through the network.

(2)Real time information view. Users can open the system interface by terminal device including fixed and mobile terminals, and view the system in a variety of real-time status and historical data.

(3)System platform maintenance and management. This function mainly for the normal operation of the entire system, including historical data storage, data intelligence analysis, system function parameter configuration, and interface display and other important functions.

(4)Equipment management and maintenance. This function is used to manage and maintain access to all the terminal equipment in the system.

(5)User privilege management and maintenance. This function is used to assign users to the system of different roles, given the appropriate permissions. Users of the system include a variety of roles, such as system administrators, regional administrators, ordinary users and agricultural experts.

3.2 Internet of things terminal classification

The main sensor classification currently used in agricultural remote monitoring and control system is shown in table 1[8].

Table 1 Sensor classification to intelligent remote measuring and control on agriculture

Terminal	Function	Sensor types
sensor	soil parameter	Thermal,Moisture, pH
	hydrology-water	DO, Water Temp, pH,
	meteorological	Pressure, Speed, Rainfall
	gas parameter	Fog, Methane, CO_2
	plant parameter	Plant height, Leaf Temp
	video images.	HD camera,Image sensor
actuator	switch Ctrl	Light, tilation, Sprinkle
	quantitative Ctrl	Shutter amplitude

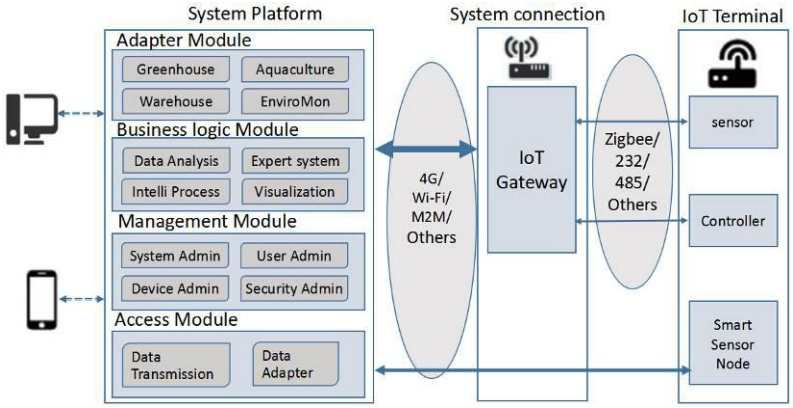

Figure 2 System architecture of remote intelligent measuring and control for precision agriculture

3.3 System framework

The architecture of remote measuring and control system proposed in this paper is shown in figure 2. In this architecture, its function module is mainly divided into the following important parts, including IoT terminal, system connection, system platform and user client.

3.3.1 Internet of Things terminal

The system currently supports multiple home networking terminal manufacturers, sensor manufacturers of terminal equipment. The terminal includes a simple sensor device, such as the terminal only one sensor, analog / digital conversion, protocol encapsulation and other functions are placed on the network element (sensor node or Internet of Things); also includes their own computing, storage resources Of the intelligent sensor terminal, you can achieve protocol encapsulation and other functions, such as M2M terminal, the global eye terminal and so on.

3.3.2 System connection

The main function of this part is to make the sensor access to the IoT-network, and then communicate with the system platform. This part is related to the terminal part, if the terminal is a simple sensor or control device, you need one or more intermediate network elements to connect. The sensor node is mainly responsible for driving sensors and actuators, the gateway is responsible for the sensor system connected with the tile network, the main function is protocol encapsulation, and local intelligent operation and processing, in the peak manufacturers system, the sensor nodes and the gateway can also be made into a network element. The network elements can also be deployed at a hierarchical level according to deployment requirements to accommodate multiple management and deployment scenarios.

If the terminal is a smart sensor, with its own computing, storage resources and operating system, then do not need the middle of the network element, directly through the Internet and platform system connected to the terminal to carry out a variety of operations, including packet encapsulation, Sensor information collection and control command execution.

As the current Internet of Things transmission protocol standards, different manufacturers choose different protocols, but also need to be based on the actual deployment of the system environment, the system also supports a variety of protocols. The sensor network connected to the Internet protocol, the system supports 4G, Ethernet, Wi-Fi, and M2M protocol can also be integrated.

3.3.3 System platform

This part is the core of the whole system, the main realization of the entire system business logic, sensing data access, data storage, and equipment, users and the entire system management. Including four major functional modules, as shown in Figure 2.

Adapter Module. Business adaptation module, mainly to support a variety of business, the system can support a variety of scenarios in the remote monitoring and control technology, scalability is good, has now tried commercial business intelligent greenhouses / greenhouses, intelligent irrigation, intelligent warehousing and so on.

Business Logic Module. Business logic module, the main function is to deal with a variety of business logic, the various sensor data for intelligent processing, and the formation of the corresponding expert system, the agricultural production environment for intelligent monitoring, intelligent analysis and intelligent control, and good readable Interface to show to the user. The system currently supports the analysis of sensor data, as well as the linkage between different terminals.

Management Module. Management module, mainly including system management, user management, equipment management and system security assurance.

Accesses Module. Access module, mainly to provide data transmission protocol solution / encapsulation, and protocol adaptation approach, with a number of sensor system manufacturers very convenient and fast docking, thus providing rapid deployment of the system.

3.3.4 User client

The system provides a web-based display interface, user can use browser directly access to information, and a variety of functions of the configuration and processing system provides smart phone-based client

software, is the machine through the client interface, the use of 4G network can be more convenient and fast access to information control.

4. CONCLUSION

The introduction of new communication technologies in agricultural production can greatly improve production efficiency and trigger new production models. This paper discusses the demand of Internet of Things technology in modern agricultural production, and proposes a general architecture of intelligent remote measuring and control technology based on Internet of Things technology, and analyzes the function and characteristics of architecture.

ACKNOWLEDGMENTS

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Fault Diagnosis System of Medical Oxygen Equipment Based on Dynamic Fault Tree

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Abstract: A dynamic fault tree model was built for the fault diagnosis system of military oxygen equipment based on the Dynamic Fault Tree Analysis method. Through the oxygen equipment fault analysis by Markov Chains and binary decision diagram, a fault diagnosis module consisting of a knowledge database and an inference unit was developed and a fault diagnosis system of oxygen equipment with remote monitor and fault diagnosis and intelligent diagnosis. The reliability and practicability of the system are verified by experiments. The results show that the system is simple and convenient, stable and reliable in performance, which is suitable for wide range of promotion.
Keywords: Dynamic fault tree analysis, Fault tree model, Intelligent diagnosis, Fault diagnosis

1. INTRODUCTION

With the oxygen producing equipment in the medical field and plateau region wide application, with the aid of computer technology and network communication technology, modern hospital of equipment remote centralized management and the demand of real-time monitoring has become more and more urgent, remote areas inaccessible for remote maintenance of equipment of the demand of remote fault diagnosis and maintenance difficult more and more urgent.The current situation is, once the oxygen generating equipment malfunction, site operation staff don't usually understand the working principle and equipment structure, baffling reason, communicate with factory technical personnel is difficult, even if the manufacturer intends to send technical personnel to the scene also can't clear what accessories, appear sometimes the phenomenon of technical personnel at the scene, sometimes even need to remove the equipment return to factory maintenance, this certainly will cause the maintenance cycle is too long, and even lead to stop. Based on the above reasons, develop a set of oxygen generating equipment fault diagnosis system realizes the fault analysis and fault diagnosis is particularly important. This study PSY - YY series medical oxygen generation system as an example, combined with historical data, on the basis of fault model is set up, with a fault diagnosis of dynamic fault tree analysis method, realize the equipment fault diagnosis.

2. DYNAMIC FAULT TREE MODEL IS ESTABLISHED

PSY - YY series medical oxygen generation system involves oxygen host and the air compressor, air tanks, filters, person, oxygen, oxygen storage tank and the oxygen compressor host devices[1]. Each kind of equipment has a fault may occur which affect oxygen generation system.The faults of each kind of equipment is used by pressure, flow rate, temperature, mechanical, factors such as a composition.Combined with oxygen generation system design principle and a large number of historical fault information of the fault tree model based on dynamic fault tree analysis method to establish as shown in figure 1.

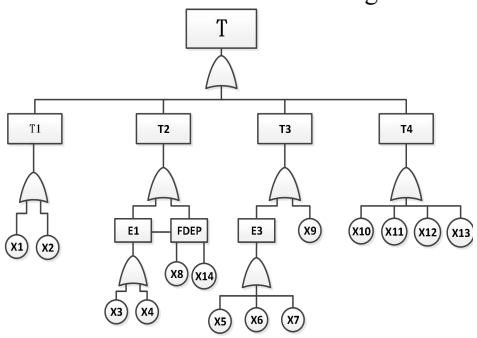

Figure 1 Oxygen system fault model

T Said of oxygen generation system outage, T1 said oxygen compressor fault, T2 said person failure, T3 said air compressor fault, T4 said by oxygen host fault, E1 said refrigeration failure, E3 said exhaust pressure set point fault has not been achieved, X1said oxygen pressure mechanical and electrical machine operation is unusual, X2 said pressure sensor fault,X3 said person outlet temperature is higher, X4 said the air compressor exhaust temperature and the person who said exports smaller values of the temperature difference, X5 said air pressure is insufficient failure, X6 said air compressor oil,X7 said air compressor overheating fault,X8 said auxiliary refrigeration equipment failure, X9 said exhaust pressure sensor fault detection, X10 said pipeline leak or filter damage failure, X11 said the adsorption pressure is unusual, X12 said oxygen concentration is unusual, X13 said traffic anomaly, X14 said to a bad compressor.

3. DYNAMIC FAULT TREE ANALYSIS

Dynamic fault tree analysis process description is as follows:

(1)Modeling.Analysis of oxygen generation system of fault data and fault type, fault type modular, according to a large number of oxygen generating equipment (this passage system and equipment) failure data and dynamic fault tree establishing

principle of dynamic fault tree model is established in this paper.Dynamic fault tree model is established in this paper is divided into dynamic model and static model is established.Among them, the static model is built based on the traditional fault tree model is established.Principles of establishing the dynamic model refer to the relationship between the static and dynamic, static relationship is one of the traditional fault tree model of relationship between the principle, dynamic relationship including cold backup door and door, the door function, priority, etc.

(2) To solve. Depth-first traversal left modular often enough in the application of dynamic fault tree analysis to dynamic fault tree is modularity, decomposed into independent static sub tree and dynamic sub tree, in which dynamic sub tree is converted to the corresponding Markov chain (Markov) to evaluate, static sub tree can use binary decision diagram (BDD) method to solve.

(3)Analysis. By solving the various independent sub tree result analysis, formed on the system of oxygen generation system fault analysis and inference (this sentence appeared two systems).Child module as a node, in order to (1) or (2) for tree analysis results for the output of the node to replace it for the whole subtree, then cycle (1), (2) can get the whole system analysis results.

On the basis of dynamic fault tree model is established, and according to the principle of dynamic fault tree analysis, get the dynamic fault tree modular depth-first traverse table on the left, as shown in table 1.

In table 1, {T,T1,T2,T3,T4,E1,E3}, are the module of dynamic fault tree for oxygen generation system, {T,T1,T2,T3,T4,E1}as a static subtree, so using the binary decision diagram method T2 to solve.For the dynamic subtree, so use based on markov chain method to solve.

Table 1 Dynamic fault tree traversal process

process	node	process	node	process	node
1	T	11	X8	21	T3
2	T1	12	X14	22	T4
3	X1	13	T2	23	X10
4	X2	14	T3	24	X11
5	T1	15	E3	25	X12
6	T2	16	X5	26	X13
7	E1	17	X6	27	T4
8	X3	18	X7	28	T
9	X4	19	E3	29	
10	E1	20	X9	30	

Based on the depth-first traversal left table can get in the middle of each variable steps tag, as shown in table 2.

Table 2 Intermediate variable corresponding steps mark

step	t1	t2	t3	tmin	tmax
T1	2	5	5	3	4
T2	6	13	13	7	12
T3	14	21	21	15	20
T4	22	27	27	23	26
E1	7	10	10	8	9
E3	15	19	19	16	18

In table 2, t1, t2 and t3 said three steps of 15 shall, by mark tmin, tmax, said mark 1 and 3 the least of the intermediate node step value.If the tmin > t1 and tmax > t2, explain the node for a module.

3.1 Dynamic Subtree Analysis

Oxygen generation system dynamic fault tree model for dynamic subtree.According to the principle of markov chain method, first the dynamic subtree into markov chain, as shown in figure 3.The Fa for person of failure.

From the state transition diagram shows that the markov chain is relatively complex, strives for the transition process of the chain length of 1 respectively T1 and T2 state transition process chain length is 2.One of the transition process of the chain length of n general formula for the calculation

$$p^{T^n}(t) = p_{0n}(t) = \prod_{i=1}^{n} \lambda_{i-1,i} \left(\prod_{i=1}^{n} \frac{1}{\lambda_{i-1,i} + \lambda_{i-1,NF}} - \sum_{i=1}^{n} \frac{e^{-(\lambda_{i-1,i} + \lambda_{i-1,NF})t}}{(\lambda_{i-1,i} + \lambda_{i-1,NF}) \prod_{j=1, j \neq i}^{n} (-\lambda_{i-1,i} - \lambda_{i-1,NF} + \lambda_{j-1,j} + \lambda_{j-1,NF})}\right)$$

In the formula $\lambda_{i-1,i} > 0, \lambda_{i-1,NF} \geq 0$.

According to a large number of oxygen generation system failure data to get reliable failure rate of bottom events such as shown in table 3.

Table 3 events failure rates

event	X1	X2	X3	X4	X5
rate	0.01	0.03	0.03	0.02	0.04
event	X6	X7	X8	X9	X10
rate	0.03	0.03	0.03	0.02	0.1
event	X11	X12	X13	X14	
rate	6×10^{-5}	6×10^{-5}	2×10^{-5}	9×10^{-5}	

According to a large amount of data, through the formula to calculate the dynamic fault tree T2 probability is 0.009.

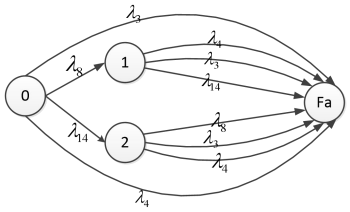

Figure 3 markov state transition diagram

3.2 Static Fault Tree Analysis

Oxygen generation system fault tree basic event sequence is:

$$X1 < X2 < X3 < X4 < X8 < X14 < X5 <$$

$$X6 < X7 < X9 < X10 < X11 < X12 < X13$$

Fault tree modular into{T1,T2,T3,T4}, as a result of this dynamic fault tree model is more complex, this article choose T3 were analyzed, and the other same module events and event analysis principle.T3 events corresponding binary decision diagram as shown in

figure 4.

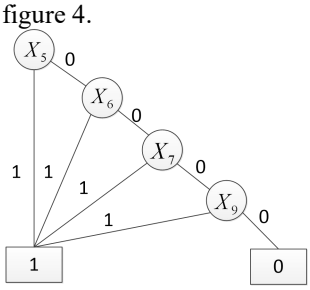

Figure 4 Binary decision diagram

T3basic event is composed of {X5,X6,X7,X9}bottom events, each event to determine whether the basic event failure.Based on the principle of binary decision diagram method can get T3 event failure rate is as follows:

$$p(T_3) = p(X_5) + [1 - p(X_5)]p(X_6) +$$
$$[1 - p(X_5)][1 - p(X_6)]p(X_7) +$$
$$[1 - p(X_5)][1 - p(X_6)][1 - p(X_7)]p(X_9)$$

T3 of oxygen generation system using the binary decision diagram method in a static fault tree based on the qualitative analysis.The bottom of each basic event as the top event, and then use the statutory binary decision diagram analysis of different bottom event probability of basic events, finally to obtain the static fault tree top eents.Using the same principle and algorithm for T1 event probability is 0.0397, T3 event probability is 0.1148, T4 event probability is 0.1701.Finally can calculate oxygen generation system static fault tree top event failure probability is 0.2945.

3.3 The Result Analysis

Based on the results, the following conclusions:

(1)T1,T2,T3,T4t,he four top events and the probability of events is the largest in the T4, namely oxygen host the probability of failure is the largest (in fact oxygen host probability of the failure of the youngest, air compressor failure probability is the largest, can communicate with chopped).Oxygen equipment is also the core of the whole oxygen generation system, therefore, in the normal production and maintenance should be more emphasis on oxygen host maintenance.

(2)T2 event probability with redundancy design of minimum said person can reduce the failure rate, so as to improve the reliability of the mechanism of cold person.

4. WRITE RULES LIBRARY

The system fault type and fault diagnosis methods have been confirmed, according to the fault type system for the establishment of the rule base.First of all, the reasoning process according to the air compressor fault, person, oxygen host faults and oxygen compressor faults different category classification number.Then according to the fault type, rule number, results and the status of keyword rule base, carried out in accordance with the keyword search in the search.

Rule base set up as shown in table 4.

Table 4 rules table is established in this paper

fault type	rule	result	status
Oxygen compressor failure	V1	Abnormal motor operation	1
	V2	pressure sensor fault	1
Cold drying machine failure	V3	The export of high temperature	1
	V4	The temperature difference is small	1
	V5	Auxiliary refrigeration equipment failure	1
	V6	compressor fault	1
air compressor failure	V7	insufficient air pressure	1
	V8	Air compressor oil leakage	1
	V9	Exhaust pressure sensor fault detection	1
Thus is the host	V10	Air filter pipeline damage	0
	V11	Adsorption pressure anomaly	1
	V12	Abnormal oxygen concentration	1
	V13	traffic anomaly	1

5.THE PROGRAM DESIGN OF FAULT DIAGNOSIS

Solution based on fault tree has been very mature, such as breadth first search algorithm, depth first search algorithm and cost tree breadth first, and even have a mixed use based on the actual situation . deeply design oxygen system fault diagnosis system diagnosis flow chart. For the first initialization, then determine whether the received user fault the application report, after receipt of the type of fault to submit the preliminary analysis of the user, inform the user through the network to the data in the next step, according to preliminary data received after the fault analysis of whether there is a corresponding solution to query the knowledge base, if there is a direct solution extraction It is sent to the user, if there is no need to be provided by the user data using the diagnosis method for fault diagnosis, put forward the solution to provide to the user and stored in the knowledge base, to solve the problem of fault diagnosis has been finished. The whole process is shown in Figure 5.

6. THE REALIZATION OF THE FUNCTION OF FAULT DIAGNOSIS SYSTEM

The fault diagnosis system of oxygen equipment is applicable to solve the traffic inconvenience difficult to overhaul this problem, so the system has the function of remote fault diagnosis. In order to predict new fault types and corresponding solutions, the system also has the function of intelligent diagnosis. Therefore, fault diagnosis of the system mainly has the function of remote fault diagnosis and intelligent diagnosis.

The communication system uses the B/S network architecture between field equipment and technical

service center, the network architecture is shown in Figure 6.

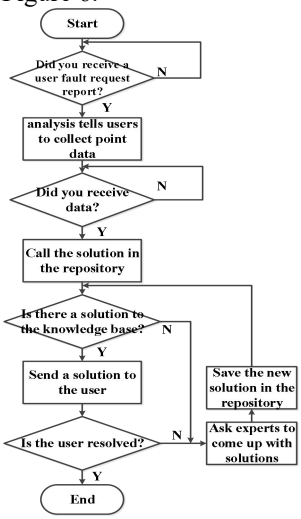

Figure 5 The Whole Process

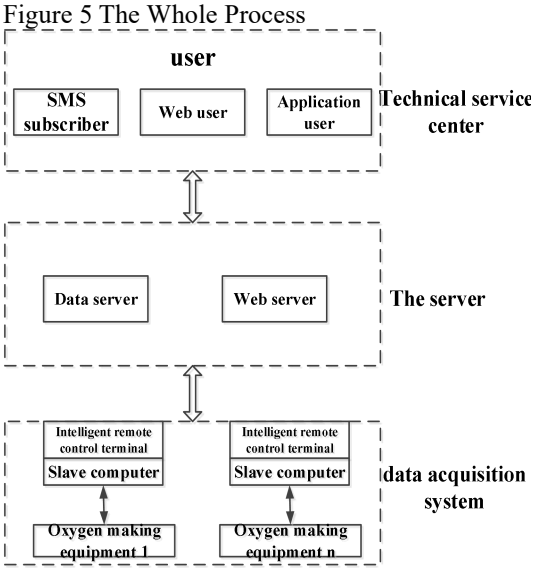

Figure 6 System Network Architecture

The network architecture consists of data acquisition system, server and technical service center, data acquisition system will be on-site data acquisition and transfers data to the end of the technical service center data server through the intelligent remote control terminal. Web editing and publishing on the Web server, the fault data with known field devices can be displayed "out of it.

In addition, SMS users and application users can benefit With the mobile phone that field equipment. This network structure realizes the remote fault diagnosis function. The system using the method of fault diagnosis of dynamic fault tree analysis method to realize the intelligent diagnosis based on function. When a fault occurs, the system can feedback analysis results to the technical staff, technical staff and gives the corresponding solutions, and the solutions are solved by the system to inform the site operation personnel. When there is a new type of fault occurs when the technical personnel according to the analysis results and corresponding data were resolved, and the solution is stored in the database. This system has the knowledge base and reasoning machine. The knowledge base is mainly used for storage of fault diagnosis principle of oxygen system and solutions, reflect the relationship between the variables and the various faults. The inference engine mainly solves the selection and application of knowledge in the knowledge base of the problem solving process, control the whole problem, according to the data server to store data, the solution in the knowledge base, the algorithm made a conclusion.

The system supports mobile phone APP remote monitoring and fault diagnosis function. The same field data through the data acquisition system will transfer the collected data to the cloud server, cloud server is a kind of virtual technology. This paper is written by eclipse software of APP mobile phone interface and interface program, display data and production status of field devices through the APP interface when there. The fault site oxygen equipment, mobile phone users can know the specific type of fault through SMS and APP. Web user interface is shown in Figure 7.

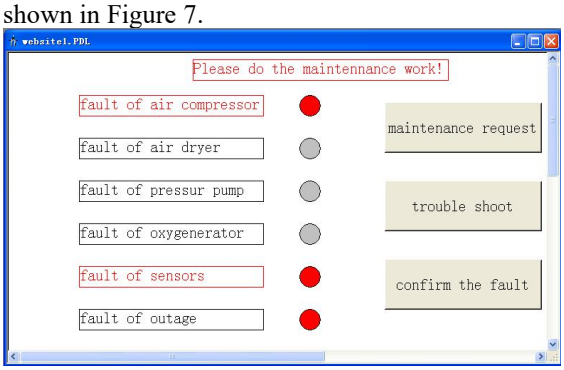

Figure 7 Web User Interface

The oxygen equipment fault diagnosis system including fault diagnosis system based on mobile phone oxygen equipment, oxygen equipment fault diagnosis system based on Web, the design of dynamic fault tree analysis method and design of reasoning machine based on knowledge base.

7. CONCLUSION

The fault diagnosis system of intelligent and remote fault diagnosis technology is the key of oxygen equipment fault diagnosis system. Dynamic diagnosis method based on fault tree analysis method can solve the remote oxygen equipment maintenance difficulties, reduce labor intensity, shorten the maintenance cycle, improve production efficiency, to avoid downtime problems for a long time. Study on the analysis method of dynamic fault tree based on the medical oxygen equipment fault diagnosis system has a large number of experiments, the results show that the diagnosis system is simple and convenient to use, stable and reliable performance, suitable for mass production.

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Influence of Compression Ratio on Performance of Diesel Engine

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Abstract: The compression ratio indicates the degree to which the gas in the cylinder is compressed when the piston is moved from the bottom dead center to the top dead center. Theoretical studies and practical applications have shown that increasing the compression ratio within the appropriate range can effectively improve the overall performance of the engine. The high compression ratio can improve the pressure and temperature in the cylinder, make the combustion more fully and improve the stimulus while effectively reducing the fuel consumption rate, improving the stimulus also improved the economy.
In this paper, the author first analyzes the influence of the compression ratio on the engine performance parameters, and then uses the engine performance simulation software AVL BOOST to establish a simulation model for a diesel engine. The performance of the diesel engine which is effected by compression ratio is quantitatively analyzed by simulation data.
Keywords: compression ratio; dead center; AVL BOOST

1. ANALYZE

1.1Effect of Compression Ratio on Fuel Consumption

By reviewing the book "Principles of Internal Combustion Engine"[1], it is found that the main way to reduce the fuel consumption of diesel engines is to improve the conversion efficiency of their thermal energy into mechanical energy, that is, to improve the effective thermal efficiency of diesel engines and reduce heat loss[3].The cycle of the diesel engine is mainly a mixed heating cycle, the cycle thermal efficiency formula is:

$$\eta_{\mathrm{t}}=1-\frac{\lambda_p \rho_0^{\kappa}-1}{\varepsilon^{\kappa-1}\left[\lambda_p-1+\kappa\lambda_p(\rho_0-1)\right]}$$

κ Is Isntropic index, ε is compression ratio, e λ_p is Pressure rise ratio, ρ_0 is Initial expansion ratio

It can be seen from the above formula that improving the compression ratio can increase the peaking firing temperature in the formula to expand the temperature gradient of the cycle, so that the cycle of thermal efficiency increases. From the structural design analysis, an important measure to improve thermal efficiency is to organize a reasonable combustion process and to reduce the heat loss of the exhaust and cooling systems to increase the BMEP[2].

1.2 The effect of compression ratio on cylinder pressure and temperature

In the combustion process, the peaking firing pressure and pressure rise rate depends on two factors: one is the ignition delay time, the other is the ignition delay period into the cylinder fuel. Shortening the delay time and reducing the amount of fuel injected during the delay can control the peaking firing pressure and pressure rise rate, while the ignition delay period and the end of the compression of the cylinder pressure and temperature of the impact. The lower the pressure and temperature of working medium at the end of the compression stroke, the longer the ignition delay period, the poor quality of the combustion, the rougher work[3]. Compression ratio directly affects the compression of the pressure and temperature of working medium at the end of compression stroke, the specific relationship is:

$$T_c = T_r \varepsilon^{n-1}$$

$$p_c = p_r \varepsilon^{n}$$

T_c p_c is the temperature and pressure of the working fluid in the cylinder at the end of compression stroke.

T_r p_r is the temperature and pressure of the working fluid in the cylinder at the end of the air intake stroke.

n is Variable index.

2. THE ESTABLISHMENT OF SIMULATION MODEL

2.1 Calculation model

The simulation object is a pressurized intercooled diesel engine with a bore diameter of 100mm, a stroke of 120mm, a speed of 2500r / min and a four stroke compression ratio of 16. The combustion model of AVL Boost is divided into: Vibe combustion exotherm model, Double Vibe combustion exothermic model, Woschni / Anisi combustion exotherm model, Hiroyasu combustion exotherm model, AVL MCC exothermic model. Which Double Vibe Vibe more accurately calculate the compression ignition engine combustion and heat release law, so the model is put to use. The figure below shows the basic diesel engine simulation model, including inlet and outlet pipes, system boundaries, cylinders, intercoolers, superchargers and motors.

2.2 Calculation scheme

In the original machine based on the primary compression ratio of 16, 16.5, 17, 17.5, 18, 18.5. The performance of diesel engine under different compression ratio is obtained quantitatively by simulating the condition of reverse towing and full

load.

Reverse towing condition: In the absence of fuel injection to the cylinder, regardless of the conditions of combustion and heat, to examine the different compression ratio on the compression end of the performance indicators.

Full load conditions: In the simulation of diesel engine in full load conditions, consider the change in compression ratio on the cylinder pressure, temperature, effective fuel economy and other performance indicators.

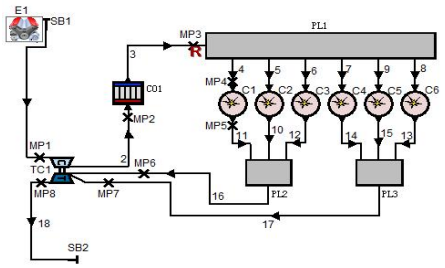

Fig. 1 Simulation Model of Diesel Engine

3. SIMULATION RESULTS AND ANALYSIS

Turbocharged diesel engine with the intake pressure increases, the peaking firing pressure and pressure rise rate also increased, in order to reduce the mechanical load generally use a smaller compression ratio. But too small compression ratio would effect the cold start and combustion performance of diesel engine , so in the premise of ensuring the mechanical load, as much as possible to improve the engine compression ratio[4].

The influence of compression ratio to the peaking firing pressure is shown in Fig. 2. With the increase of the compression ratio, the peaking firing pressure increases, and the compression ratio is increased by 0.5, the peaking firing pressure is increased by 0.55MPa, when the peaking firing pressure exceeds a certain value, the diesel engine will work rough, which is an important reason to limit the compression ratio.

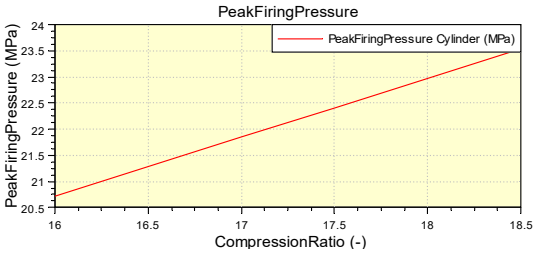

Fig. 2 The Effect of Compression Ratio on The Peaking Firing Pressure

The effect of compression ratio on fuel consumption is shown in Fig. 3. The fuel consumption rate decreases with increasing compression ratio. When the compression ratio increased by 0.5, the fuel consumption rate decreased by an average of 1g / (KW · h). But when the compression ratio increased from 16 to 16.5, the fuel consumption rate decreased by 1.92 g / (KW · h), this is because the compression ratio increases, the fuel has a better fire environment which helps to obtain a higher flame propagation speed, thus shortening the ignition delay, so that the fuel can be injected more stable and fully burned.

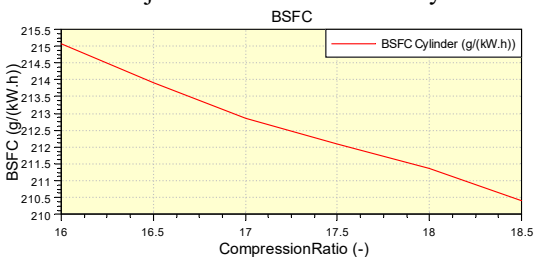

Fig. 3 Effect of Compression Ratio on Fuel Consumption

The effect of compression ratio on temperature can be measured in terms of both exhaust temperature and maximum combustion temperature, as shown in Fig. 4 and Fig. 5. As can be seen from the figure, with the increase in compression ratio, the exhaust temperature and the peaking firing temperature are decreasing, and the rate of decline is getting faster. This is because when the compression ratio is increased, the temperature gradient of the cycle is enlarged, the expansion ratio of the engine is increased, the maximum circulating pressure is sharply increased, and the useful energy of the thermal energy is increased, so that the maximum combustion temperature is reduced, the gas temperature also decreases.

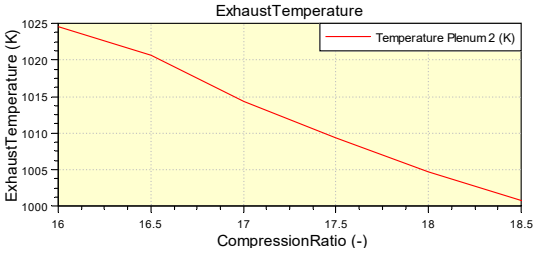

Fig. 4 Effect of Compression Ratio on Exhaust Temperature

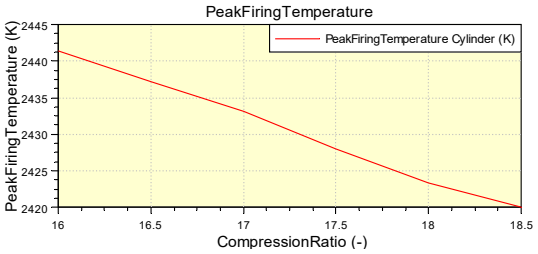

Fig. 5 Effect of Compression Ratio on Peaking Firing Temperature

The effect of compression ratio on pressure can be obtained by the BMEP, as shown in Fig. 6. It is shown that the BMEP increases with the increase of the compression ratio, and the effective average pressure is increased by 0.01 MPa per liter. This is because the compression ratio increases, the beginning burning point of the temperature and pressure increases which is conducive to completely, fully burned, increasing the heat and fuel calorific value ratio, thereby increasing the BMEP.

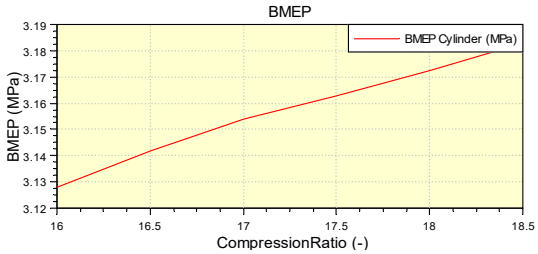

Fig. 6 Effect of Compression Ratio on BMEP

4. CONCLUSION

Compression ratio is an important performance index parameter of the diesel engine, whichgher compression ratio can achieve higher combustion quality, improve the combustion process, get good economy and power.

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Road Travel Time Prediction Based on Kalman and ARIMA Model

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Abstract: Considering the unstableness of single travel time prediction model, Kalman filter prediction and time series analysis(ARIMA) combined model are proposed in the prediction. With the good real－time of Kalman filter and the strong linear fitting ability of ARIMA, the two models are used to predict one same link travel time independently and these results are dynamic weighted so to achieve the best prediction result. It proved that the combined model, which takes advantage of the two models, have higher accuracy in prediction than that of single model. The combined model can be an efficient method to the urban travel time prediction.
Keywords: Kalman filter; time series analysis; hybrid model; road travel time prediction

1. INTRODUCTION

Road travel time is the main basis for the urban traffic management and control departments to provide effective information to the travelers, and to conduct reasonable traffic guidance and improve the utilization of traffic. TTP (Travel Time, Prediction) has become the focus of research by experts and scholars both at home and abroad[1]. In recent years, with the rapid development of intelligent transportation system, the research in this field has also made significant progress in many time prediction model, the more common is mainly divided into the following four types[2] Calman (Kalman filtering) filter model of [3]-[4], the pattern recognition model (K-Nearest, Neighbours, KNN) [5], time series model (ARIMA models[6]) and artificial neural network model (Artificial Neural Networks, ANNs) [7]. However, the study shows that none of these methods can be used to predict the travel time of all sections, and appropriate models and methods should be chosen according to the actual traffic conditions [8]. In 1870s, Bates, Granger et al proposed a combination model to forecast the thought of 9, is the combination of the model prediction results through the reasonable way of combination of weaknesses in order to obtain the best prediction results. This paper carries on the forecast to the city road travel time based on Kalman filtering prediction and ARIMA analysis model, make use of their good real-time and high precision advantages, so as to improve the prediction accuracy of the model and practical performance.

1 Road travel time combination forecasting model

1.1 Kalman filtering model

The Kalman filtering problem can be described as follows: using the observation data vector $y(1), y(2), \cdots y(n)$, the least squares estimation of the individual components is made $n \geq 1$. The Kalman prediction model is used to predict the travel time of urban sections. First, the prediction model is established as follows: $k, k-1, \cdots k-n+1$ is used as the prediction of vehicle time through this section of the road travel time with the average travel time of a section of time, taking into account the specific situation of the traffic, the road travel time here take 4 time ($k, k-1, k-2, k-3$) as the influencing factors on the prediction of the model as shown in (1):

$$T(k+1) = H_0(k)T(k) + H_1(k)T(k-1) + H_2(k)T(k-2) + H_3(k)T(k-3) + w(k) \quad (1)$$

In the formula, $T(k+1)$ is the travel time of the system which is predicted; $H_i(k)(i=0,1,2,3)$ is the system parameter, $w(k)$ is the zero mean white noise, which is the system observation, $R(k)$ noise is the covariance matrix of the system. Define state vector:

$$\begin{aligned} A(k) &= \left[T(k), T(k-1), T(k-2), T(k-3)\right] \\ x(k) &= \left[H_0(k), H_1(k), H_2(k), H_3(k),\right]^T \\ y(k) &= T(k+1) \end{aligned} \quad (2)$$

The formula (1) can be transformed into the state equation and observation equation of Kalman system, such as equation (3):

$$\begin{aligned} x(k) &= \varphi(k, k-1)x(k-1) + u(k-1) \\ \mathrm{y}(k) &= A(k)x(k) + w(k) \end{aligned} \quad (3)$$

In the formula, $x(k)$ is the state vector, $y(k)$ is the observation vector, and the state transition matrix $\varphi(k, k-1)$ is the process noise; $u(k-1)$ is the covariance matrix which is the observation noise, and the covariance matrix $R(k)$; $u(k-1)$ and $w(k)$ is the uncorrelated zero mean white noise.

According to the Kalman filtering theory, the following recurrence formulas are obtained:

$$\begin{aligned}
&\hat{x}(k)=x(k|k-1)+K(k)\left[y(k)-A(k)x(k|k-1)\right]\\
&x(k|k-1)=\varphi(k,k-1)\hat{x}(k-1)\\
&K(k)=P(k|k-1)A^{T}(k)\left[A(k)P(k|k-1)A^{T}(k)+R(k)\right]^{-1}\\
&P(k|k-1)=\varphi(k,k-1)P(k-1)\varphi^{T}(k,k-1)+Q(k-1)\\
&P(k)=\left[1-K(k)A(k)\right]P(k|k-1)
\end{aligned} \tag{4}$$

The travel time prediction of the next section can be obtained by calculation $\hat{x}(k)$, as shown in equation (5).

$$T(k+1)=A(k)\hat{x}(k) \tag{5}$$

1.2 ARIMA analysis model

Time series analysis is a data analysis method based on statistics. The prediction principle is that the travel time of a section is considered as a set of time series with time. Box-Jenkins is a commonly used method of time series analysis model, also called ARIMA, called the differential autoregressive moving average model (Auto-Regressing Integrated Moving Average, abbreviated ARIMA), this model is often used for the prediction of non-stationary time series.

ARIMA is a hybrid form of the AR model and the MA model, and its general expressions are as follows:

ARIMA (P, q) form:

$$\begin{aligned}
&y_t=\varphi_1 y_{t-1}+\varphi_2 y_{t-2}+\cdots+y_{t-p}\\
&+\mu_t+\varepsilon_t-\theta_1\varepsilon_{t-1}-\theta_2\varepsilon_{t-2}-\cdots-\theta_q\varepsilon_{t-q}
\end{aligned} \tag{6}$$

In the model, y_t is the sampling coefficients, $\varphi_i(\mathrm{i}=1,2,\cdots,\mathrm{p})$ is the autoregressive coefficients and $\theta_i(\mathrm{i}=1,2,\cdots,\mathrm{q})$ is the moving average coefficients. ε_t is the time series t perturbation at the time, in the same time, it is a sequence of white noise that obeys the normal distribution.

The travel time of urban section is a random time series, $\{y_t\}$ is regarded as the travel time sequence of the obtained section, and $\{\varepsilon_t\}$ is regarded as the error sequence of the travel time of the obtained section. ARIMA model is stationary but the road travel time is a non-stationary time series, then, can be through the d time difference, converted to stable, and then use the ARMA generation model, this model is the ARIMA model (p,q,d). The first order difference formula (7) is:

$$\triangle y_t=y_t-y_{t-1} \tag{7}$$

A sequence of d differential means $d-1$ a difference calculation on the basis of a sequence of differential sequences $\left\{\triangle^{d-1}y_t\right\}$. After the gradient is stationary, we can use the autocorrelation function and the partial correlation function to determine the value, and then estimate the road travel time series value.

1.3 Combination Model Of Kalman Filtering And ARIMA Analysis

In the Kalman filter and ARIMA forecasting results are combined in the process, to determine its weight is very important, it determines the size of the proportion of the two prediction methods of output in the total prediction results, it will directly affect the prediction accuracy of the model. The concept of dynamic weight is introduced in this paper. The so-called dynamic weight means that the weights of the composite model are adjusted constantly with the change of prediction error, so that the best prediction output can take the leading role in the total results. To describe changes in this error, a dynamic error is defined, as shown in equation (8).

$$e_{d,i}(t)=\frac{1}{k}\left[e_{\alpha\gamma,i}(t)+e_{\alpha\gamma,i}(t-1)+\cdots+e_{\alpha\gamma,i}(t-k)\right] \tag{8}$$

In the model, $e_{d,i}(t)$ is the dynamic error of the method i which is taken as the cumulative number of errors, and k is the sample number that is usually determined by the travel time; $e_{\alpha\gamma,i}(t)$ is the absolute relative error for the prediction output of the road L section method i.

The formula is as follows:

$$e_{\alpha\gamma,i}(t)=\left|\frac{y(t)-\hat{y}_1(t)}{y(t)}\right| \tag{9}$$

In the model, $\hat{y}_1(t)$ is the predicted output value which is the actual value of the travel time of the section.

After the dynamic error of the two methods is obtained, the travel time prediction and the output data fusion can be carried out, and the dynamic weight is determined by the inverse ratio method. The formula is as follows:

$$w_i^*(t)=\frac{1}{e_{d,i}(t-1)} \tag{10}$$

In order to make sure the sum of weights is 1, the upper dynamic weights $w_i^*(t)$ are normalized, and the final weights of the combination model are obtained, such as formula (11).

$$w_i(t)=\frac{w_i^*(t)}{\sum_{i=1}^{n}w_i^*(t)} \tag{11}$$

Kalman filter and ARIMA analysis, combined model prediction, road section travel time, steps are as follows:

Kalman travel time model and ARIMA model are used to predict the travel time of the road section, and the prediction results are obtained $\hat{y}_1(t)/\hat{y}_2(t)$.

Calculate the error between the two model prediction result and the true value, and determine the dynamic weight $w_1(t)$、$w_2(t)$.

According to the dynamic weight, the proportion of the predicted results is assigned, and the optimal prediction results are obtained. From the perspective of the combination forecasting process model, prediction model and ARIMA analysis model to predict the travel time using Kalman filter, Kalman

filter model in real-time, ARIMA model has high prediction accuracy, this model play the advantages of the two models, the dynamic weight distribution, obtained the best prediction results.

2 empirical study

In this paper, the northern part of Beijing city Deshengmen street and Zhongguancun road section as the research object, choose November 20, 2013 17:00 to link travel time data of 19:00 within two hours as samples, using 17: 00 to 60 sets of data on 18: 00 combined forecasting model calibration test, 18:01 19:00 60 group to verify the method using MATLAB simulation the simulation of the three models, the prediction results are shown in Table 1. Due to space limitations, partial predictions are given below. The latter five groups were interval 5min time forecasts.

Table 1 Prediction of road travel time

TIME	actual value(s)	predicted value
16:11	131.35	131.72
16:12	131.46	131.79
16:13	129.78	130.13
16:14	134.15	133.84
16:15	133.71	134.24
16:16	129.49	131.56
16:17	131.48	132.15
16:18	132.35	132.90
16:19	134.11	134.24
16:19	131.78	132.00
16:20	139.54	137.96
16:25	144.28	146.16
16:30	159.26	157.23
16:35	137.89	137.28
16:40	140.00	141.72

In order to determine the SVM-Kalman filtering dynamic model, single SVM model, using two kinds of evaluation index below the forecast results for evaluation: mean absolute error, MAE, mean absolute percentage error, MAPE root mean square error, RMSE. The formula is shown in formula (12).

$$MAE = \frac{\sum |\text{Observed value} - \text{predicted value}|}{N}$$

$$MAPE = \frac{1}{N}\sum \frac{|\text{Observed value} - \text{predicted value}|}{\text{Observed value}} \quad (12)$$

$$RMES = \sqrt{\frac{\sum (\text{Observed value} - \text{predicted value})^2}{N}}$$

The errors of the three models are compared, as shown in table 2.

Table 2 error comparison of prediction methods

Error index	Kalman filtering model	ARIMA analysis model	Combination forecasting model
MRE	0.0021	0.0018	0.003
MAPE	0.0312	0.0277	0.0052`
RMES	0.0081	0.0071	0.0013

As shown in Figure 1 and table 1, the error of MRE is the smallest in the 3 forecasting models, and the RMES is the largest. This indicates that the combination forecasting model has the best prediction effect.

3 conclusion

Because of the complexity and randomness of the road network, it is difficult to obtain satisfactory prediction results only when using a prediction method in the road travel time prediction. Based on the measured data of urban traffic, this paper uses Kalman filter prediction and ARIMA analysis model to predict it, and gets better prediction results. The proposed combination model provides a new method for traffic control departments to control traffic and induce vehicles. However, there is no sudden traffic accident or traffic flow sudden change during the study period of the object section predicted by this paper. Therefore, when the special traffic condition occurs on the road section, the prediction effect of the model needs to be further tested.

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The Study of the Design and Utility for the AUV anti-fall System

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Abstract: As one of the important direction of China's current aerospace and related machinery research and development, UAV has been widely regarded in the field of technology development and application. Due to remote control and immature structure design, the UAV has frequent falling problems, which not only affects the effective performance of UAV functions, but also has certain security risks. This article namely to fall prevention of unmanned aerial vehicle (UAV) as the research object, in an overview of the concepts and applications of the unmanned aerial vehicle (UAV) classification on the basis of deep analysis of unmanned aerial vehicle (UAV) fall prevention system design, the new type of unmanned aerial vehicle (UAV) fall prevention system contains the parachute and measurement and control device, and summed up the new fall prevention good effectiveness of the unmanned aerial vehicle (UAV).
Keywords: UAV; anti-fall; parachute; measurement and control device

1. THE CONCEPT AND APPLICATION OF UAV

In recent years, with the improving of the level of science and technology in China, all areas of production, management and other activities are increasingly mechanized, intelligence, UAV as an important representative of the current flight instruments in our country, its application fields are becoming more and more extensive. However, the deep application causes problems, especially the falling of UAV. As a result of failure, remote control failure, etc., may cause the UAV to fall, the falling can also cause injury to people, things and so on. In view of this, the author develope the anti- falling system which is based on the theory of knowledge and experience to avoid UAV'S falling from a fault and its structure is simple, which can realize the fall launch automatic judgment and automatic start.

UAV is short for unmanned aerial vehicle, which is operated by radio remote-control equipment and self-contained program control devices. From a technical perspective, which can be divided into unmanned fixed-wing aircraft, unmanned vertical takeoff and landing machines, unmanned airships, unmanned helicopters, unmanned multi-rotor aircraft, and unmanned paratroopers. And UAV can be divided into military and civilian applications according to its application. In the military aspect, UAVs are classified as reconnaissance aircraft and target aircraft. There is a real need in civilian aspect, the use of UVA has been expanded on the area of aerial photography, agriculture, plant protection, selfie, express delivery, disaster relief, observation of wildlife, surveillance of infectious diseases, mapping, news reporting, power inspection, disaster relief, film and television shooting etc. The developed countries are also actively expanding their applications and developing on UAV.

2. DESIGN OF ANTI-FALL SYSTEM

The new- type of the anti-fall UAV, which includes UAV , parachutes and measurement and control device. And the parachute and measurement and control device , are main parts of the anti-fall system, are set up in the body.

(1) Design of the parachute

UAV fall prevention system contains the parachute canopy and ejection device, described the ejection device including mobile piston, push rod and the electric magnetic card head. And the electric magnetic head includes electromagnet and spring head, and the canopy is set at the top and the push rod is in the mobile piston. There is a spring at the bottom of moving piston, and the setting of moving piston side has a bayonet, the spring card header card is on the bayonet.

(2) Design of the control device

The detection and control devices in the anti-fall system are mainly responsible for real-time monitoring of the UAV's flight speed, flight height and balance. The measurement and control devices mainly include height sensor, acceleration sensor and single chip microcomputer. The height sensor includes the airspeed tube, a voltage sensor, a temperature sensor and A/D module, and the airspeed tube, voltage sensor and A/D module are connected in turn. Acceleration sensor including quality, bending reeds and base, the quality of the block is composed of inherent quality and added mass blocks, the inherent quality of block are connected to the base by bending reeds, added mass and connection, and the inherent quality blocks of woe to the interior of the base fixed combiner and Faraday rotation mirror, inherent quality and base between winding with sensing optical fiber.

3. THE UTILITY OF UAV

(1) Achieve the anti- fall of UAV

The UAV's anti-falling system can realize the anti-falling of UAV and its structure is simple. The utility model of a fall UAV, using the electromagnet,

produce magnetic force, will attract of spring clip, so as to make the spring will move the piston up, the driver of the airflow and the push rod will parachute, so as to realize the fall prevention of UAV, the control model of electromagnet, simple structure, when the fall prevention, then push down the push rod, and can be in mobile live chandrasekhar spring card head, the umbrella body back again, can be reused.

(2)Achieve the automatic judgment and automatic start of anti - falling start

The UAV has height sensor and acceleration sensor. When the UAV starts flying, people can set the anti-falling program automatically when the UVA is at a height and acceleration. The height sensor including a pitot tube, a electric pressure sensors, temperature sensors and A/D module, pitot tube, a electric pressure sensor and A/D module connected in sequence, pitot tube to measure air pressure, through a electric pressure sensor, air pressure into electrical signals, then through A/D module will electrical signals into digital signals. At the same time, the temperature sensor is set through the microcontroller, the pressure data is converted into high data by temperature parameter correction, and the accurate measurement of high data is realized. The acceleration sensor including mass, bending reeds and base, the quality of the block is composed of inherent quality and added mass blocks, the inherent quality of block are connected to the base by bending reeds, added mass and inherent quality blocks of connection, the interior of the base fixed woe to the combiner and Faraday rotation mirror, inherent quality sensing optical fiber winding between blocks and the base, through the increase or decrease the additional quality adjustable quality blocks of total quality, realize the adjustment of the sensor sensitivity, with leaf expansion and deformation, the deformation of the signal can be converted into acceleration data. DSP digital signal processor is installed in the single-chip microcomputer, and the temperature sensor, A/D module and sensor fiber are connected with DSP digital signal processor. MCU with DSP digital signal processor is installed inside, the height of the fall prevention program set start and acceleration data, when they arrive in this data, starts the electromagnet, and start the fall prevention program, automatic judgment and start.

4. CONCLUSION

To sum up, UAV has a broad application prospect due to it can realize remote operation with remote operation, related researchers must actively develop its fall prevention system to promote the smooth operation of the UAV. The parachute and monitoring device have realized the real-time monitoring and prevention of the flying of UAV and the structure is simple and has a good effect.

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Survey on Game Theory Based Privacy Protection

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Abstract: Game theory is emerging as an important method to tackle the privacy problems. This paper surveys the theories, methods and applications on how game theory is applied in privacy protection. Four representative types of problems are discussed and the game based solutions are presented. Facing each problem, we focus on how to determine game players, how to choose strategies and what action rules are set in each privacy problem. The methods of privacy quantification and Nash equilibrium calculation are also narrated. Specially, we discuss how the strategies of different users influence the protection solution, besides the traditional consideration of two sides, user and adversary. We analyze the innate characters of each type of problem and the relationship with the corresponding game model. Some detailed comparisons are also made about Nash Equilibrium solving in different privacy solutions. The challenges in applying game theory in privacy protection are presented, as well as some open problems. Finally, this paper discusses several future directions in some emerging application areas, such as mobile computing, big data analytics and cloud storage applications.
Keywords: privacy protection; game model; nash equilibrium; strategy

1. INTRODUCTION

Privacy is a hot issue caused widespread concern in recent years. It involves many participants, such as users, service providers, malicious access privacy, they both cooperative and competitive relationship, each participant motivation has its maximum benefits. For example, based on mobile phone positioning and navigation services, users must provide their own the geographical location information to obtain navigation services, while opponents can through the user location information to infer user privacy information to obtain interests. The relationship between the user and the service provider, the adversary, objectively conform to game theory models the relationship between the participants, using the method of game theory to solve the problem of privacy protection has become a new Research on privacy protection method. Different from the traditional method of privacy protection based on game theory through mechanism design, descript the participants' benefits and costs simulate their rational choice process and find the best solution for each of them by analyzing the game equilibrium

The game model has three basic components participants, strategy and revenue Participants refer to rational decision-makers involved in the game, they are to maximize their own interests, to formulate relevant strategies; each player has set his own strategy, every game can only choose one strategy. All participants in the strategy of selection of strategy combination; obtained in the specific strategy combination of the interests of the participants is called the yield, calculated using the utility function. In the process of the game, a combination of strategies called optimal solution conditions is not a participant through alone change strategy and increase revenue, the strategy is called the Nash equilibrium. The choice between main research game theory competition nature participation strategy, to analyze and predict the behavior of the individual privacy protection based on game theory. The key lies in the supporting method of describing user privacy requirements and environmental factors into the corresponding factors of game theory, namely the analysis of competition between parties, the parties strategy, demand and profit; and through the structured method to find the Nash equilibrium point.

Game theory in wireless network security, privacy and other fields have many applications, [6-8,11-13], this paper will review the results, analysis of privacy problem modeling method based on game theory, the competitive strategy for target selection and Nash equilibrium solution process, finally discusses the game theory to solve privacy issues facing challenges, research and development this direction.

2. PRIVACY PRESERVING METHODS BASED ON THE STARK BERG GAME MODEL

In many applications, the parties involved in behavior has the following relation first strategy as party leader, through the observation of the other strategies to develop strategies to the other party as a follower, the two sides to maximize their own interests for the purpose, namely for the stark Berg game, such as the physical layer security[10]. Privacy Private investment through the location privacy protection below [24, 25] and service providers to invest in protection of customer privacy, privacy protection scheme is given based on the model of Berg stark game.

2.1 Location Privacy Protection

Based on the application of geographic information,

users need to submit the location information to obtain service at the same time, choose the fuzzy location method of location privacy, but the fuzzy will reduce the quality of service, so the privacy protection and the quality of location based services is the contradictory relationship; at the same time, on the basis of adversary privacy protection method by the user set the corresponding countermeasures, guess the true position through the fuzzy location observation of user.

Shokri and others will be zero and Bias Stackelberg game for location privacy protection [18] party, for users, service providers and the adversary, privacy protection framework as shown in Figure 1. The user first formulated privacy policy objective is to ensure the privacy protection mechanism of a certain quality of service under the premise of reasonable to reduce the opponent guessing accuracy; the adversary then performs the attack mechanism, aim to set suitable mechanism to improve the guessing attack accuracy. The enemy is the loss of the user privacy information, user location information and the adversary is uncertain, so this game model belongs to zero and Bias game.

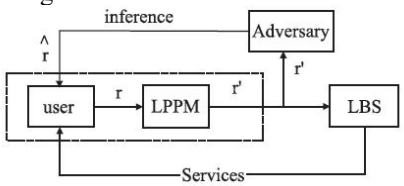

Fig. 1 Location privacy protection framework

The user location privacy protection mechanism of LPPM (Location Privacy Protection Mechanism), with a certain probability distribution of $\varphi(\mathbf{r})$ select the location of different $\mathbf{r}'$ to replace the true position of $\mathbf{r}$, or is the true position of fuzzy $\mathbf{r}'$, expressed as $\mathbf{fake}(\mathbf{r}'|\mathbf{r})$, and then sent to the location of the service provider to obtain related services making guesses. Adversary mechanism, fuzzy $\mathbf{r}'$ position through the observation to infer the location of the user $\mathbf{r}$, said the opponent's strategy for $\mathbf{hit}(\hat{\mathbf{r}}|\mathbf{r}')$. In this game, the game the utility function is

$$\text{privacy}\left(\varphi,\text{false},\text{hit},d_p\right)=\sum_{\mathrm{r}',\mathrm{r},\hat{\mathrm{r}}}\varphi(\mathrm{r})\,\text{fake}\left(\mathrm{r}'|\mathrm{r}\right)\text{hit}\left(\hat{\mathrm{r}}|\mathrm{r}'\right)d_p\left(\mathrm{r}\right.$$

. $d_p(\mathbf{r},\hat{\mathbf{r}})$ is the quantized user privacy needs. User privacy utility is in the user policy and strategy the adversary is known, that the adversary the user location for the user Effect of location privacy. The user's goal is to maximize the user privacy, and the opponent's goal is to minimize the user privacy, calculate its benefit based Nash equilibrium solution is to consider the other best choice. So, thanks for user privacy expectations formula (1) below.

$$\begin{aligned}&\sum_{r'}\Pr\left(r'\right)\min_{\hat{\mathrm{r}}}\sum_{r}\Pr\left(r|r'\right)d_p\left(\mathrm{r},\hat{\mathrm{r}}\right)\\&=\sum_{r'}\min_{\hat{\mathrm{r}}}\sum_{r}\varphi\left(\mathrm{r}\right)\text{fake}\left(\mathrm{r}'|\mathrm{r}\right)d_p\left(\mathrm{r},\hat{\mathrm{r}}\right)\end{aligned}\quad(1)$$

The competitor's expectation of the user's best strategy proceeds as shown in the formula (2):

$$\sum_{r}\varphi\left(\mathrm{r}\right)\max\sum_{r'}\sum_{\hat{\mathrm{r}}}hit\left(\mathrm{r}'|\mathrm{r}\right)d_p\left(\mathrm{r},\hat{\mathrm{r}}\right)\quad(2)$$

The Kobo Nash equilibrium point is the optimal solution under multiple constraint conditions, solving the problem can be reduced to the solution of linear programming problem, the optimal user privacy protection mechanism and the opponent's best guess attack, respectively [17].

2.2 The Investment Decision Problem Of Service Provider To Protect Customer Privacy Information

In many Internet applications, the service provider will usually ask for personal information to the user in return, provide better personalized service or commodity price discount. If the service provider intentionally or accidentally leaked user data, it will bring losses to the user, reducing the user trust in the service provider. Although the service providers in the information security increase investment to reduce the risk of leakage of user privacy, but service providers in the premise of no benefit, no motivation to invest in. D'Acquisto et al. Proposed damage sharing strategy, using stark Berg game model to solve [1], the service provider clearly once disclosure of user privacy is the need to undertake a certain loss. The game strategy respectively. To control customer submitted personal information, service providers control security investment privacy. As the goal of the game: the customers provide the most personalized service in order to obtain a small amount of privacy, service providers invest at least L^* case to bear at least loss, the loss of the user is expressed as L^*, which is in the process of game and maximize their own benefit strategy, Nash equilibrium strategies for the customer and the service provider $\left(L^*,L^*\right)$.

At first the customer and the service provider has the demand curve corresponding to the $\frac{q}{q^*}+\frac{p}{p*}=1$, where q is the actual business services (quantitative value), p is the customer purchase price, q^* is the maximum number of businesses can provide services, customers can bear $p*$ (willing to pay) the price to provide privacy in the customer. After the service provider can provide more services for customers, q^* into $q^*\left(1+\alpha\right)$, the demand curve corresponding to $\frac{q}{q^*\left(1+\alpha\right)}+\frac{p}{p*}=1$, α which is a marginal demand factors, and the amount of user privacy

information and businesses to get the $\alpha_{\max}$ is the upper limit. The model is the key parameter to introduce businesses to bear the loss ratio, ratio of η shows privacy service provider to take the money after the loss, $1-\eta$ represents a ratio of loss of money after the responsibility of the customer privacy leak, so the customer and provider. Bear the loss respectively $(1-\eta)LP_{db}$ and ηLP_{db} where L refers to the user privacy, information leakage losses. P_{db} denotes the probability of data leakage. Therefore, the utility function for the game customers formula (3) shown as :

$$S_c = \frac{(p^*-\hat{p})^2}{2p^*} q^* \left[1+\alpha_{\max}\left(\frac{L}{L_{\max}}\right)^v \right] \quad (3)$$
$$-(1-\eta)LP_{db}v$$

Among them, $L_{\max}$ is the upper limit of L, $\hat{p}$ is the unit price, v for privacy parameters, the smaller the value of V to provide customers with less privacy can get better service. And customers get due to provide personal information before the return part of the formula, the latter part of said users bear the loss of data leakage caused the utility function of service. The provider is formula (4) shown:

$$S_{sp} = \frac{p^*-\hat{p}}{p^*} q^* \left[1+\alpha_{\max}\left(\frac{L}{L_{\max}}\right)^v \right] \quad (4)$$
$$(\hat{p}-\hat{c}) - I - \eta LP_{db}$$

Among them, $\hat{c}$ is the unit cost of I for service providers to invest in privacy cost. So the first part of the formula of income for the service provider of sales service, the second part is the third part of the safety investment, said users bear the loss of data leakage caused. By calculating the derivatives of the formula can be used to solve the Nash equilibrium.

3. PRIVACY PRESERVING METHOD BASED ON EXTENDED GAME MODEL

In many applications, the existence of the order of action and continuity, competition both sides goal is to maximize their own interests, such as short link network node revocation mechanism [12] and prevent insider attacks such as authorization model [13]. This kind of problem for using extended game model. The following by wireless organized networks of trust and privacy issues and tradeoffs in pervasive computing environment exposure problem, given the detailed solutions.

3.1 Trust and privacy tradeoff in Wireless Ad Hoc Networks

In wireless ad hoc networks, nodes can communicate with each other, on the basis of the information transmission and nodes are divided into two categories: benign nodes and malicious nodes. Raya 19 by Bias et al. Dynamic game in order to solve the wireless ad hoc network node trust and privacy tradeoff. Vote based on the messages sent by the node. The malignant nodes removed. In order to credibility of a node to send a message to the other nodes need to evaluate the vote, and the voting process will reveal their privacy information such as identity and location information, the greater the contribution of voting, node privacy leak more. It is assumed that each node is rational, expected at least to leak privacy information for the corresponding service, will be the free rider problem, which does not contribute to reap profit. If all nodes some free riding, so can't determine the news credibility to remove malicious nodes. So, the contribution and privacy, each node and other nodes of the game. Each ballot is called a stage, many times the opportunity to vote for each node, this game is continuous, and the participant of other parties involved in the information to fully grasp in the process of the game, so the author adopts continuous Bias game model to solve this problem. The author describes the problems with macro game G_{AD} and micro game G_{TC} .

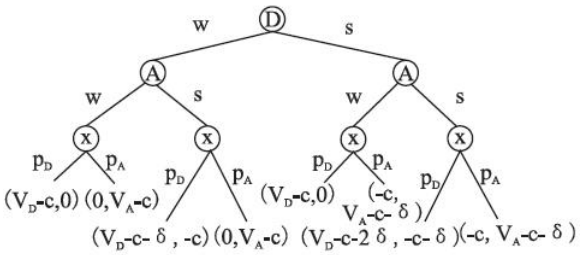

Fig. 2 Extended game tree

Macro game G_{AD} refers to consider all participating nodes behavior from a global perspective, the players on the whole is divided into the attacker A and defender D, which is $P=\{A,D\}$. In each round of voting, they have the same voting strategy, S (Privacy Information) or W, $S_A = S_D = \{W,S\}$. The first defender set decision, then the decision to attack, both sides decided to take turns, until it reaches the deadline for the game. The game goal is through the vote of malicious nodes to remove. v_A and v_D respectively when the attacker or defender said won the game when the return. p_D、p_A said that the last stage of the game both sides win game probability (related to each side of the number of nodes), the $p_A + p_D = 1$.

Micro game GTC

Considering the multiple benign behavior of nodes, to maximize the overall interests. Benign node with K benign nodes. The trust level of each participant $t_k \le 1$, obtained by the contribution of information; ϕ is with the amount of information to offer the trust value conversion factor. The utility function of each participant is shown in the formula (5) the leaked privacy information, each node share the common

benign revenue minus.

$$\pi_k\left(t_1,t_2,\cdots,t_k\right)=\frac{v_p}{K}-\frac{t_k}{\phi} \quad (5)$$

Through the analysis of the G_{TC} of the subgame perfect equilibrium optimal strategies for each individual to participate in the $t_k^*=0$. As a result of this is not ideal, the author returns r to encourage participants to vote earlier, each node due to the formula (6):

$$\pi_k\left(t_1,t_2,\cdots,t_k\right)=\frac{v_D}{K}+\frac{t_k}{\sum_{i=1}^{k}t_i}-\frac{t_k}{\phi} \quad (6)$$

At this point, the best strategy for $t_k^*=\frac{\phi r\left(K-1\right)}{K^2}$.

3.2 Identity Exposure In Pervasive Computing Environment

In the pervasive computing easy to leak privacy information of users and service providers in the transaction process under the environment protection, the user can use the better hierarchical identity model. Their privacy identity model based on the hierarchy of personal identity information is organized into a tree from the root node to the leaf nodes, each item of information is gradually refined. The more close to the root node. The identity information generalization, more people with this information on behalf of the disclosure of information for users the privacy threat is smaller; leaf node usually contain very specific identity information, to identify a person or a group of people rarely, leaking the privacy information using the extended game theory to research in ubiquitous computing environment for identity exposure users threaten. Zhu et al [14]. In this game, the game participants were to provide personal information of users and ask for information service providers. There are three types of user strategies were not providing information and termination of service, to provide information and accept service and consultation; service provider strategy also has three kinds, respectively for information, termination of service, receive information and provide services. First, by the user according to the service provider to obtain personal information to make a decision, as long as the game is not completed or terminated, both sides take turns to make a decision, and expand the game at the end of round. For example when the limited service provider for information to the user, if users choose to provide information consultation strategy, is according to the hierarchical identity model to find the most general identity information collection to the service provider recommendations. If service providers choose to continue negotiation, will request more information to the user. The game goal for both users and service providers need to In this case, the game tree is used to calculate the perfect Nash equilibrium of the game by using the back stepping method, thus obtaining the equilibrium results satisfying the needs of both the users and the service providers

4. PRIVACY PRESERVING METHOD BASED ON COOPERATIVE GAME MODEL

Cooperative game theory is used to solve the stakeholders have a competitive relationship, to maximize the benefits of the strategy through cooperation. For example, when a user registered social network, the website will authenticate users, and through the verification information to help users recommend friends, but the site may also leak user privacy, so users and social networking sites is cooperation and competition at the same time, both sides abide by the agreement of. Anna et al binding and often adopts double game model to solve the authentication problem in the social network when the user registered [11]. Cooperative game can be divided into two bargain and multiplayer alliance game. The problem of privacy protection in data publication is given to solve the privacy of cooperative game based on the model of the program in the k- data released in the anonymous technique often used to protect personal privacy information. K-Anonymous refers to the existence of at least k quasi identifiers cannot be identified, recorded in the published data, so that an attacker cannot distinguish the specific individual belongs to information privacy, the biggest risk of information leakage K users can afford. The traditional method of anonymous definition of K can be obtained in advance, the loss of information in the anonymous is completed, if the amount of information loss beyond the acceptable range, then adjust the K value to calculate the anonymous process, it caused great waste of. Srinivasa et al[16,17] will be used in coalition game release problem of privacy preserving data anonymity based on k-. Its basic thought is to be released data

Each tuple in the table as a participant, dividing the process data table is to compute the game alliance. The goal is to make the party's loss at a given threshold. The specific information loss process, according to the data in the database domain characteristic K may be calculated value range, according to the union game conclusion 17 the relationship $2k\le N\le k\prod_{i=1}^{|Q/D|}L_i$, which can be obtained in the range of K.

$$\left[\frac{N}{\prod_{i=1}^{|Q/D|}L_i}\right]\le k\le\left[\frac{N}{2}\right]$$

Among them, T is the data table, QID said in a data table set of quasi identifier attributes, such as age and zip code, the attributes of each I in the QID can be used to represent a concept hierarchy tree, L_i concept tree corresponding to the I property of the height of the tree. Then, according to the concept of sensitive information dynamic generalization. Among

them, the root node for the higher degree of generalization of information. According to the value of each layer corresponding to the tuple corresponding to the parties involved in the game the calculation proceeds, the utility function as shown in formula(7):

$$payoff\left(t_j/QID\right)=\prod_{i=1}^{|QID|}\frac{r_{ij}}{L_i},\forall t_j\in T \qquad (7)$$

r_{ij} said the i attribute concept tree corresponding to the generalization properties of the j layers. Through the calculation proceeds of each tuple, find the same combination of benefit tuples into a union, namely the equivalence class of EQ_j , a division of equivalence classes all equivalence classes together constitute the data table. If the current loss of information after the division did not reach a given threshold, then continue along the direction of benefit and generalization of roots, calculated for each tuple, until it meets the threshold requirements so far. Because a tuple is generalized to have the same value in the league can't identify the specific identity of anonymous, so after the release of the meet requirements. The benefit is the equivalence class alliance in each tuple benefits and union privacy is defined as a minimum return all tuples in the equivalence class. Finally, according to the equivalence partitioning results, calculating the value of K, K for each the minimum value of the set size of an equivalence class and the anonymous processing of the data set. This method avoids the repeated calculation of anonymous process

6. SUMMARY AND OUTLOOK

By using the method of game theory to solve the problem of privacy protection, which can take into account users, adversaries multi parties interests, seeking solutions to meet the interests of the relationship between quality and service, the balance between privacy protection. But the use of game theory to solve the problem of privacy is facing challenges, mainly solving the game theory in the model selection, user privacy the quantitative and the Nash equilibrium point.

Quantification of privacy needs is a key problem, also is a challenge, the challenge is how to extract the actual preferences of participants and select the appropriate model and return function. Through the analysis of game behavior strategy, will describe the solution form specific privacy issues for game goals. Quantification of privacy and no existing work the unified form of privacy. Most of the work only from the theory of abstract generalization, there are some specific work by[16-18]. Numerical representation of privacy.

Privacy protection for users and game participants usually have cooperation, or against the enemy, but also has several relations between them, the participant number, interaction and game influence game model selection. Based on game strategy space size, can be divided into finite and infinite which is usually expressed as a strategy. Discrete form, and the infinite continuous variables. The strategy goal of the game is to participate in the game to reach expectations, it is closely related with the game strategy. In order to achieve the goal of the game is Nash equilibrium, need to use the appropriate method of solving game equilibrium analysis of privacy, even if only two people involved in the game, too to solve the Nash equilibrium in polynomial time. Although different game models have equilibrium in different ways, but there is also in this game, stacklberg model usually adopts the method of dominant equilibrium and linear programming, expanding game usually adopts inverse method. This paper summarizes the different methods of equilibrium game model, see Table 1 on page, and summarizes the relationship between game and game model, so as to provide reference for the selection of game model and the Nash equilibrium for solving different privacy issues. This work is especially suitable for the protection of privacy has a conflict of interest problems. The discussion presented below two representative applications.

In the aspect of mobile computing, wireless network operators and wireless application providers too often obtain user privacy information, and probably illegal use of user privacy in the service process. In such problems, the user and the service provider has multiple cooperative and competitive relationship, therefore it is suitable for the use of game theory model for privacy protection. For example: the shop for the user's personal information in providing free WIFI at the same time, users also have different network bandwidth requirements, but also has many coherent service relationship between users and businesses. Therefore, the sequential game model to solve the bandwidth problem for multiple users to provide privacy, users can also provide different levels of privacy for different bandwidth.

Cloud service is a hot research field recently, more and more popular as mobile phone contacts, cloud storage in daily life. When users in the use of cloud services, user data in the cloud storage and storage location is transparent to the user; furthermore, the service provider may use contains specific users in different applications of discrete privacy information user sensitive information through data mining and integration technology. So the reasoning cannot use the traditional methods of privacy preserving good for privacy protection. Because of the existence of the relationship of co-operation and competition between users and service providers, game theory provides a new solution for cloud computing problems in privacy protection, the research and application direction in the future.

This paper reviews the application of game theory in various types of privacy protection, and application

of the stark Berg game, extended game, auction game and cooperative game in the protection of privacy in the classification summary, pointed out by game theory, general rules and difficult to solve privacy challenges. Through the analysis of the characteristics, details how to solve the game model and the problems, and the future direction of research and application are discussed.

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Research on Parameter Identification of Incinerator System Based on Auxiliary Model

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Abstract: Based on the theory of incineration system, this paper puts forward the establishment of the mathematical model of the dynamic characteristics of the temperature control system of the incinerator - the Box-Jenkins model for the general control of waste liquid incineration equipment in the chemical industry. By using the input and output data collected in the field, the generalized augmented randomized gradient algorithm based on the auxiliary model is deduced. The algorithm is used to identify the parameters of the incinerator system model and obtain the concrete matrix equation. The accuracy of the obtained model is verified by computer simulation, which provides a reference for further optimization of the temperature control system of incinerator.
Keywords: incinerator; Box-Jenkins model; auxiliary model; multi-innovation identification; stochastic gradient

1. INTRODUCTION

Incinerator is an indispensable equipment in petroleum, chemical, electric power, metallurgy and other industrial processes, mainly for the disposal of waste industrial production . In order to ensure the smooth progress of the production process, it is necessary to optimize the control of the flue gas temperature of the incinerator, but also to achieve the purpose of recycling and reduce the environmental pollution.In view of the fact that the temperature control has the characteristics of multivariable, strong coupling, non-linearity, roughly after the state is not fully measurable, the operating conditions change frequently, so the improvement of the control system is based on the establishment of reasonable dynamic characteristics of mathematical model.Based on the background of a chemical plant incinerator system, an extended model based on output error autoregressive sliding system (Box-Jenkins system) is introduced. Then the AM-MI-GESG algorithm is introduced.Compared with the least squares algorithm, the algorithm has the advantages of small computation and no covariance matrix. The input and output data of the operating system are sampled and analyzed, and the model parameters are estimated by using the collected data to obtain the mathematical model of the dynamic characteristics of the incinerator. The auxiliary model identification method and the multi-message identification method are the newest methods of parameter identification, which can effectively solve the problem that the intermediate variable is not measurable and colored noise interference. Identification theory based on the auxiliary model is applied to the parameter identification of Box - Jenkins model of incinerator with color noise interference.The auxiliary model is established by using the auxiliary model output instead of the actual undetectable output of the system, replacing the colored noise term of information vector with the estimated noise value, expanding the scalar information as the information vector, increasing the length of the new message, and then put forward the auxiliary model based on multi innovation generalized extended stochastic gradient identification algorithm (AM-MI-GESG). The convergence speed of AM-MI-GESG algorithm is faster and the calculation is moderate. It is proved that the AM-MI-GESG identification method based on the auxiliary model can accurately identify the parameters of the temperature control system of the incinerator, and the robustness of the system is strong, which lays the foundation for the optimization of the parameters of the temperature control system of the late incinerator.

2 Incinerator object analysis

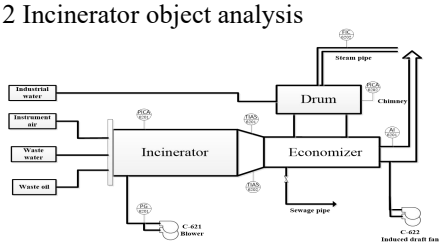

Fig.1 Structure of incinerator furnace

The structure of the incinerator furnace is shown in Fig. 1, which consists of incinerator, economizer, drum, chimney, inlet duct, steam pipe, sewage pipe and waste oil.The temperature is 900-1050 degrees Celsius when incinerator in normal condition, waste oil and wastewater with chemical substances is decomposed into environmentally friendly substances by high temperature.The zirconia analyzer AI-6201 is used to determine whether the product is completely burnt, and the oxygen content was confirmed to be discharged into the atmosphere through the

chimney.The heat generated by the burning process enters the economizer, and the water in the drum is changed into steam. Because the heat generated by the incinerator is more, the pressure in the drum can reach up to 10Kg under normal working conditions, and the utility model can provide sufficient air source for the normal production and operation of the boiler.The incinerator is a MIMO (multi input multi output) system with strong coupling, and the interaction of the parameters is nonlinear.When the steam pressure of steam pipeline is changed, the other parameters will be changed to ensure the stability of the furnace temperature and the oxygen content in the flue gas.Incinerator system is a time delay system, and some parameters of the system are time-varying, so it is not feasible to establish the mathematical model of the dynamic characteristics by studying the characteristics of the system.Therefore, the main task of the boiler equipment is to meet the production needs, and supply a certain index (such as pressure) of the steam, and under the condition of economic security running.

According to the actual operation, it is known that the incinerator system is a very complex MIMO system, and it is difficult to establish a model which is completely consistent with the actual situation.Based on the actual operation of the incinerator, the incinerator system model is represented as a three input and two output system, as shown in Fig.2:

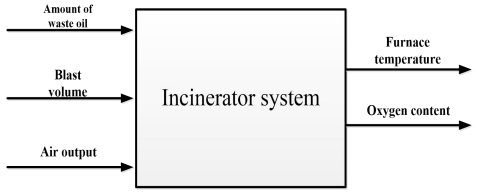

Fig.2 Incinerator combustion system

3 The auxiliary model based AM-MI-GESG

3.1 Identification model of incinerator

Linear output error autoregressive moving average model (Box-Jenkins model) has been widely used in many fields such as communication, chemical engineering, biomedicine and so on.A scalar nonlinear Box-Jenkins model with known bases is as follows:

$$y(t)=\frac{B(z)}{A(z)}f(u(t))+\frac{D(z)}{C(z)}v(t) \tag{1}$$

The incinerator system three input two output Box-Jenkins model is represented as follows:

$$\begin{pmatrix}y_1(t)\\y_2(t)\end{pmatrix}=\begin{pmatrix}\frac{B_{11}(z)}{A_{11}(z)} & \frac{B_{12}(z)}{A_{12}(z)} & \frac{B_{13}(z)}{A_{13}(z)}\\ \frac{B_{21}(z)}{A_{21}(z)} & \frac{B_{22}(z)}{A_{22}(z)} & \frac{B_{23}(z)}{A_{23}(z)}\end{pmatrix}\begin{pmatrix}u_1(t)\\u_2(t)\\u_3(t)\end{pmatrix}+\begin{pmatrix}\frac{D_1(z)}{C_1(z)}\\ \frac{D_2(z)}{C_2(z)}\end{pmatrix}v(t) \tag{2}$$

$u(t)\in R$:system input,representing the amount of waste oil, blast volume and wind volume; $y(t)\in R$:system output,representing furnace temperature and flue gas oxygen content; $v(t)\in R$:zero mean random white noise, $A_{ij}(z),B_{ij}(z),C_{ij}(z)$和$D_{ij}(z)$ is a polynomial of the backward shift operator of z^{-1} , that is $z^{-1}y(t)=y(t-1)$ .And

$$\begin{aligned}A_{ij}(z)&=1+a_{ij}(1)z^{-1}+a_{ij}(2)z^{-2}+\cdots+a_{ij}(n_{ij})z^{-n_{ij}}\\ B_{ij}(z)&=1+b_{ij}(1)z^{-1}+b_{ij}(2)z^{-2}+\cdots+b_{ij}(n_{ij})z^{-n_{ij}}\\ C_j(z)&=1+c_j(1)z^{-1}+c_j(2)z^{-2}+\cdots+c_j(n_j)z^{-n_j}\\ D_j(z)&=1+d_j(1)z^{-1}+d_j(2)z^{-2}+\cdots+d_j(n_j)z^{-n_j}\end{aligned} \tag{3}$$

According to the above, the MIMO system can be decomposed into two MISO systems.As shown in Fig.3:

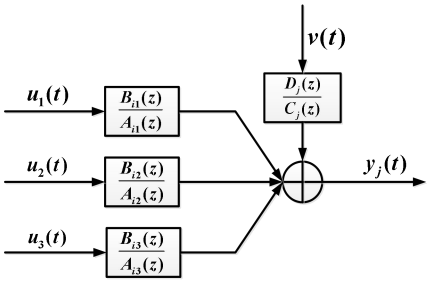

Fig.3 MISO system

For the two MISO systems, the structure of the system is the same, but there is no correlation between the output variables. Therefore, the research on the identification parameters of the incinerator system model can be attributed to the study of the identification parameters of a single MISO system.

3.2 Incinerator auxiliary model based AM-MI-GESG

By means of formula (2) and MISO system of incinerator, the intermediate variable is defined:

$$\begin{aligned}x_1(t)&=\frac{B_{11}(z)}{A_{11}(z)}u_1(t)\\ x_2(t)&=\frac{B_{12}(z)}{A_{12}(z)}u_2(t)\\ x_3(t)&=\frac{B_{13}(z)}{A_{13}(z)}u_3(t)\\ w_1(t)&=\frac{D_1(z)}{C_1(z)}v(t)\end{aligned} \tag{4}$$

so:

$$y_1(t)=x_1(t)+x_2(t)+x_3(t)+w_1(t) \tag{5}$$

$$\theta=\begin{pmatrix}\theta_{1s}\\ \theta_{2s}\\ \theta_{3s}\\ \theta_n\end{pmatrix}\in R^n \tag{6}$$

$$\theta_{1s}=\left[a_{11},a_{12},\cdots,a_{1n_{a1}},b_{11},b_{12},\cdots,b_{1n_{b1}}\right]^T \tag{7}$$

$$\theta_{2s}=\left[a_{21},a_{22},\cdots,a_{2n_{a2}},b_{21},b_{22},\cdots,b_{2n_{b2}}\right]^T \tag{8}$$

$$\theta_{3s}=\left[a_{31},a_{32},\cdots,a_{3n_{a3}},b_{31},b_{32},\cdots,b_{3n_{b3}}\right]^T \quad (9)$$

$$\theta_n=\left[c_1,c_2,\cdots,c_{n_c},d_1,d_2,\cdots,d_{n_d}\right]^T \quad (10)$$

the information vector is defined as:

$$\varphi(t)=\begin{pmatrix}\varphi_{1s}\\ \varphi_{2s}\\ \varphi_{3s}\\ \varphi_n\end{pmatrix}\in R^n \quad (11)$$

$$\varphi_{1s}(t)=\left[-x_1(t-1),-x_1(t-2),\cdots,-x_1(t-n_{a1}),\right.$$
$$\left.u_1(t-1),u_1(t-2),\cdots,u_1(t-n_{b1})\right]^T \quad (12)$$

$$\varphi_{2s}(t)=\left[-x_2(t-1),-x_2(t-2),\cdots,-x_2(t-n_{a2}),\right.$$
$$\left.u_2(t-1),u_2(t-2),\cdots,u_2(t-n_{b2})\right]^T \quad (13)$$

$$\varphi_{3s}(t)=\left[-x_3(t-1),-x_3(t-2),\cdots,-x_3(t-n_{a3}),\right.$$
$$\left.u_3(t-1),u_3(t-2),\cdots,u_3(t-n_{b3})\right]^T \quad (14)$$

$$\varphi_n(t)=\left[-w_1(t-1),-w_1(t-2),\cdots,-w_1(t-n_c),\right.$$
$$\left.v(t-1),v(t-2),\cdots,v(t-n_d)\right]^T \quad (15)$$

all kinds of above, can get:

$$x_1(t)=[1-A(z)]x_1(t)+B(z)u(t)=\varphi_{1s}^T(t)\,\theta_{1s} \quad (16)$$

$$x_2(t)=[1-A(z)]x_2(t)+B(z)u(t)=\varphi_{2s}^T(t)\theta_{2s} \quad (17)$$

$$x_3(t)=[1-A(z)]x_3(t)+B(z)u(t)=\varphi_{3s}^T(t)\theta_{3s} \quad (18)$$

$$w_1(t)=[1-C(z)]w_1(t)+D(z)v(t)$$
$$=\varphi_n^T(t)\theta_n+v(t) \quad (19)$$

available from (16) - (19):

$$y_1(t)=\varphi_{1s}^T(t)\theta_{1s}+\varphi_{2s}^T(t)\theta_{2s}+\varphi_{3s}^T(t)\theta_{3s}+\varphi_n^T(t)\theta_n+v(t)$$
$$=[\varphi_{1s}^T(t)\quad\varphi_{2s}^T(t)\quad\varphi_{3s}^T(t)\quad\varphi_n^T(t)]\begin{bmatrix}\theta_{1s}\\ \theta_{2s}\\ \theta_{3s}\\ \theta_n\end{bmatrix}+v(t) \quad (20)$$

$$=\varphi^T(t)\theta+v(t)$$

$$\varphi^T(t)=\begin{bmatrix}\varphi_{1s}^T(t)\\ \varphi_{2s}^T(t)\\ \varphi_{3s}^T(t)\\ \varphi_n^T(t)\end{bmatrix},\theta=\begin{bmatrix}\theta_{1s}\\ \theta_{2s}\\ \theta_{3s}\\ \theta_n\end{bmatrix} \quad (21)$$

define and minimize quadratic criterion functions:

$$J(\theta)=\sum_{j=1}^{t}[y_1(j)-\varphi^T(j)\theta]^2 \quad (22)$$

let $\hat{\theta}(t)$ denote the estimated value of θ at time t, then the GESG algorithm is as follows:

$$\hat{\theta}(t)=\hat{\theta}(t-1)+\frac{\varphi(t)}{r(t)}[y(t)-\varphi^T(t)\hat{\theta}(t-1)] \quad (23)$$

$$r(t)=r(t-1)+[\varphi(t)]^2,r(0)=1 \quad (24)$$

However, the conventional random gradient algorithm can not achieve the identification of the Box-Jenkins model parameters of the incinerator system, the information vector contains unknown variables, unpredictable noise and unmeasurable white noise items.Based on the auxiliary model, the parameters of Box-Jenkins model are studied by the idea of auxiliary model identification.The auxiliary model is shown in Fig.4:

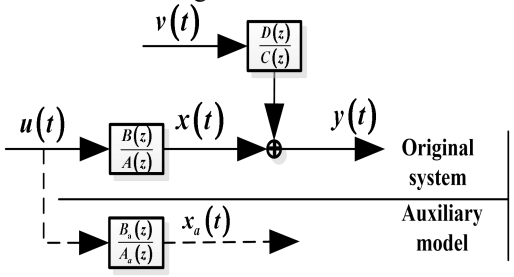

Fig. 4 Box-Jenkins model with auxiliary model

The transfer function of the auxiliary model is $B_a(z)/A_a(z)$. $B_a(z)$ and $A_a(z)$ have the same order with $B(z)$ and $A(z)$. $x_a(t)$:auxiliary model output.As can be seen from Fig.4:

$$x_{a1}(t)=\frac{B_{a11}(z)}{A_{a11}(z)}u_1(t)=\varphi_{a1s}^T(t)\theta_{a1s} \quad (25)$$

$$x_{a2}(t)=\frac{B_{a12}(z)}{A_{a12}(z)}u_2(t)=\varphi_{a2s}^T(t)\theta_{a2s} \quad (26)$$

$$x_{a3}(t)=\frac{B_{a13}(z)}{A_{a13}(z)}u_3(t)=\varphi_{a3s}^T(t)\theta_{a3s} \quad (27)$$

$\varphi_{a1s}(t)$, $\varphi_{a2s}(t)$ and $\varphi_{a3s}(t)$ is the auxiliary model information vector at time t of $u_1(t)$ 、 $u_2(t)$ and $u_3(t)$; θ_{a1s} , θ_{a2s} and θ_{a3s} is the auxiliary model parameter vector at time t of $u_1(t)$, $u_2(t)$ and $u_3(t)$; The unknown variables, the unknown residuals and the correlated noise terms in the conventional stochastic gradient algorithm are replaced by their estimates, $\varphi_{ais}(t)$, $\varphi_{an}(t)$ and $\hat{\varphi}(t)$ is:

$$\varphi_{ais}(t)=[-x_{ai}(t-1),-x_{ai}(t-2),\cdots,-x_{ai}(t-n_{ai}),$$
$$u_1(t-1),u_1(t-2),\cdots,u_1(t-n_{bi})]^T$$
$$\varphi_{an}(t)=[-w(t-1),-w(t-2),\cdots,-w(t-n_d)$$
$$v(t-1),v(t-2),\cdots,v(t-n_d)]^T \quad (28)$$

available from (20):

$$\hat{v}(t)=y_1(t)-\hat{\varphi}^T(t)\hat{\theta} \quad (29)$$

available from (7):

$$\omega_1(t) = y_1(t) - x_{a1}(t) - x_{a2}(t) - x_{a3}(t) \quad (30)$$

define and minimize quadratic criterion functions:

$$J(\theta) = \sum_{j=1}^{t} [y_1(j) - \varphi^T(j)\theta]^2 \quad (31)$$

Obtain:

$$\hat{\theta}(t) = \hat{\theta}(t-1) + \frac{\hat{\varphi}(t)}{r(t)} e(t) \quad (32)$$

$$e(t) = y(t) - \hat{\varphi}^T(t)\hat{\theta}(t-1) \quad (33)$$

$$r(t) = r(t-1) + [\varphi(t)]^2, r(0) = 1 \quad (34)$$

Although the above AM-GESG algorithm can estimat θ , the simulation results show that the convergence rate is slow.Then, based on the theory of multi - interest identification, AM-MI-GESG is deduced to improve the accuracy of parameter estimation.Specific practices are as follows:

The single innovation in the AM-GESG algorithm is extended to vector innovation:

$$E(p,t) = \begin{bmatrix} y(t) - \hat{\varphi}^T(t)\hat{\theta}(t-1) \\ y(t-1) - \hat{\varphi}^T(t-1)\hat{\theta}(t-1) \\ \vdots \\ y(t-p+1) - \hat{\varphi}^T(t-p+1)\hat{\theta}(t-1) \end{bmatrix} \quad (35)$$

P:innovation length.

Define stacking vectors $Y(p,t)$:

$$Y(p,t) = [y(t), y(t-1), \cdots, y(t-p+1)]^T \in R^P \quad (36)$$

Accumulation innovation matrix $\phi(p,t)$:

$$\phi(p,t) = [\hat{\varphi}(t), \hat{\varphi}(t-1), \cdots, \hat{\varphi}(t-p+1)] \in R^{n \times p} \quad (37)$$

The AM-MI-GESG algorithm based on the Box-Jenkins model of incinerator system is expressed as follows:

$$\hat{\theta}(t) = \hat{\theta}(t-1) + \frac{\phi(p,t)}{r(t)} E(p,t) \quad (38)$$

$$E(p,t) = Y(p,t) - \phi^T(p,t)\hat{\theta}(t-1) \quad (39)$$

$$r(t) = r(t-1) + [\varphi(t)]^2, r(0) = 1 \quad (40)$$

$$\phi(p,t) = [\hat{\varphi}(t), \hat{\varphi}(t-1), \cdots, \hat{\varphi}(t-p+1)] \in R^{n \times p} \quad (41)$$

$$Y(p,t) = [y(t), y(t-1), \cdots, y(t-p+1)]^T \in R^P \quad (42)$$

$$\hat{\varphi}(t) = \begin{bmatrix} \hat{\varphi}_{a1s}(t) \\ \hat{\varphi}_{a2s}(t) \\ \hat{\varphi}_{a3s}(t) \\ \hat{\varphi}_{an}(t) \end{bmatrix}, \theta = \begin{bmatrix} \hat{\theta}_{a1s} \\ \hat{\theta}_{a2s} \\ \hat{\theta}_{a3s} \\ \hat{\theta}_{an} \end{bmatrix} \quad (43)$$

$$\begin{aligned} \varphi_{ais}(t) = [&-x_{ai}(t-1), -x_{ai}(t-2), \cdots, -x_{ai}(t-n_{ai}), \\ &u_1(t-1), u_1(t-2), \cdots, u_1(t-n_{bi})] ; \\ \varphi_{an}(t) = [&-w_1(t-1), -w_1(t-2), \cdots, -w_1(t-n_c), \\ &v(t-1), v(t-2), \cdots, v(t-n_d)] \end{aligned} \quad (44)$$

$$x_{ais}(t) = \hat{\varphi}_{ais}(t)\hat{\theta}_{ais}(t) \quad (45)$$

$$\omega_1(t) = y_1(t) - \sum_{i=1}^{3} x_{ais}(t) \quad (46)$$

$$\hat{v}(t) = y_1(t) - \hat{\varphi}^T(t)\hat{\theta}(t) \quad (47)$$

The AM-MI-GESG identification algorithm based on the Box-Jenkins model is derived in this paper.The calculation process of the parameter vector in the algorithm is shown in Fig.5:

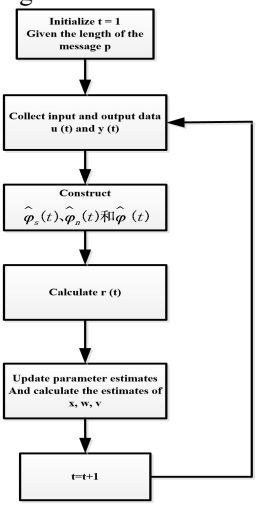

Fig.5 Calculating flow chart

3.3 Results and Analysis of Incinerator Model Identification

In the previous chapter, the MIMO model of incinerator temperature control system was established. The MIMO system is decomposed into two subsystems which have the same structure but the output is not affected by the other MISO. The subsystem parameters are identified using the derived AM-MI-GESG algorithm. But units and frequency of field input/output data is different and contains steady-state value (DC component), so need to preprocess the data before parameter identification. Pretreatment includes three aspects: Firstly, the data is sampled and then the steady-state value is removed. Finally, the high and low frequency noise is removed.In the study of the temperature control system of the incinerator, the data of the AM-MI-GESG algorithm should be the change of the steady state value before the excitation signal is added.Therefore, it is only concerned with the processing of steady-state values.After sampling, the data are processed with zero mean value. Finally, the data are used to identify the parameters.

10000 groups of data were collected through field debugging, and the model parameters were identified

using the first 3000 sets of data as input and output;The remaining 7000 sets of data are used to verify the correctness of the resulting model, but the data is too much to simulate the distortion, so the data between 3000 and 4000 is used as the model validation data. $\{v(t)\}$ is a random white noise sequence, the mean value is zero, the variance is 1.The temperature identification system and the oxygen content identification system are set to P=4 and P=6, and the data length L is set to 3000.The AM-MI-GESG algorithm is used to estimate the parameters of two MISO systems, and the optimal results are shown in Fig.6 and Fig.7:

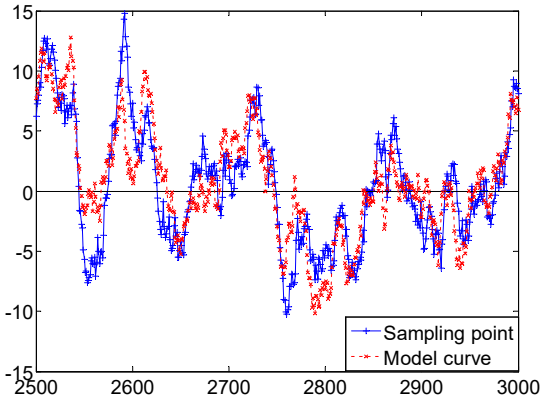

Fig. 6 Temperature identification of incinerator

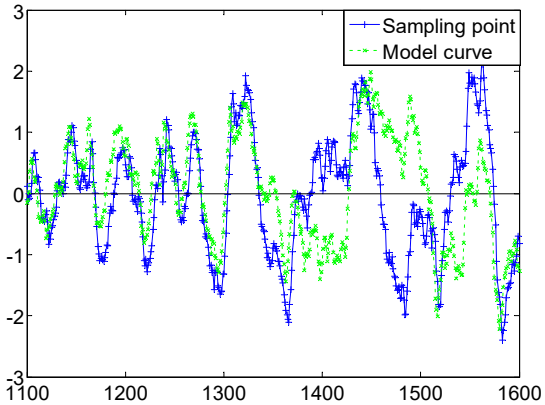

Fig. 7 Oxygen content of incinerator

From the simulation results, we can see that the curve of the identification model is basically consistent with the measured curve, and the follow-up is very good. The AM-MI-GESG expression of the incinerator temperature control system based on the Box-Jenkins model is as follows:

$$\begin{bmatrix} y_1(t) \\ y_2(t) \end{bmatrix} = \begin{bmatrix} \frac{0.01936z+0.02605}{z^2-1.32z+0.3404} & \frac{-0.004036z+0.01805}{z^2-1.325z+0.3489} & \frac{0.01671z+0.009961}{z^2-1.32z+0.3547} \\ \frac{0.001902z+0.003354}{z^2-1.563z+0.6174} & \frac{0.0005194z+0.002905}{z^2-1.531z+0.5497} & \frac{z^2+0.003087z+0.001806}{z^2-1.531z+0.5580} \end{bmatrix} \begin{bmatrix} u_1(t) \\ u_2(t) \\ u_3(t) \end{bmatrix} + \begin{bmatrix} \frac{z^2-0.2447z+0.03669}{z^2-1.323z+0.3413} \\ \frac{z^2-0.1024z+0.02791}{z^2-1.547z+0.5562} \end{bmatrix} v(t)$$

The model must be verified to determine the accuracy of the identification parameters, so as to determine the value of the model. There is no uniform standard, this paper is to verify the consistency of the actual curve. The identification model is a simplification of the actual operation of the system in theory, the operation results can not be completely consistent with the actual results, especially the industrial model, so long as the model simulation results and actual results show that the approach can accurately identify the model. So as long as the model simulation results and the actual operation results can be similar. In this paper, we use the collected data from 3000 to 4000 to verify the result of Box-Jenkins model and calculated its output .The model output and the actual output are expressed on the same simulation diagram, and the accuracy of the identification model is judged by two curve fitting. The results of temperature and oxygen content of incinerator are shown in Fig.8 and Fig.9:

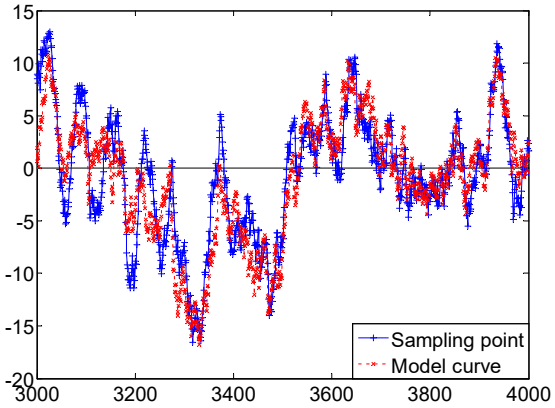

Fig. 8 Accuracy of incinerator temperature identification

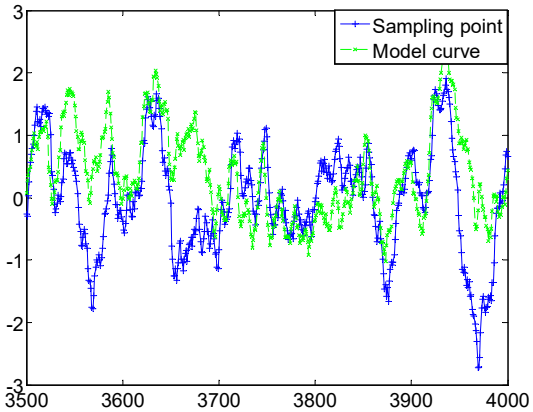

Fig.9 Oxygen content identification of incinerator verification

By comparison, it is concluded that the model of multi input multi output temperature control system is basically in line with the actual operating conditions.

4 Epilogue

The operation condition of the incinerator temperature control system is complicated, and the variables are interrelated,so the control precision is

not ideal.By using the Box-Jenkins model and combining with the actual operation of the incinerator, a multi-information generalized broadening random gradient algorithm (AM-MI-GESG) based on the auxiliary model is proposed to obtain the parameters of the process object model.Through the introduction of the theory of multi innovation identification, the innovation length is increased and the convergence speed and accuracy of the algorithm are improved;The introduction of the auxiliary model makes the parameter identification of Box-Jenkins model realized.The parameters of MIMO model are identified by the input and output data collected on the spot, and the correctness of the model identification results is verified, which lays the foundation for improving the accuracy of the incinerator temperature control.

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Parameter optimization of PID controller based on Improved Genetic Algorithm

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Abstract: According to the characteristics of long time delay and poor control precision of PID controller, this paper proposes an improved genetic algorithm to optimize the parameters of PID controller. On the basis of the improved genetic algorithm combined with fuzzy control theory, the PID parameters are adjusted by the adaptive selection, crossover and mutation probability. The improved genetic algorithm can accelerate the convergence of the algorithm while maintaining the diversity of the population, and then make the fuzzy mutation in the process of optimizing the input to the fine-tuning stage. The results show that the improved genetic algorithm can effectively improve the PID parameter optimization ability and improve the response ability and stability of the control system.
Key words: improved genetic algorithm, parameter optimization, PID controller, crossover and mutation

1. INTRODUCTION

With the increasing air pollution, the state gradually treats exhaust gas as a top priority project for clean air. Incinerator incineration of waste gas is one of the effective ways to deal with the exhaust gas, the traditional incinerator control using conventional PID technology, conventional PID does not have the ability to adapt to the dynamic characteristics of the system and the static characteristics of poor control results, resulting in incineration instability, Incomplete phenomenon is serious.

Genetic algorithm (GA) has a short history of research, and then after 30 years of development, it has made great achievements in the application and theoretical research. Genetic algorithm is a kind of optimization algorithm which has good global search ability, good robustness, no need to solve the problem space itself, and does not depend on prior knowledge.

In this paper, an improved genetic algorithm is proposed, which is based on the fuzzy control theory, and the design method of intelligent adaptive PID controller is proposed to make the parameters of PID control intelligent on-line adjustment, Set up.1

2.CONTROL SYSTEM OF INCINERATOR AND IMPROVEMENT OF GENETIC ALGORITHM PID CONTROLLER STRUCTURE

Figure 1 shows the structure of the incinerator A1801, mainly by the furnace, blower, burner, chimney and the corresponding pipeline and other components.

Figure 2 is to improve the genetic algorithm to achieve the controller parameters adaptive tuning structure. The PID controller is connected with the controlled object to form a closed-loop system. The result of the waveform analysis is processed by fuzzy logic reasoning and nonlinear control. Finally, the optimized control parameters are obtained.

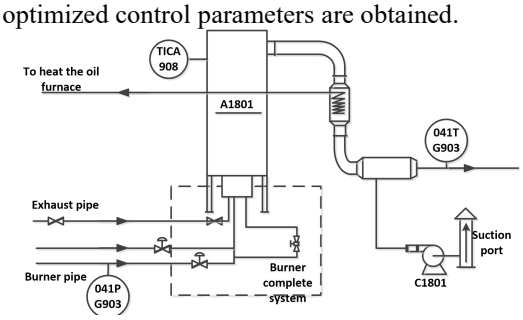

Fig 1 Structure of incinerator furnace

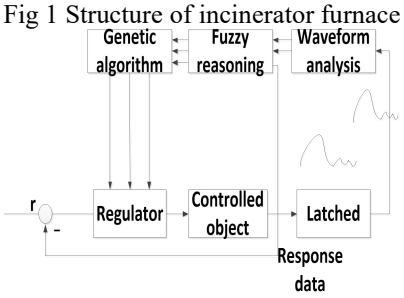

Figure 2 PID controller structure

3.PID CONTROL ALGORITHM

The conventional digital PID controller has the following formula:

$$u(k) = k_p error(k) + k_i \sum_{j=0}^{k} error(j)T +$$

$$k_d \frac{error(k) - error(k-1)}{T}$$

In the formula, Kp, Ki and Kd are proportional coefficient, integral coefficient, differential coefficient, T is sampling period, k is the sampling number, k = 1,2, ... error (k-1) and error (k) (K-1) and the k-th time.

4.GENETIC ALGORITHM

The principle of the genetic algorithm is to express the decision variables $X = [X_1, X_2, ... X_n] T$ with n symbols X_i (i = 1, 2 ... n): $X = X_1 X_2 ... X_n \rightarrow X = [X_1, X_2, ..., X_n] T$, each X_i as a genetic, the symbol string X as a chromosome.

Genetic algorithm GA has the following characteristics:

1.GA is the calculation of the coding parameter of the problem parameter, not the parameter itself;

2.GA through the objective function value to calculate the adaptation value, do not need other derivation, so the dependence on the problem is

small;
3.GA algorithm using the choice of crossover, mutation of these three operators are random operation, rather than determine the rules;
4.GA in the solution space for high and high heuristic search, rather than exhaustive or completely immediately search.
(1) Generation of initial population
At present, the genetic algorithm is mainly coded in real coding and binary coding. The binary code used in the basic genetic algorithm can not reflect the structure of the problem, and the length of the individual is large, which occupies more computer memory, and it is difficult to improve the precision. To improve the feature, this paper uses the Gary Code to carry out the individual code. There is only one code bit between the codes corresponding to the integer, and the remaining bits are the same. There are three parameters in the system that need to be optimized, ie, Kp, Ki, Kd, which can be combined into a three-dimensional vector as each independent individual in the genetic algorithm

$P = [\ K_p \quad K_i \quad K_d\ ]$

(2) Determination of fitness function
In the genetic algorithm, through the individual's fitness to determine whether the individual is close to or reach the optimal solution degree. Through the group of winning and losing, high adaptability to the next generation of the possibility of relatively large, low fitness individuals will be eliminated. The fitness function is the only basis for distinguishing between good and bad groups, the driving force of population evolution, the fitness function is nonnegative and the value is bigger and better. The following fitness function is used in this paper:

$$F(k+1) = e^{-\beta|e_s(k+1)|}$$

$$e_s(k+1) = W - y_s(k+1)$$

Where: F (K) is the fitness function, W is the desired output, y_S (k + 1) is the output value estimated by the object model, and es (k + 1) is the estimated deviation.
When the mathematical model of the controlled object is known

$$G_0(z) = \frac{B(z^{-1})}{A(z^{-1})}$$

$$y(z) = \frac{B(z^{-1})}{A(z^{-1})}u(z)$$

$A(z^{-1})$, $B(z^{-1})$ is the first polynomial, y (k) and u (k) are the first polynomials of the denominator polynomial and the molecular polynomial, respectively. Respectively, for the system input and output. Write the difference equation:

$$y(k+1) = -a_1 y(k) - a_2 y(k-1) - \cdots -$$

$$a_n y\ (\text{k-n+1}) + b_1 u(\text{k}) +$$

$$b_2 u(\text{k-1}) + \cdots + b_m u(k-m).$$

For an individual xi = [K_{i1} K_{i2} K_{i3}], the corresponding control amount ui(k) is calculated as:

$$u_i(k) = u(k-1) + K_{i_1} e(k) +$$

$$K_{i_2} e(k-1) + K_{i_3} e(k-2).$$

Where: u(k-1) is (k-1)the step of the optimal solution.
Estimate the output with the mode ysi(k+1):

$$y_{s_i}(k+1) = -a_1 y(k) - a_2 y(k-1) - \cdots -$$

$$a_n y\ (\text{k-n+1}) + b_1 u_i(\text{k}) +$$

$$b_2 u_i(\text{k-1}) + \cdots + b_m u_i(k-m).$$

Where: y(k),y(k-1),y(k-n)is the output value of the system actually measured before step k; the estimated ysi(k+1)output value of the i-th entity corresponding u_i(k)to the object

$$e_{s_i}(k+1) = W - y_{s_i}(k+1)$$

$$Fi(k+1) = e^{-\beta|e_{s_i}(k+1)|}$$

β is the transformation coefficient.
(3) Crossover and Variation
In the improved genetic algorithm, the crossover probability Pc and the mutation probability Pm are important. The larger the Pc, the faster the new individual produces. However, when Pc is too large, the genetic algorithm is too likely to be destroyed in the genetic algorithm, so that the individual structure with high fitness will soon be destroyed; but if Pc is too small, the search process will be slow, before. For different optimization problems, it is necessary to try again and again to determine Pc and Pm, and it is difficult to find the best value for each problem.
The improved genetic algorithm is to allow Pc and Pm to change automatically with the change of fitness. Pc and Pm are increased when the individual fitness of the population tends to be consistent or tends to local optimum, and Pc and Pm are reduced when the fitness of the population is relatively dispersed. Thus, Pc and Pm in the improved genetic algorithm can provide the best Pc and Pm for a certain solution. The improved genetic algorithm preserves the convergence of the genetic algorithm while maintaining the diversity of the population.
The improved genetic algorithm crossover probability and mutation probability are:

$Pc=0.9,\ \ Pm=0.1-[1:1:Size]\times 0.01/Size$ Where Size is the number of samples.
(4) Realization of fuzzy reasoning
At the beginning of the genetic algorithm, the sampled value is compared with the set value to get the error signal e and the error rate $\dot{e}$ of change as the input of the fuzzy controller. The output is the three parameters KP, Ki, Kd of the PID controller. As shown in Figure 3.

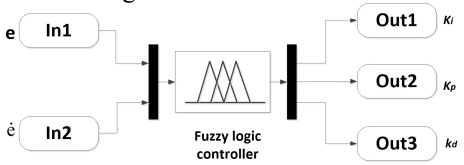

Figure 3 evolutionary initial fuzzy logic controller

input and output

The Kp, Ki, and Kd values are used as the kernel of the search range of the genetic algorithm. Since the parameters obtained are close to the optimal solution, the search range is reduced. In order to increase the scope and ability of the algorithm search, we use the random number instead of the mutation method, that is, within the search range, randomly select a number instead of the need to mutate the individual, while online detection of individual diversity in the group The When the diversity has been reduced to a certain level and confirmed to have entered the late evolution, for the need for mutation in the individual through the waveform analysis at this time to obtain the system output curve of the maximum overshoot Mp and adjust the time t. As a fuzzy controller input, and the output instead of the corresponding need to be mutated in the group to get the parameters of PID parameters after the variation, as shown in Figure 4.

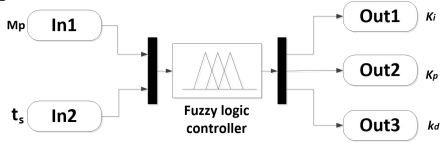

Figure 4 Evolution of the late fuzzy logic controller

(5) Improved genetic algorithm to optimize the PID parameters of the steps

1.to determine the KP, Ki, Kd range of change;

2.generate the initial population, and according to the fitness function to calculate the individual fitness value;

3. according to the individual fitness value, the use of certain methods to select the individual to be crossed;

4.pairing the selected individuals;

5.the mutation of the new individual to the operation;

6.convergence judgment, if not meet the convergence conditions, return to step 3and 4step, re-genetic operation;

7.to meet the convergence conditions, the resulting parameter is KP, Ki, Kd optimization value.

The flow chart is shown in Figure 5 below:

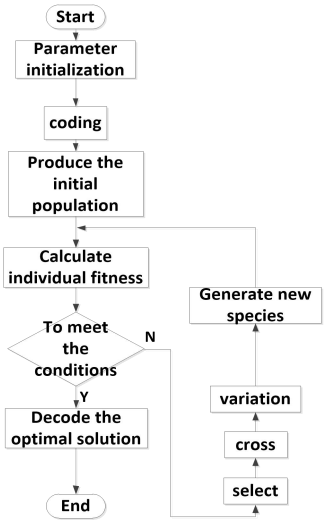

Figure 5 PID parameter optimization process

5.EXAMPLE APPLICATION

(1) control system hardware design

Incinerator control system by the host computer and the next two components. The host computer uses Siemens SIMATIC IPC547eco model of industrial control computer. At the same time, install the Siemens configuration software WinCC V7.0 on the host computer to configure the user interface.

The next machine adopts S7-300 series PLC. Incinerator PLC control system using Siemens PS307 2A power supply, responsible for the CPU input and output power supply. Control the central processor using Siemens CPU315-2DP, it has an Ethernet port, can communicate with the host computer. The digital module has one SM-321 (DI) and one SM322 (DO), which controls the start and stop control of the solenoid valve, blower, and incinerator. The analog module has two SM331 (AI) and three SM322 (AO), which are responsible for collecting field piping pressure, furnace pressure and furnace temperature.

The next bit machine through the 485 communication protocol from the scene to collect data, the host computer through the Ethernet protocol and the next machine real-time transmission of data. The host computer to monitor all the equipment at the scene, and through the control of the next machine to control the field equipment, collected from the scene to be processed and real-time transmission to the host computer, the final data transmission to the host computer to record and store.

(2) Control system software design

System programming tools using Siemens STEP7 V5.5 programming software, the entire system using ladder language and structured methods of programming, PLC program using OB organization block, FC and FB function blocks, DB data and SFB function blocks. The PLC calls the associated function blocks by scanning the main program cycle OB1 organization block. Custom function FC_MAN achieves reliable control of motor, solenoid valve and control valve by calling function block FB_Pump, FB_Solenoid Valve and FB_Adjuster Value. Custom FC_AUTO achieves the heating of the incinerator by calling function blocks FB_PT, FB_LT and FB_Add Material. Precise control.

(3) Simulation comparison

The second-order transfer function of the furnace temperature is now selected as follows:

$$G(s) = \frac{300}{s^2 + 40s}$$

The sampling time is 100 ms and the input is a step signal. Target selection is as follows:

$$J = \int_0^\infty [w_1 |e(t)| + w_2 u^2(t)]dt + w_3 t_u$$

E (t) is the error, u (t) is the controller output, tu is the rising time, w1, w2, w3 is the weight, c (t) is the output of the controlled object.

When the genetic algorithm is programmed, the number of samples is M = 30, the crossover probability Pc = 0. 9, the probability of mutation $Pm=0.1-[1:1:Size]\times 0.01/Size$ The value of Kp is in the range of [0,30], and the range of Ki and Kd is [0,1]W1 = 0.899, W2 = 0.001, W3 = 3.0, get the optimal parameters:PID tuning results for Kp = 10.2308, Ki = 0.3782, Kd = 0.4563, performance index J = 7.3651.

Conventional PID control and improved genetic algorithm using the PID control step response shown in Figure 6, Figure 7 shows. Figure 8 is the optimization of the cost function J.

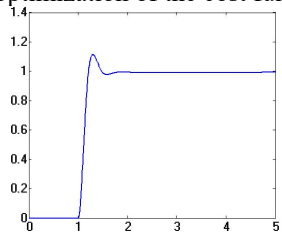

Figure 6 Conventional PID control step response

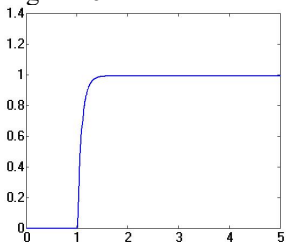

Figure 7 Improved genetic algorithm PID controller step response

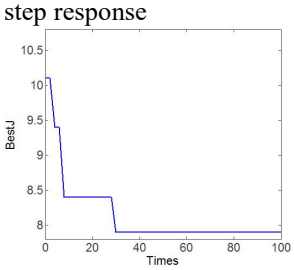

Figure 8 Optimization of the cost function J

5. CONCLUSION

In the PID controller design, PID parameter tuning is a complex and complex work, through the multi-comparison analysis shows that in the improved genetic algorithm PID controller overshoot than the ordinary PID control is small, the paper on the The basic genetic algorithm has been improved, mainly for the coding, selection operator, crossover operator, mutation operator has been improved. After MATLAB simulation, it is proved that the improvement is effective, and the advantages of fuzzy control technology in dealing with unknown model or model imprecision are effectively overcome the problem of excessive search.

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Design and Application of Temperature Control System of Reactor Based on Interpolation Fuzzy Control

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Abstract:Aiming at the problem of insufficient accuracy of fuzzy control in the control process, the introduction of linear interpolation algorithm, proposed an interpolation fuzzy control method, the simulation results show that this algorithm can improve the precision of fuzzy control. The algorithm is implemented on PLC, and finally applied to the control system of polycarboxylate superplasticizer. The algorithm has good control effect and is simple and easy to realize.
Keywords: fuzzy PID; temperature control; linear interpolation

1. INTRODUCTION

Batch reactor as a chemical production equipment commonly used in the production process has been widely used. Because of its complex chemical reaction mechanism, susceptible to external conditions, reaction material purity and many other factors, and the temperature control system has a nonlinear, hysteresis, modeling and other characteristics. Which can lead to the control effect of the traditional PID control method. Fuzzy control is a rule-based control method, which can be designed according to the expert experience. Because the controlled object has no dependence on the mathematical model, Linear, large lag, the model structure of the object is not valid for effective control. However, the performance of fuzzy control and its control rules and scale factors and other relevant parameters of the relationship between the value, coupled with the relevant parameters rely on the designer's experience and experimental test data, especially when the characteristics of the controlled object changes, the fuzzy controller The relevant parameters and fuzzy rules can not be adjusted accordingly, making the controller adaptability is weak, affecting its application and control effect. Over the years, with the development of fuzzy control theory, many scholars in the reactor temperature control system to do a lot of research and exploration, and put forward some practical solutions. [1]Based on the fuzzy PID control strategy, the fuzzy feedforward controller is added, and a new fuzzy PID control strategy is proposed, which improves the feedforward dynamic compensation of the control system and improves the performance of the fuzzy controller ;[2] According to the characteristics of the reactor temperature control system, an ideal Smith fuzzy control method is obtained, and its simulation is verified, and a good simulation result is obtained. In [3], a variable universe fuzzy And the optimization algorithm is used to optimize the scaling factor. The simulation results show that the algorithm has high control precision. [4] The fuzzy temperature control is optimized by using the fuzzy adaptive PID control algorithm. It can be seen that the fuzzy control is very common in the reactor temperature control. Although these studies improve the effect of fuzzy control in some respects, there are still some problems, such as real-time adjustment and poor adaptability.

In this paper, a polycarboxylate water-reducing agent synthesis control system is taken as an example. Aiming at the characteristics of non-linearity, large hysteresis and time-varying in the process of chemical reaction, a hybrid control system based on interpolation fuzzy algorithm is proposed. Temperature control for optimization and design.

2. SYNTHETIC PROCESS

Polycarboxylate water reducing agent synthesis control system process, including pre-ingredients, feeding, mixing, reactor heating, temperature, cooling and finished cans and other parts, as shown in Figure 1.1-finished tank; 2-polymerizer; 3-liquid metering tank; 4-A metering tank; 5-B material metering tank; 6-water metering tank; 7-agitating motor

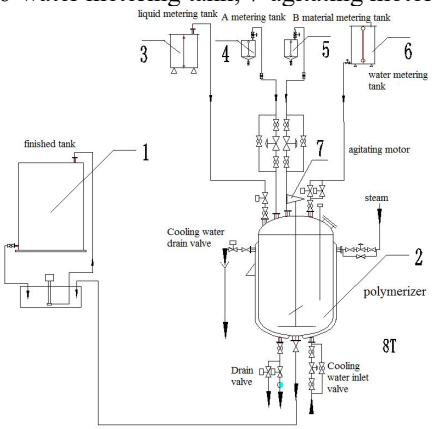

Figure 1 Production Process

The following describes the polycarboxylate

superplasticizer synthesis process.First, the water and A, B raw materials, from the pump will produce raw materials to the respective measurement tank, where water, liquid alkali through the solenoid valve into the polymerization reactor, and according to the amount of control solenoid valve switch. In order to make the amount of water more accurate, equipped with a large and a small solenoid valve, through the production staff input water and the size of the valve ratio to determine the size of the valve closed limit. When the raw materials in each metering tank meet the production requirements, the next step of the synthesis of production, A material and B material through the control valve to the polymerization tank evenly drop the feed, feeding began by adjusting the steam valve on the polymerization reactor temperature operation. According to the requirements of the kettle temperature requirements to 70 ℃ and maintain a constant temperature of 70 ℃ , the temperature error should be maintained at ± 2 ℃ . After the completion of the drip to maintain constant temperature for one hour, and then cooled to 50 ℃ test is qualified, according to the production needs to add the liquid alkali to adjust, after the delay of 30 minutes after the end of this production, open the discharge valve pump with the finished product Into the finished trough.

3.INTERPOLATION FUZZY CONTROL ALGORITHM

Fuzzy control the majority of the use of look-up table, that is, the amount of input for the different input to calculate the amount of fuzzy control query table, in the actual control process, according to the detection of input, through the query table and fuzzy rules to find the corresponding output [6]. A typical dual-input single-output fuzzy control algorithm is shown in Figure 2. In addition, e, Δe, u, respectively, that error, error changes and control output, their corresponding discrete field are E, EC and U; k1 and k2 for the error, the error of the quantization factor, k3 for the control output factor The

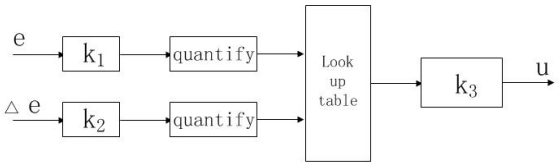

Figure 2 Conventional fuzzy control algorithm

In the process of blurring the continuous precision quantity using the fuzzy rule table, the interval of the selected integer is too large, which will cause the serious loss of the information quantity. When the fuzzy quantity is precise, the discrepancies between the two fuzzy quantities , The output control amount u will inevitably produce a transition, resulting in fluctuations in the controller output. Therefore, the discontinuity caused by the quantization caused by the control of the dead zone and the control effect is the main reason that the conventional fuzzy control is poor in steady-state control accuracy.

In order to further improve the performance of the control system, the interpolation method is introduced. In this paper, the binary function interpolation algorithm based on binary function is used in the rectangular domain. (E,EC) constitute a plane of a certain area is divided into several rectangles, choose one of the rectangular domain A, B, C, D, as shown in Figure 3. The vertex coordinates of the rectangular field are, respectivelyA(E_i , EC_j),(E_{i+1}, EC_j),C(E_{i+1}, EC_{j+1}),(E_i , EC_{j+1}).Assume the functions on vertices A, B, C, and D, U_{ij}、$U_{i+1,\ j}$、$U_{i+1,\ j+1}$、$U_{i,\ j+1}$ Value is known. The following formula can be used:

Hypothesis x_i, x_{i+1} Is the fuzzy value of the adjacent two independent variables, y_j, y_{j+1} Is the fuzzy value of the corresponding dependent variable. And satisfied $x_i < x < x_{i+1}, y_j < x < y_{j+1}$

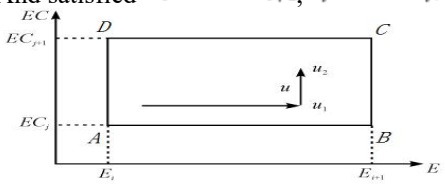

Figure 3 rectangular field diagram

According to the formula (1) in accordance with the rectangular domain diagram of the process of obtaining U as follows:

$$U_1 = U_{ij} + (U_{i+} \quad (2)$$

From the above equation, U(i, j) in any (E, EC) rectangular domain depends only on the adjacent four corner values. In this study, the algorithm is applied to the fuzzy control algorithm. For any time, E and EC do not have to be rounded, but the U value is obtained by using the interpolation formula according to the query table corresponding to the four corners.

4. INTERPOLATION FUZZY CONTROL ON THE REALIZATION OF THE PLC

The theoretical temperature of the reaction vessel is 70℃, the theoretical field of temperature deviation is [-2 ℃ , +2 ℃],the theoretical field of temperature deviation rate is [-0.5 ℃ /s, +0.5 ℃ /s] In order to facilitate the engineering calculation, the fuzzy domain of E is [-6,+ 6], the fuzzy domain of EC is [-6, + 6], and the fuzzy domain of output U is [-3, -3] The Temperature difference, temperature difference rate and output are used 7 fuzzy subsets, namely {NB NM NS ZR PS PM PB}. The fuzzy rules are shown in Table 1. Where NB is negative, NM is negative, NS is negative, ZE is zero, PS is positive, PM is positive, and PB is positive.

In addition, during the operation of the system, there will be some values such as temperature deviation and deviation rate falling outside the domain of the

theory domain, which will be corresponding to the fuzzy domain. At this point, it is necessary to transgress the transboundary points outside these domains, and treat the points above or below the boundary of the fuzzy domain as boundary point processing. As the PLC in the complex control process there are limitations, so the fuzzy control query table stored in the PLC's memory, the entire PLC control using off-line tabulation, online look-up table.

EC \ E	NB	NM	NS	ZE	PS	PM	PB
NB	PB	PB	PM	PM	PS	PS	ZE
NM	PB	PM	PM	PS	PS	ZE	ZE
NS	PM	PM	PS	PS	ZE	ZE	NS
ZE	PM	PS	PS	ZE	ZE	NS	NS
PS	PS	PS	ZE	ZE	NS	NS	NM
PM	PS	ZE	ZE	NS	NS	NM	NM
PB	ZE	ZE	NS	NS	NM	NM	NB

(1) Offline design

In the design of fuzzy controller, in order to achieve online look-up table, first of all fuzzy query table into the PLC data block DB1. The description of the fuzzy query table in the data block DB1 is as follows: In order to simplify the program design, the elements [-6, + 6] in the input fuzzy domain are transformed into [0, + 12], and the control amount U in the fuzzy control table Query table from left to right, from top to bottom way to store the data block DB1, the address of this to 0 ~ 168. According to the quantization of the elements in the fuzzy domain corresponding to the EC and E can be U address E * 13 + EC, and finally get the control amount U. Offline part of the design as shown in Table 1 fuzzy control query form.

(2) online part of the design

In the program, according to the fuzzy quantization program to e1, e2, ec1, ec2 and 4 adjacent values and by querying the fuzzy control rule table, we get the fuzzy under different combinations of E and EC, and use the function block FB1 to write the fuzzy query program. Control the output control amount U_ (i, j), respectively, stored in VW150, VW160, VW170, VW180, and then according to the interpolation algorithm to get the final control u.

U \ E \ EC	EC_1	EC_2	EC_3	EC_4	⋯	EC_j
E_1	U_{11}	U_{12}	U_{13}	U_{14}	⋯	U_{1j}
E_2	U_{21}	U_{22}	U_{23}	U_{24}	⋯	U_{2j}
E_3	U_{31}	U_{32}	U_{33}	U_{34}	⋯	U_{3j}
⋮	⋮	⋮	⋮	⋮	⋮	⋮
E_i	U_{11}	U_{12}	U_{13}	U_{14}	⋯	U_{1j}

Table 1 fuzzy control query table

(3) Simulation analysis

According to the mechanism modeling method, the approximate mathematical model of chemical production polycarboxylate water reducing agent reactor is: G (S) = (ke ^ (- τs)) / (s (Ts + 1))

The parameters were obtained by experiment: the scale factor k = 20.5, the time constant T = 85, and the delay factor τ = 32. MATLAB simulation results shown in Figure4:

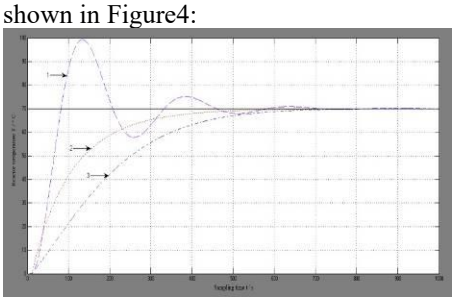

Figure 4 system simulation diagram

1 Based on the classical PID control algorithm;

2 Based on interpolation fuzzy control algorithm;

3 Based on conventional fuzzy control algorithm

It can be seen from the simulation diagram that the interpolation fuzzy control algorithm is more ideal than the conventional fuzzy control algorithm and the classical PID control effect. It can be realized in the PLC only by simple checklist and interpolation calculation. The precision control can reach ± 1 ℃ , Not only can avoid the classical PID control algorithm appears overshoot oscillation and the system response speed is superior to the conventional fuzzy control algorithm.

5. SYNTHETIC CONTROL SYSTEM DESIGN

The system uses Siemens S7-300 as the core and the solenoid valve, electric control valve, temperature sensor, load cell, peristaltic pump and other equipment composed of control system.

(1) Hardware design

Polycarboxylate water reducing agent synthesis control system by the host computer and the next crew. The host computer system uses two SIMATIC IPC547E industrial computer to monitor two synthetic production lines in real time. On each of the two industrial computers, WINCCV6.2 is installed to display the configuration screen, and the real-time information of the production process is displayed on the man-machine interface. Operation production personnel can intuitively understand the progress of production. And can also query the status of the equipment in the production process and the corresponding parameter values, in the form of data tables or graphs displayed at the same time to the production process of the sudden situation and fault information alarm and alarm records, in order to produce Personnel to quickly resolve the fault and analyze the cause of the malfunction. The lower computer system mainly completes the operation, control and operation of the production equipment such as solenoid valve, regulating valve, stirring motor, peristaltic pump and so on, and the state of the

reactor and the raw material tank in the production process, such as temperature, liquid level, weight , Pressure, flow and other production parameters for real-time collection and processing. The lower computer and the two host computer through the TCP / IP protocol to communicate between the next master station and slave through the Modbus protocol communication, control system network structure shown in Figure 5.

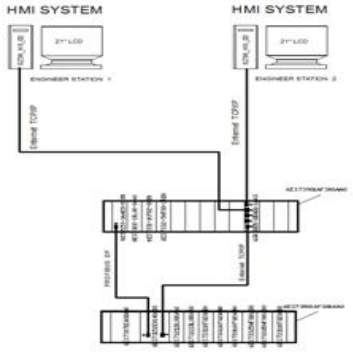

Figure 5 control system network structure diagram

(2) software design

The program uses ladder language and structured method to write the program, through the preparation of FB blocks and FC blocks to achieve temperature, drip flow and the corresponding solenoid valve, stirring motor, control valve and other control procedures, the program mainly includes the main program, initialization procedures, Data acquisition program, drip program, temperature control program, alarm program, peristaltic pump control program, remote / local and manual automatic control program, A / B metering tank feed program, and create shared data blocks and background function blocks, Where DB10 is used to store the fuzzy rule table. The PLC calls the associated FB and FC by scanning the main loop OB1 organization block.

6. CONCLUSION

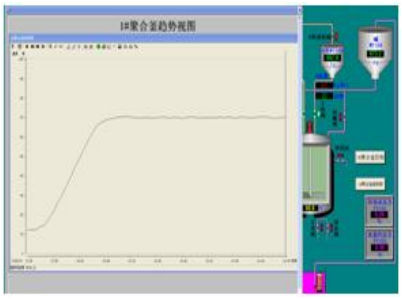

Figure 6 1 # reactor temperature curve

Based on the interpolation fuzzy control algorithm, the linear interpolation algorithm is used to overcome the shortcomings of the conventional fuzzy control algorithm, and the interpolation fuzzy control algorithm is combined with the PLC to make up the fuzzy control. In this paper, the fuzzy control algorithm based on the fuzzy control algorithm is proposed. Accuracy is not high and into the steady-state slow and so inadequate, suitable for practical applications in the application. As shown in Figure 6, for the project during the debugging of 1 # reactor temperature curve, from the test results to meet the process requirements.

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Design of Gesture Recognition Based on Haar Classifier

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Abstract: In order to realize the recognition of hand gestures in the context of complex background and changing light environment, the gesture classification and recognition using Haar classifier is proposed. First, the positive and negative samples were established for two typical gestures: fist and palm. Second, use the classifier training tool in OpenCV to train the fist and the palm of the hand, and get the two classifiers. Finally, use Python language and OpenCV to write programs and then use the classifier to capture the video and gesture recognition. The results showed that using Haar classifier can get a good result about recognizing a particular gesture under the complex background, and the accuracy rate is as high as 90% .The design can be applied to gesture control or hand motion tracking and other occasions.
Keywords: Haar classifier; Gesture recognition; python; OpenCV

1. INTRODUCTION

Human-computer interaction based on gesture recognition is widely used in robot control, 3D animation, entertainment, automotive, security certification and many other areas. In recent years, with the development of augmented reality technology and virtual reality technology, gesture recognition technology gets more and more attention. Some well-known international companies such as Sony, Toshiba, Nintendo, Microsoft and IBM have committed to gesture interaction in consumer electronics and release many products, but there are still some deficiencies. At present, the development of gesture recognition technology is gradually turning to use computer vision to analyze gestures as a purely visual way. Gesture detection is the core of visual gesture interaction, and its essence is system analysis. The author proposes a detection scheme based on Haar classifier and realized detection of two special gestures: fist and palm. This scheme achieves good results in the detection of many types of complex scenes.

2. HAAR CLASSIFICATION ALGORITHM FUNDAMENTALS INTRODUCTION

Haar-like features is a common characterization operator used in the field of computer vision. It was first used in face describing. The most commonly used Haar-like features can be classified into three categories: the line feature, edge feature point feature (the center feature), diagonal features.[6-7]
There are four kinds of edge features: x direction, y direction, x oblique direction, y oblique direction; eight kinds of line features; two kinds of point features; two kinds of diagonal features. Each feature is calculated by the pixel value.The calculated difference is the Haar-like feature characteristic value.[6]
The following figure shows the distribution of the average of feature values of all positive and negative samples in 20 * 20 sub-window. It is found that the difference between positive samples and negative samples in distribution is slight. Note that there is a difference in the distribution curve when the feature value is more than or less than a certain value. This shows that: most of the characteristics is very small for recognition. But there are some characteristics and the corresponding threshold, can effectively distinguish the positive samples and negative samples.

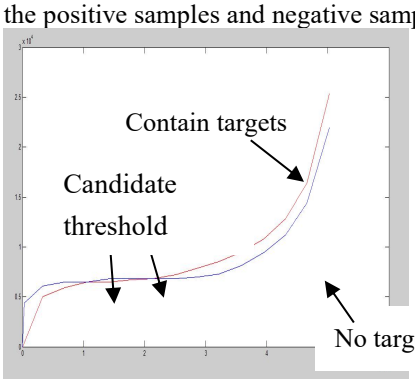

Fig.5 Haar feature values distribution map

The original weak classifier is only a basic Haar-like feature classifier, which calculates the input image Haar-like feature values, and compares the feature values with the initial weak classifiers feature values. In order to determine wither the input image is the target object or not, it needs to train those week classifier to become the best weak classifier. The mathematical structure is as follows:[9]

$$h(x,f,p,\theta) = \begin{cases} 1 & p \cdot f(x) < p \cdot \theta \\ 0 & \text{Other} \end{cases} \quad (1)$$

Where x is a child window image, f is a feature of

the image, p and θ is used for composition thresholds.

Then the weak classifier is trained to generate the optimal classifier. Process of training optimal weak classifier is actually looking for the right thresholds of classifier to make the classifier interpretation error lowest for all samples.

Specific operation is as follows:

1) For each feature, compute eigenvalues of all training samples, and sort.

Scan sorted eigenvalues again and each element sorted in the table is calculated following four values:

All positive samples weights and t1;

All negative samples weights and t0;

The positive samples weight and s1 before this element;

The negative samples heavy and s0 before this element;

2) Final obtained the classification error for each element.

$$r = \min(s_1 + (t_0 - s_0), s_0 + (t_0 - s_0)) \quad (2)$$

In this formula, we should find the element which the value of r is the smallest, the element as the optimal threshold.

Then combine these optimal weak classifiers together to form a strong classifier.

Strong classification requires iterative rounds of T, as follows:

1. Given the training sample set S, which has total of N samples, wherein X and Y respectively correspond to the positive samples and negative samples; T is the largest training cycles;

2. Initialize the sample weights as $\frac{1}{N}$, the initial training is the probability distribution of the samples;

3. The first iteration of training N samples is used to obtain a first optimal weak classifier.

4. Increase the weights of sample which was misjudged in the last round;

5. Put the new sample and the sub-sample which is misclassified in previous iteration together as new round of training.

6. The loop executes step 4-5, after T round, you can get the number of T optimal weak classifiers.

7. The optimal combination of T weak classifiers gets strong classifier combinations as follows:[6-8]

$$C(x) = \begin{cases} 1 & \sum_{t=1}^{T} a_t h_t(x) \geq \frac{1}{2}\sum_{t=1}^{T} a_t \\ 0 & \text{Other} \end{cases}$$

$$a_t = \log\frac{1}{\beta_t} \quad (3)$$

Haar detection system is based on the reality of an image as input, and then does the multi-regional, multi-scale testing. The so-called multi-zone, it is to divide the picture into many blocks, and each block should be detected. Since the training data are generally about 20×20 small images, for big target, also need to detect with multi-scale. For multi-scale detection mechanism, there are two general strategies .One does not change the size of the search window, but continuous image scaling. This approach obviously needs to operate each area for characteristic value of the scaled image, so the efficiency is not high enough. Another way is to continuously initialize the search window size for the training image size and expand the search window to search. This method solved the weak in first method. At the regional amplification process will appear the same target has been repeatedly detected, which requires consolidation area and here will not be discussed.[9]

The flow chart is as follows:

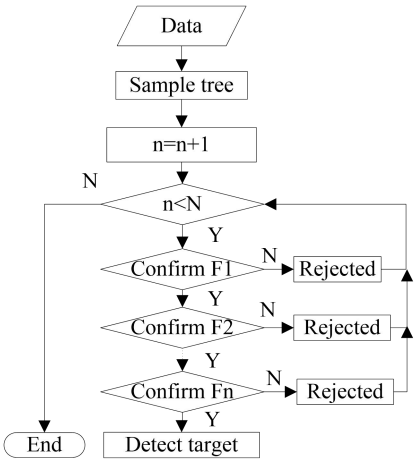

Fig.6 Flow chart of Haar classifier monitoring system

In this flowchart, N is the size of sample set, F1, F2, F3.... Fn represent haar features.

Whichever search method will be, it always outputs a lot of sub-window image for input image .When these child windows are cascaded filtered image classifier, will continue to be screened each node, discarded or adopted.

Not only need good hardware support as a basis, for each part of the system also need to be optimized. The most critical is to be realistic, rational design of the detection system, so that each part of the implementation to achieve the desired effect.

3. IMPLEMENTATION PROCESS

The Palms classifier, for example, first selects the positive and negative samples. In this design, both positive and negative samples are gradation images with 20×20 pixels, the number of positive samples is 1550; the number of negative samples is 5088.

Fig. 7 palm positive samples (part)

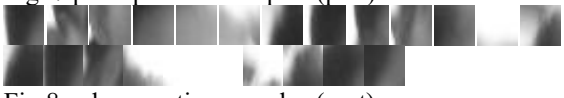

Fig.8 palm negative samples (part)

Firstly, set the positive and negative sample description file. Each row of description file is

constituted by file name, the target number of samples, as well as coordinates of the target sample frame structure. In this design, each sample just contain a target, and the target rectangle is " 0 0 20 20 " (i.e., the entire sample image).

The classifier training process is shown in the following figure:

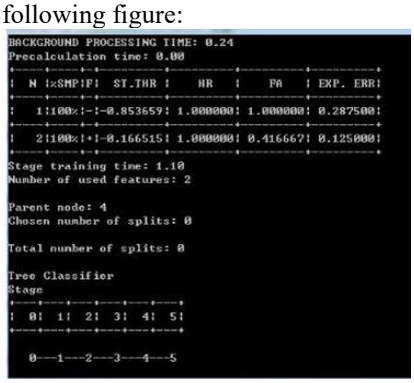

Fig. 11 Sample training process

4. EXPERIMENTAL RESULTS

The programming environment is python2.7.8. OpenCV version is 2.4.11. Computer hardware environment: CPU: i3-390m, memory: 4GB. Use USB camera capture video, detect the gesture of video in real-time. And set the "scalefactor" parameter to 1.3 (targeting images in each acquired image scaling in size), "minneighbors" parameter set to 5 (designated each candidate rectangle to be retained the number of adjacent rectangles) test results as follows:

(a) Detecting palm (far)

(b) Detecting palm (near)

(c) Detecting fist (far)

(d) Detecting fist (near)

Fig.12 detecting gesture

5. CONCLUSION

For traditional gesture recognition, this paper proposes a gesture recognition using Haar classifier gesture recognition. Training with the specific gesture, the trained classifier is used to detect gesture. At the same time, this paper elaborates the algorithm and the training process of Haar classifier. For the overall process description and explanation of the recognition process of the experiment has great significance. Compared with the traditional color-based gesture recognition technology, this method can not only overcome the influence of light, but also improve the ability to detect gestures in complex background.

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Research on the Application of Sports Dance Courseware in Physical Education Teaching in Colleges

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Abstract: The Courseware of sports dance was applied to college physical education, and the feasible analysis of the application of multimedia assisted courseware in sports dance teaching was carried out. The main conclusion: the introduction of multimedia courseware is a new concept in the teaching reform of sports dance, can not only broaden the teaching methods, but also conform to the trend of reform in current physical education, students and relevant experts. Suggestions: to strengthen the research and development of courseware for sports dance, and to increase the use of multimedia courseware in sports dance teaching, and to increase the teaching contrast experiment.
Keywords: Physical Education;Courseware; Sports Dance

Under the influence of western culture , China's reform and opening up further deep, in 1920s, China's first dance from Shanghai to Tianjin, Guangzhou and other popular developed cities, followed by the beginning of 80s, the sports dance was popular with our country and developed quickly. foreign experts and outstanding players have to give lectures, performances, communication, training in China, making the sports dance gradually to promote the country. In 1994, Beijing Sport University opened specialised course first.The initial course can not learn from the teaching experience and appropriate teaching materials, operation characteristics, coupled with the types of sports dance are various, complex and changeable, with the tacit understanding between partners is not enough, it is difficult for students within the time to master sports dance movements proficient, therefore, there are a lot of problems in the development of College Physical Education curriculum about sports dance.

1.COURSEWARE OF SPORTS DANCE'S ANALYSIS ON AUXILIARY TEACHING NEEDS

Through the analysis of many unfavorable factors in the development of sports dance, it is a novel idea to use the multimedia computer assisted instruction courseware in the teaching of sports dance. The multimedia courseware is combined with the teaching of sports dance , making full use of cyber sources, using modern tools to collect all kinds of information, to make up for the deficiency of traditional teaching, so that students can use the specific input and output devices. They demonstrate study by repeated operation, playing the subjective initiative and creativity of students by the way of men-machine conversation,and effectively improve the quality of teaching and training effects of sports dance by using a variety of senses,and careful observation, careful thoughts , repeated practice and improving the skills of dance.

Multimedia computer technology is applied to the classroom, making courseware to make up for the lack of teachers and low level of technical shortcomings. The sports dance originated in the west, different from Chinese dance in charming. Hiring foreign teachers is an effective method to improve students' technology. Through the network learning, learning advanced information and foreign related teaching materials and teaching courseware, teachers can not only grasp the skills of modern teaching technology, but also make up for their lack of demonstrated actions and make students appreciate the charming of sport dance, followed by improving learning interest.

2. APPLICATION AND EVALUATION OF CAI COURSEWARE IN SPORTS DANCE

2.1.Application of courseware in Teaching

In each class of courseware assisted instruction, the teacher demonstrates about 10 minutes and 20 minutes, and the students can practice the courseware freely according to their own needs. The teacher handed out courseware to each student and they studied after class. The use of CAI courseware in the classroom of teaching physical dance can not only revise knowledge, but also strengthen the teaching.

Teachers can let students preview MCAI courseware to deepen understanding of the action when they are teaching physical dances; during the time of practice, they need to choose learning content directly by own operation to play students' independent learning ability. At the end of the course, the students can review the key and difficult points in the class by watching the courseware, and strengthen the students' understanding of the actions and consolidate the content of the course.

2.2 Result evaluation of courseware

2.2.1 Analysis of students' subjective attitude

Table 1 Student subjective attitude feedback form

Survey content	positive answer	negative answer

Proficiency in operating a computer	90.3%	9.7%
Do you often read sports dance materials	46.7%	53.3%
Can the MCA worker mobilize initiative	94.7%	5.3%
Can the MCA workers mobilize their enthusiasm for study	96.1%	3.9%
Do you study MCA courseware seriously	93.3%	6.7%
Does the MCA worker play a role in correct memory	90.5%	9.5%

Table 1 shows that the students are proficient in operating computers accounting for 90.7%.It can be seen in the era which information and technology develop rapidly that the modern college students have no problems to the basic computer operations and can make full use of teachers' teaching courseware for learning.

The number of students who often reads teaching materials accounted for 46.7%, less than half of the total number of students.It illustrates students are not interested in teaching materials and boring text information is difficult to arouse students' enthusiasm and interest in learning. The use of computer courseware shows vivid active videos, simple graphics, with text information, can make students to mobilize multiple senses, learning from different angles, the rapid establishment of correct action representation, enabling students to master the technical movements in the limited teaching time.Teachers can focus on correcting student's error actions. In addition, students choose their own learning content, their own plans, and control the progress of learning.These are conducive to play their personal expertise.

2.2.2 The analysis about factors of influencing emotions in learning process

The analysis shows that 94.7% of students think that the use of multimedia courseware in teaching can arouse their initiative to learn and practice the movement .8% of students think the initiative are improved after using courseware assisted introduction.The formal said their learning attitude is very serious after using courseware. From the above data analysis , the use of MCAI courseware in traditional teaching can fully mobilize students' enthusiasm and initiative, improve active thinking consciousness, strengthen the self evaluation and ability that we deal with theorematic and technical problems in learning process, understand stressed problems more comprehensive and profound .

2.2.3The analysis of teaching satisfaction and demandable situations

Courseware of sports dance is popular with students and recognition, so all students hope to use courseware to assist teaching in late teaching of sports dance, and that the use of MCAI courseware in teaching is more conducive to the mastery of skills and information resources, improve the learning interest.

The use of MCAI courseware in sports dance teaching can meet the needs of students' learning and interest training. In the future , we should try to make courseware suitable for different teaching objects and courseware types.

2.2.4 Analysis of students' subjective attitude through comprehensive attitude scale

Through analytical datas of the comprehensive attitude scale show that students are very interested in courseware and learning initiative is very strong. In the future, multimedia assisted teaching is necessary to teaching. At the same time, we can see that the satisfied degree of MCAI courseware in sports teaching is positive. Therefore, from the psychological tendency and emotional experience of students using MCAI, the use prospect of sports dance multimedia courseware is optimistic. This puts higher requirements for teachers and students. It is necessary for teachers to constantly improve their comprehensive quality, and students should constantly improve their computer skills and improve their self-learning ability to use courseware.Only in this way can our teaching methods be combined with modern computer technology and play an active role.

2.2.5 Advantages and Prospect Analysis of courseware assisted instruction

The integration of sports dance teaching and computer network can provide rich teaching information resources for teachers and students, but also can break through the limitation of time and space and establish mutual instruction and collaborative learning environment, producing a more ideal teaching effect.

The traditional teaching media is not compared with highly interaction.The insert of many international competitions and developing videos of the latest technical actions lets students understand the forefront of the domestic and foreign information technology and the latest action as soon as possible, to provide an effective platform for exchange and learning for teachers and students

3. CONCLUSIONS AND SUGGESTIONS

3.1 Conclusions

3.1.1Multimedia courseware assisted instruction is a new idea in teaching reform of sports dance. It can not only broaden the teaching methods, but also conform to the current reform trend of physical education, and get the approval of students and experts.

3.1.2Multimedia courseware provides students with vivid learning environment while making up for deficiencies in routine teaching, stimulating students' interest in learning and improving teaching effectiveness. Students watch their actions, images and analysis to find their deficiencies in time.

3.1.3Under the premise of obtaining abundant teaching resources, the teacher has innovated the teaching mode of sports dance. The research and production of multimedia courseware of sports dance not only complement and assist to special courses, but also try to apply it to the general course of sports dance, provide a useful reference for other projects and other sports activities

3.2 Suggestions

3.2.1As a new teaching method, multimedia courseware of sports dance should not only build the "hardware" facilities of the school to provide a platform for the integration of multimedia courseware and traditional teaching,but also strengthen and improve the software construction of teachers.

3.2.2Making multimedia CAI courseware not only has the knowledge of sports technology, but also has audio-visual knowledge, computer, art and other aspects of knowledge. The sports dance courseware which is stored in CD and has a more comprehensive knowledge should be further developed.

3.2.3In teaching activities of sports dance, we can increase the use of multimedia courseware in sports dance teaching, and increase the contrastive experimental study of teaching.

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Study on the Countermeasure of the Teaching Reform of Athletics in Athletics University in the New Situation

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Abstract: Track and field is the foundation of sports, can promote the formation of sports skills and successful use of technology to prevent sports injuries, but today's track and field teaching set mode and teaching mode that is inconsistent with the modern concept of life-long physical education. This paper investigates college students and graduates using questionnaire survey to find out the causes of the difficulties in track and field courses, and provides directional reference for teaching reform. The research results show that the concept, methods and principles of the development of athletics training and track and field training reform have a good effect and contribute to the overall development of China's physical education reform.
Keywords: Fitness development training, Excel statistics analysis, track and field teaching reform

1. INTRODUCTION

For researches on athletics course teaching reform, lots of people have made efforts by which the course teaching reform are propelled that makes contributions to our country physical education reform.

This research based on previous efforts, analyzes university public athletics course questionnaire results, hope to get the course current situation causes through data indicates in questionnaire results, explore pathway of course reform to make contributions to propel our country physical education reform.

2. RESEARCH OBJECTS AND METHODS

Research objects: Take one municipality university students as research objects, research on university athletics public courses current situations' drawbacks, put forward that bring heart health training events from outward development into university athletics public course.

Research methods: Document literature, investigation method and mathematical statistics method, from which document literature uses pedagogy, management and curriculum books as well as CNKI, CQVIP and Wan-fang database periodical documents as materials and theoretical basis, investigation method is by questionnaire validity and reliability testing, mathematical statistics is mainly using Excel spreadsheet and SPSS statistics software [1-4].

Questionnaire setting: In order to ensure effectiveness of compiled questionnaire, adopt experts judge method to test questionnaire in research process, grades divide into unreasonable, basically reasonable and reasonable such three grades, and the questionnaire gets evaluation results from physical education theory experts and athletics curriculum specialists.

3.CURRENT SITUATION OF PUBLIC ATHLETICS COURSES AND EXTEND PROGRAM COURSE DEVELOPMENT ANALYSIS

3.1 Analysis of students' evaluation results on public athletics courses

Questionnaire sets 6 options on students evaluation of public athletics course, option one is dull, boring, uninterested; option two is body building value can be replaced by other events [1-3]; option three is pattern of teaching is single without creativeness; option four is test and evaluation method is unreasonable; option five is court infrastructure is poor and short of apparatus; option six is useless in future.

Table 1 Investigation results table of students evaluation on public athletic courses

Option types	Option selective numbers of people	Percentage
Option one	188	38.76 %
Option two	24	4.950 %
Option three	36	7.420 %
Option four	32	6.600 %
Option five	20	4.130 %
Option six	185	38.14 %
Total numbers of people	485	100 %

From Table 1 data can get students each evaluation proportion distribution conditions; from Table 1 column diagram's distribution condition can know that 38.76% students think that athletics course is dull, boring and uninterested, 38.14% students think that athletics is useless for their future body building, the other options proportion that students chosen are all quite small around 6.0%. It can be concluded that students subjective consciousness of public athletic course is option one and option six, proportion of the two options and that of other options reflect that

athletics gets marginalization due to its discipline limits [5].

3.2 Investigation result analysis of university students' cognition on field event and track event

Important degree cognition investigation table that regards field event as university students' body building ways in school, it divides the important degrees into 4 grades which are respectively grade one(important), grade two(normal), grade three(not important)and grade four (unknown), its conditions as Table 3 shows.

Table 2 University students' cognition degree table on field event body building way

Importance cognition degree	Proportions of students in different degrees
Grade one	18%
Grade two	22%
Grade three	55%
Grade four	5%

For important degree cognition investigation table that regards track event as university students' body building ways, it similarly divides into four grades as Table 3 shows, makes their statistics result with Excel into pie chart as Figure 2 shows.

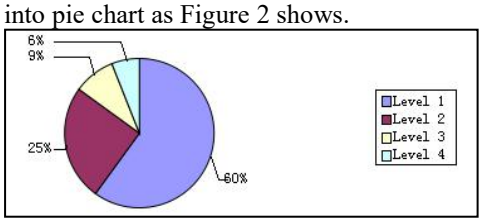

Figure 2: University students 4 kinds' cognition proportions that takes track event as body building way

From data in Figure 2 can know that with track event as university students' body building way and thought it to be important numbers of people is 60% of totals, only 9% students do not think it important. It can reflects that track event plays an important role in body building attributes, while table 2 data indicates that takes field event as body building way and thought it important numbers of people only covers 18%, and 55% students don't think it important; From statistics results in Table 3 and Figure 2, it is indicated that the importance cognition of regarding field event as body building way in the eyes of most of university students is less than that of track event, which reflects in one aspect that convenience situations of school court affects impression of students.

3.3 Investigation result analysis of university graduates body building ways

In order to research athletics role in lifelong sports events, carries on investigation of 11 kinds of body building items on university graduates body building ways, and makes classified study on different genders students, items that selected are jogging, athletics, football, basketball, volleyball, martial arts, badminton, aerobics, ping-pong, swimming and tennis, analyzes 485 pieces of retrieving questionnaire data through questionnaire surveying, the quantitative data conditions that got is as Table 4 shows.

Table 3 University graduates body building way investigation statistical results table

No.	Item	Man student number	Man student %	Woman student number	Woman student%	Total%	Rank
1	Jogging	65	13.40 %	121	25.95 %	39.25 %	4
2	Athletics	2	0.41 %	0	0 %	0.41 %	11
3	Football	52	10.73 %	12	2.47 %	13.2 %	8
4	Basketball	210	43.29 %	8	1.65 %	44.94 %	2
5	Volleyball	31	6.39 %	11	2.27 %	8.66 %	9
6	Martial arts	21	4.33 %	15	3.09 %	7.42 %	10
7	Badminton	111	22.89 %	91	18.76 %	41.65 %	3
8	Aerobics	15	3.10 %	157	32.37 %	35.47 %	5
9	Ping-pong	203	41.86 %	152	31.34 %	73.2 %	1
10	Swimming	51	10.52 %	25	5.15 %	15.67 %	6
11	Tennis	39	8.04 %	32	6.61 %	14.65 %	7

From data in Table 4 can know that jogging, football, basketball and badminton are first choice of university lifelong sports, while athletics ranks at the bottom of multiple selection items, it reflects that athletics selection course living status in university.

3.4 Each university outward development course setting current situation analysis

In order to enrich public athletics course, eliminate the course forms singularity and lack of interests, drive university students learning so that achieve converting athletic course sports event into students lifelong body building events, it specially sets athletic courses outward development and correlation events, from which correlation events setting has 3 types, which are respectively orientation movements, field survival and climbing events. Investigate on 16 universities in one municipality since 2005, its result presents as the mark form in Table 5.

Table 4 Outward development course setting and correlation events setting 16 universities investigation result

University No.	outward	Correlation course setting conditions

	development course setting conditions	Orientation movement	Field Survival	Climbing movements
1	√	√	√	×
2	√	√	×	×
3	×	×	×	√
4	×	×	×	×
5	×	√	×	×
6	×	×	×	×
7	×	×	×	×
8	×	√	×	×
9	√	√	√	√
10	×	×	×	×
11	√	√	√	√
12	×	×	√	×
13	×	×	×	×
14	×	√	×	×
15	×	√	×	×
16	√	√	×	×
combined	5	9	4	3
Note: “√”shows the course has been set , “×”shows the course hasn’t been set , date in total column are numbers of “√”.				

From Table 5 investigation result can know that one area university outward development course setting proportion is 29%, no setting proportion is 71%, therefore the area university outward development teaching setting is quite poor, and the course itself is needed to be improved.

3.5 Investigation result analysis of university students’ cognition attitudes towards outward development

In the paper, it puts forward that bring outward development into public athletics course. In order to have an anticipative estimation on the effects after such item introduction, it specially makes questionnaire survey to students’ attitudes about outward development, divides attitudes into positive attitude, neural attitude and negative attitude, sets 20 questions, the investigation result is as Table 6 shows.

Table 5 Investigation result of university students attitudes towards outward development each question

Question setting	Positive attitude		Neural attitude		Negative Attitude	
	Numbers of people	proportion	Numbers of people	proportion	Numbers of people	proportion
learning outward development	45	55.4 %	29	36.7 %	5	3.8 %
interested in outward development	59	74.8 %	16	20.3 %	3	3.8 %
willing to understand field survival knowledge	71	94.9 %	3	3.8 %	1	1.3 %
think present university students should cultivate emergency capacity	76	94.9 %	4	5.1 %	0	0.0 %
think outward development has high safety	32	41.8 %	38	48.1 %	8	10.1 %
think outward development is psychological challenge	56	69.2 %	6	7.6 %	18	22.8 %
willing to attend school set outward development course	67	83.5 %	13	16.5 %	0	0.0 %
think university students need to improve psychological quality	64	79.7 %	16	20.3 %	0	0.0 %
think outward development is helpful for future learning and life	74	94.9 %	3	3.8 %	1	1.3 %
Would like to try after understanding high altitude events	63	75.9 %	15	19.0 %	4	5.1 %
think it is necessary to hold outward development in university	71	88.6 %	6	7.6 %	3	3.8 %
think outward development can access to university	62	84.8 %	10	12.7 %	2	2.5 %

think university student need to take outward development	70	88.6 %	7	8.9 %	2	2.5 %
Hope the hold party of outward development is university	45	57.0 %	33	41.7 %	1	1.3 %
prefer to current university sports course	25	31.6 %	46	58.3 %	8	10.1 %
prefer to current physical education curriculum events	16	20.3 %	48	60.7 %	15	19.0 %
prefer to “teachers pass down and students receive” learning way	7	8.9 %	49	62.0 %	23	29.1 %
Hope students itself leading physical education course	66	79.7 %	10	7.6 %	3	12.7 %
traditional physical course has great effects on individual psychology	19	24.1 %	52	65.8 %	8	10.1 %
outward development has great effects on future	46	58.2 %	33	41.8 %	0	0.0 %

From data in Table 6 can know 83.5% university students are willing to attend school organized outward development, 88.6% students think outward development holding in university is conform to their own requests, 94.9% students think that outward development is very helpful for their future learning and life, therefore outward development entering into university physical education course is contemporary university students inner heart sincerely calls.

4. ATHLETICS PUBLIC COURSE CURRENT SITUATION CAUSES ANALYSIS AND REFORM IDEAS

4.1 Influence analysis of lifelong physical education on athletics course

Athletics events mainly including field event and track event, for field event, it has high jump, shot put and long jump; while for track event, it has sprint, middle-distance race and relay race so on. Since times are different, traditional athletic events already cannot be adapted to the development of times, which cannot meet the demand of students’ lifelong physical education demands. The symbol that shows the well-received extent of lifelong physical education events can be found from the proportion that sports exercise events cover that students engage in after graduating. This paper carries on questionnaire survey on 485 students respectively in the aspects of field event and track event; their statistics result is as Table 7 shows.

Table 6 Investigation result statistics of students’ lifelong sports exercise events – field event and track event

Investigation Options	Field event investigation result		Track event investigation event	
	Number of people	Proportion	Number of people	Proportion
1. will take it as body building way	3	0.62 %	258	53.20 %
2. occasionally take it as body building way	25	5.15 %	72	14.85 %
3. will not take it as body building way	455	93.81 %	150	30.93 %
4. don’t such body building way	2	0.41 %	5	1.03 %

From data in Table 7, it is known that university students take field event as body building way after graduation only cover 0.62%, and only 5.15% students occasionally take it as body building way, but 93.18% students will not take it as body building way, which reflects that field event due to its own and environmental restrains cannot become lifelong sports event. University students after graduation that take track event as body building way only cover 53.20% of totals, and 14.85% students occasionally take it as body building way that is to say track event regarded as university students lifelong sports event is accepted by exerciser.

4.2 Influence analysis of teacher to course

Athletics attributes can be divided into essential attribute and nonessential attribute. Researchers usually recognize and seize objective law with things attributes, and should seize comprehensive energy of each attribute of things. The original intention of athletics emergence and development is human pursuit of survival, health and the realm of perfect combination between body and spirit. For a long time, athletics researchers mostly from biological “physical property” perspective partial highlight athletics attributes, while it is little that researchers comprehensive get acknowledge of athletics from human development perspective. In view of this, it largely limited athletics development space in the field of body building, which is also athletics educators mixed up sports competitiveness with fitness nature, athletics accordingly produce competitive attribute and fitness attribute, difference between the two as Table 8 shows.

Table 7 Athletics fitness and competitive attributes comparison conditions

Attribute No.	Fitness attribute	Attribute No.	Competitive attribute
1	For the masses, with the purpose of taking exercise, improving health and strengthening physical quality	1	For the athletes, with the purpose of improving sports performance and winning in competitions
2	Master basic techniques, pursuit of the optimized result of body building	2	Pursuit of optimized techniques and sports performance
3	have special body building theory, principal and method	3	have special training theory, principal and method
4	According to age, gender and health conditions, define different content, forms method	4	have special competition event, form and method
5	no strict requests with sports court and equipment specification	5	have strict requests with sports court, equipment specification

In public athletics course, teachers usually mix up its fitness attribute concept with that of competitive attribute, which leads to athletics impressed students as faster, higher and farther Olympic Games competitive spirits. It should be clearly understand that Olympic Games spirit is a stage that challenges human extremes, which will cause injury to great extent. However, university sports teachers excessively pursuit of athletics competitive functions and ignore its body building attribute, therefore reform direction should develop towards fading competitive attribute and deepening fitness attribute.

4.3 Athletics public course teaching reform new idea

Athletics public course teaching way reform directions can be started with athletics training and athletics body building outward development such two aspects. Set athletics physical skill training department and athletics body building outward development department in university, two departments are for different learning objects, with different learning purposes, teaching methods and modes. Take outdoors exercise, field survival; outward development and so on newly developed sports as one part of athletics course. In order to make athletics teaching contents enriched and interested and let traditional athletics teaching content no more major exercise course, bring into athletics quality body building, outdoors exercise, field survival and outward development newly development sports as well as athletics event teaching to compose of new athletics teaching content system.In the following, it states the setting modes of athletics physical skill training department and athletics outward development department such two departments, so as to provide reform ideas for athletics public course teaching.

Athletics physical skill training department:

Athletics physical skill training department training targets problems not only concerning athletics physical skill training department training direction, but also it has direct connection with cultivation quality of students in training. Through analysis can know that university physical skill training department training targets is enable students not only master one athletics event basic knowledge and sports skills, but also should get further understanding of humanistic value behind athletics and let them build confidence, self-esteem, self-improvement spirits, help students spirits quality growing, maturing and perfecting.

Athletics physical skill training department training events are depend on university students interests and their sports gift, selection of training events contents should be consistent with students' requests. Every university can organize some suitable events with a certain advantage to drive whole school integral training efficiency according to school actual conditions and features;

Athletics physical skill training department majors in athletics training; it is strict with athletics coaches in special quality. Same as coaches cannot replace sports teachers, and it needs different specialty cultivation pathway. Due to our country university amateur sports training affiliates to sports and education system management "two-way" system, coaches and sports teachers' mutual replacement is universal. On the condition that most of school cannot set special coaches, the advantages of employing of part-time coaches are that it will influence neither on training level nor physical education quality.

Athletics outward development department:

Construction of athletics outward development department can meet university students themselves demands, is helpful for changing traditional education thoughts and ways, is helpful for increasing students social adaptation ability and propel to students physical and psychological health and comprehensive development.

Bring into experiential learning way, differences between experiential learning and traditional learning ways are as Table 9 shows.

Table 8 Two learning ways distinguish conditions table

Traditional learning way	Experiential learning way	Traditional learning way	Experiential learning way

1. past knowledge	1. it's feelings	6. single, stimulate	6. peak experience
2. Memory	2. comprehension and cognition	7. center on teachers	7. center on students
3. independent learning	3. team learning	8. standardized learning	8. individualized learning
4. focus on knowledge and skills	4. focus on ideas and attitudes	9. Theorization	9. realization
5. no contact	5. direct contact	10. emphasize learning	10. emphasize learning from practice

Ideas introduction, such as: cooperation education idea, intercourse teaching thoughts, overall education idea, experiential "exploration learning" idea and new ideas conform to contemporary sports course health

Athletics outward development department's introduction of heart health events, heart health events including communicative event, self challenge event, team cooperative event and team trust event, their introduction principals are : possesses targeted, comprehensiveness, adaptation, professional complementarities and integrated.

Make reasonable control of teachers basic qualities, it require that teachers can timely teach in front of students with different roles, these roles including: coach, lecturer, instructor, referee, participant and heart guider, so as to make correct judgment of students psychology reflection from their words and deeds as well as movements and guide and correct them by applying reasonable ways or roles.

5. CONCLUSIONS

This paper utilized literature review and mathematical statistics method researching on questionnaire investigation result of students in university and graduates, to provide data basis and theoretical basis for university athletics public course. In this paper, firstly analyzed university public athletics course current situations, then analyzed caused for current situation, finally put forward the introduction of athletics outward development and athletic training reform ideas to improve athletics public course current situations, which provided directional references for our country athletics reform.

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University Aerobics Curriculum Education Value Application Research

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Abstract: Aerobics course in the music accompaniment; the practitioners have the function of the common development of body and mind. Through the different actions to train the ability of coordination of the various parts of our body, to a certain extent, aerobics is a collective exercise, dance and music artistic, creative, time feeling, sense of rhythm, rhythm and keeping fit, entertaining, permanent a sport. More and more college students lack the opportunity to exercise, which makes up for this defect. Therefore, this paper will study and analyze the education value application of college aerobics courses from two aspects of fitness and fitness.
Keywords: Aerobics; Education value; Fitness bodybuilding

1. INTRODUCTION

Aerobics is a melting sports and art, bodybuilding and entertainment, which integrates aerobic exercise, and with its unique characteristics and charm to attract the students and was deeply loved by everyone. It not only can promote health, enhance physical fitness, can also improve psychological environment, enhance mental health, prevention of mental illness. College students are an important group who is physical and mental health are directly related to the future of the motherland. Most of them are brainworkers, with relatively little physical activity. After simple mental work, if there is no suitable physical exercise, it will inevitably affect their health. Aerobics is gymnastics, music and dance to be in harmony an organic whole, it is an easy and beautiful sports, in the gym at the same time, give people artistic enjoyment, make people happy and enjoy the fun of exercise, alleviate the psychological pressure, promote health of body and mind development, thus achieved the effect of fitness healthy heart. It has a profound impact on college students.

2. FITNESS VALUE

College students in the process of learning aerobics course could see its movement continued for a long time, but the intensity is relatively small, belongs to a kind of typical aerobic exercise, to a certain extent, and has the fitness value of university students.

(1) Promote the healthy level of college students

Aerobics has a positive effect on the aerobic endurance of learners. In aerobics learning and practicing, they are basically in various lift a leg jumping, action, change can effectively make the body's muscle fibers, coarsen the power of lower limbs and then improve their body jumping ability of the whole body, through each lumbar abdominal muscle group exercises to strengthen the practice, to strengthen the coordination and cooperation of each part, that they can be hard on key parts of the body [1-3]. Aerobics courses can obviously improve the body quality of the exercisers. Moreover, 98% of college learning calisthenics courses are girls, relative to the boys their joint ligament not good boys, overall is relatively loose, but they have good joint flexibility. During the exercise of calisthenics, some kicking, splitting and other corresponding actions can be used to cultivate and develop the flexible quality of female college students. Aerobics learning, there will be various twist, jumps in this high on their hands and feet coordination, to coordinate the onset of parts of our body, let the body parts and harmonization of eye sight, if they often practice can effectively enhance their various parts of the body, coordination between the various muscle group, to promote the motorium produce excited feeling extremely important in the cerebral cortex, also can cultivate their ability to inhibit its own transformation, also can cultivate their sensitive quality as a whole [4-7]. Arrange the aerobics course in university, and guide students to concept of aerobics exercise, to improve their memory, and the performance of each part of the body and the flexibility of the nervous system, has the obvious fitness value.

(2) Promote the physical function of college students

According to the above description, we know that calisthenics is a typical aerobic exercise, which is beneficial to college students' physical function. On the one hand, through exercise and sports practice can effectively improve their respiratory system energy, embodied in two aspects of deep breathing, respiratory gas exchange capacity, so that the movement intensity is moderate course conducive to the development and improve their cardiopulmonary function, thereby increasing the corresponding lung capacity, once encounter athletic strenuous exercise, such as 800 meters can effectively meet the needs of the their athletic intensity of gas exchange, so as to overall improve the level of function at the same time to consolidate and enhance the vitality of their lungs, and finally achieve the purpose of longevity. Aerobics sports college students in the process of the human

body, on the other hand, the hips got fully exercise, obviously caused by the comprehensive activities, can effectively exercise their lumbar muscles, pelvic muscle, the peristalsis of the stomach has obvious promoting effect, thus to strengthen the body's digestion function, promote their body of various nutrients absorption and utilization. Regular exercise of aerobics classes can also improve the flexibility of various joints of the body and enhance the strength and elasticity of the muscles of the body. For college students, aerobics courses have obvious fitness value, which has certain effect on their body height, bone strength, physical enhancement and skill improvement.

3. HEALTHY VALUE

The combination of music, dance and exercise is of great importance to cultivate college students' aesthetic, emotional regulation and interpersonal relationship cultivation.

(1) Improve their aesthetic ability

Aerobics courses play a positive role in cultivating college students' sentiment and improve their aesthetic ability. Aerobics is always accompanied by music; music is the soul of aerobics, aerobics exercise of college students in the music accompaniment, movement, under the bright rhythm in their accurate grasp the rhythm of music and sport, to stimulate their brain cells to stimulate their youthful vitality of the movement. In addition, the accompaniment of music can effectively control the excitability of brain cells in college students, and has a positive effect on regulating their emotions. Therefore, in the process of aerobics curriculum, teachers can choose the tune lively, strong music rhythm, can in the shortest possible time to relatively effectively mobilize their mood, in excitatory music accompaniment can focus on training the trainees music rhythm and movement of beauty to enjoy, in imperceptible movement in the beautiful music and movement of the happy enjoyment. Grasp aerobics movements enthusiasm is bold and unrestrained, choose appropriate music to realize the perfect coordination of the aerobics movement with music, make aerobics integrating emotion and soul, for college students becomes colorful, clear artistic sports, college students in the process of exercise is no longer a passive, but rather a kind of art infection transmission, fun and enjoy a feast, and, in conjunction with the good music to improve their rhythm feeling and metrical sense has a positive effect.

(2) It is helpful to regulate their emotions. Under the new situation, college students' life and study will inevitably encounter some psychological problems, and their ability to resist setback is not strong, in the face of setbacks very prone to depression, tension, and anxiety and other psychological problems, this is a kind of mental disorder. To some extent, this is a necessary way for college students to grow and develop into adulthood, which is a normal phenomenon. But, for the current study results have some unstable factors exist in college students' psychological development, many students are only children, since the childhood have parents' blessing, a psychological state in college has not yet been mature and stable, in the face of some kind of learning life stress, emotional stress and employment pressure at a loss, disoriented, prone to obstacles in psychology, which has a negative influence on their mental health. Therefore, calisthenics can effectively help them to achieve psychological stress and tension relief. Exercise is an effective means to relieve psychological pressure. Lively music and lively rhythm, beautiful movements to guide students to revel in the beautiful rhythm, music and bodybuilding movements to transfer their attention, soul purification has obvious effect, thus in the shortest possible time to help them to eliminate the psychological level of depressive feeling, totally immersed in aerobics sports of China and the United States and happy feelings, will be some life bad deep, boredom and disappointment to vent, inspire their vitality, guides them to keep a good state of mind, from the basics to improve their life interest, cheerful the mood, relieve pressure to achieve the target of mental health.

(3) It is helpful to cultivate their harmonious interpersonal relationship

Aerobic exercise not only has the body image of beautiful shape, based on the aesthetic need of college students to reasonable arrange action bring their artistic enjoyment of beauty, in cultivating college students' action harmonious beauty and rhythm beauty at the same time, strive to guide and improve their pursuit of beauty, appreciation, feeling and ability of creating beauty, to cultivate college students' good personality has a certain effect, provide the basis for cultivate their harmonious personal relationships. Regular aerobic exercise, in group activities to help them to form a bright and cheerful disposition, lively, brave, generous, enthusiasm, such as personality, find confidence in movement, cultivate their magnanimous mind in team communication and positive personality. Because calisthenics is an open exercise, interaction is obvious, which can effectively enhance their collective consciousness and interpersonal relationship. In aerobics match competition, and strive to develop their mutual love and unity, humility, common progress, to guide and modest trust each other good quality, in the process of the whole movement needs every learner actively cooperate with, communication, and to cultivate their cooperation consciousness and cooperation ability, the role of team spirit is very clear, effectively cultivate their harmonious interpersonal relationship.

4. CONCLUSION

Aerobics exercise in enhancing the mental health,

body function and health level and interpersonal harmony, on the basis of the aerobic endurance exercise on their body load on the movement, movement time has certain requirements, such as complete sets of movements by practicing strive to cultivate their sense of rhythm and the coordination of each part of the body, have a certain intensity; In the process of learning requires them to have the courage to explore, does not fear the difficulty, does not fear endures hardship, the spirit of innovation. For some hard to do action can overcome fatigue feeling to active practice. Therefore, aerobics to hone, exercise their strength of will also have certain influence, can use in the process of all kinds of setbacks and the pressure in the face of strong willpower to overcome the difficulties and overcome difficulties.

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Correlation Analysis of Physical Fitness Test and Physical Health of Students

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Abstract: With the development of the national health strategy and the promotion of education, the students' physical health has gradually increased to the topic of discussion in sports and education. This article from the student's physical health and sports scores, for students' physical health, sport time schedule, as well as the students' sports attitude change studied. Through the investigation of the students' physical health and sports scores, using SPSS software to carry on the chi-square test. Found that poor student's physical health, overweight, underweight, overweight, underweight, malnutrition of unhealthy phenomenon more serious. From a certain extent, this also affects the student sports test result, so the sports test into student achievement and comprehensive evaluation system. is an important measure of comprehensive development for students? Through the investigation of the students' sports time, found that after the implementation of physical health test, the transition of the students' sports attitude is very big, the students basic in physical education, sports activities are mainly school supervision and independently exercise play a role.

Keywords: Student constitution; Physical health; Physical tests

1. INTRODUCTION

Since the new curriculum reform, physical fitness testing has gradually integrated into the main factors that evaluate students' comprehensive level. In the integrated education, the education community gradually confirms system of students, sports as a comprehensive project integrating entertainment, game, exercise and fitness [1].

The inclusion of physical fitness tests into the comprehensive examination subjects of students is a reform measure of the new method of education in recent years. There has been a lot of discussion about the measure, which has led to a series of questions about whether it should be included in the student comprehensive test [2]. De-qin Chen, for example, China's examination of physical fitness test carried on the thorough analysis of the test the physical fitness test examination of the People's Republic of China [3]. Through the investigation in recent years after joining physical health test, the change of Chinese examination. Specific physical health test studied to test the impact of, and from the perspective of students. schools and so on has carried on the comprehensive elaboration, the paper points out that the examination of physical fitness test is an expression of students' comprehensive ability. In addition, evaluation of a middle school student in the aspect of beauty, intelligence and physique full-scale development need. Join sports element in an examination is a major reform in Chinese examination. Also, break the academic major proportion of the situation of correct measures [4].

The effect of physical fitness test is not only to improve the physical quality of students, but also to the students' mental health. Under the pressure of study, many students suffer from stress, mental distortion and physical and mental health. Many scholars have analyzed the role of physical health testing in this. Blue water to test the physical fitness test reform in teaching of sports analyzed, and the "Beijing test the physical health test research on the effects of reform of sports teaching in junior high school", is an examination of Beijing sports, for example, launched a physical health test research on the effects of sports teaching in junior high school.

This article is in reference based on a large number of literature material, through to the physical fitness test scores of students and their body to investigate. In addition, analyze the physical health of student's test scores, physical activity time and it is the correlation of physical health. So as to evaluate the students in the physical health test after sports attitude changes and the change of the physical condition of themselves. Finally affirmed the physique health test is an important measure of comprehensive development for students.

2.RESEARCH BACKGROUND AND SIGNIFICANCE

The construction of physical education system is the key to physical education, and it is the ultimate goal of the evaluation of sports teaching by the three groups of schools, students and parents. Besides, sports teaching system, physical education standard and physical education content are three important parts in the construction of physical education system.

In the Figure 1 study, it can be seen that schools, students and parents are an important part of physical education, and as the ultimate beneficiaries of education, students are extremely critical. To this end, this study analyzed the importance of education in sports through the students' physical health.

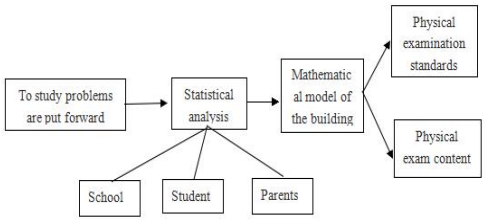

Figure 1 The flow chart

The study of student groups not only solves the problem of education, but also a new reform of sports education. In this paper, the author has conducted in-depth study on students and put forward the background and significance of the following research.

2.1 Research background

For the study of student groups, the following research background is proposed:

(1) Students' education problem is increasingly becoming the focus of society. Students are the future of a country.

(2) Students' healthy growth has become a top priority in students' education, which is constantly being recognized and concerned by people from all occupations.

(3) At the present stage, the status of sports is getting higher and higher, and sports education is becoming an increasingly important issue in the educational circle. It is important to make education sports a more thorough education.

(4) Physical fitness testing is one of the evaluation criteria for students' comprehensive quality. At this stage, more and more schools have incorporated sports scores into their overall grades.

2.2 Research significance

In view of the above research background, the following research significance is proposed:

(1) The research on students' physical fitness test is helpful to observe the progress of education in student sports, and make the student sports education more thorough.

(2) Integrate physical fitness test into student comprehensive performance, help to study the overall development of students and raise questions about the status quo;

(3) Physical fitness tests are compulsory measures to promote students' attention to sports, and physical fitness tests restrict students' physical exercise habits to a certain extent.

3. BASIC SITUATION OF STUDENTS' PHYSIQUE TEST

3.1 Statistics of physical health of students

With the improvement of economic conditions, the students' learning situation is becoming more and better. Many parents to give children a good learning situation, in order to let children, have more time to study. Give the child good or conditions, nutrition collocation is also very good, but under the adequate nutrition collocation, many children because of heavy study pressure lead to do not have time to take exercise. Crisis in body circumstance, the phenomenon such as obesity, too thin appeared frequently. Based on the basic investigation of the students' physical condition, the reliability of the survey results analyzed by SPSS software, and the reliability was determined. Therefore, use the next analysis.

3.2 Statistics of student sports test

Student sports test is one of the indicators of testing students' body quality, at the same time also is one of important way, students can be divided into body bad students and normal students in the two groups, and compares two groups of middle school students' sports achievement situation respectively. By comparing the differences and then analysis, the importance of physical health test. The statistics based on the survey of students' sports test scores, and the study of the survey results must abide by the principle of reliability, that is, the results of statistics have the value and significance of analysis. In this paper, SPSS software used to analyze the reliability of its reliability, so it can have used for the next analysis.

4. COMPARISON OF CORRELATION BETWEEN PHYSICAL HEALTH AND PHYSICAL FITNESS OF STUDENTS BASED ON X^2 TEST

4.1 Students' physical health

Students is a key in the sports education system, in view of student's physical health situation, Table 1 has conducted a survey and the reliability analysis, and to increase the use of probability and statistics in the X^2 test, the test results are shown in Figure 2 below, the comprehensive analysis of the results.

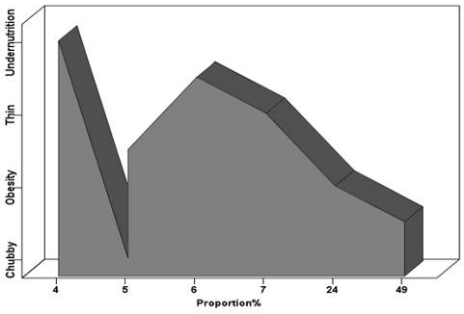

Figure 2 Student physical health

The following conclusions can have obtained from the statistical diagram of the above students' physical health:

(1) Among Chinese students, there are a large number of unhealthy, overweight, obese, lean and malnourished students, accounting for 51 percent of all students surveyed.

(2) In statistics, only 49% of students are in normal health, which is more evidence that Chinese students are in poor health;

(3) Through the statistical investigation, it is obvious that Chinese students are in poor health, mainly because of the excessive pressure of learning and less time for physical exercise.

Using software to test the data of the above survey,

the test results showed that:
(1) The physical health of students significantly affected by physical education. In the most direct and obvious physical features of students, sport has obvious influence on their fat and thin.
(2) Thus, promote students' physical health, make it in healthy growth, accept education, learning theory knowledge, sports is the indispensable one; it has a great effect for its comprehensive development.
4.2 Students' sports test scores
Rapid development of student sports, students for sports value, the most direct performance is the physical test result, for this reason, in view of the data statistics, now will the X^2 test, and the next step is to in-depth analysis on the results, such as Figure 3.

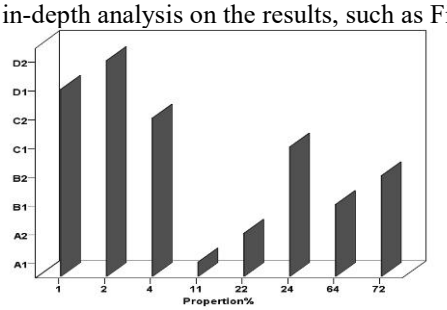

Figure 3 Student sports test scores
According to the statistics of the above students' sports test scores, the following conclusions can have obtained:
(1) The athletic performance of normal students is also relatively high, which has a very important relationship with sports activities and physical exercise.
(2) The health situation of poor students, the sports performance is bad, is affected by the daily sports behavior, this part of the students just to sports as a test, and to truly realize the real meaning of physical health test, so as to meet the effect is not obvious.
Using software to test the above data, the results are as follows:
(1) The correlation between students' physical test scores and students' physical education is very significant, which is not much deviation from the actual theory, so the results are in accordance with the actual statistics.
(2) The physical testing in student achievement and comprehensive evaluation system, an important measure is conducive to the development of students, the proportion of the future should pay more attention to physical health test, promote their all-round development.
5. STATISTICAL ANALYSIS OF STUDENTS' SPORTS ACTIVITIES
The high and low scores of students' physical test results directly affect their physical health, but the key to the sports testing lies in the time distribution of their sports activities. In statistics, China's most of the time the students' sports activities is given priority to with more than 60 min, a small number of students of sports time within 30 to 60 min, it shows that sports activities in China has gradually improve the status of student ceremony, Xu Sheng sports frequency increased significantly.

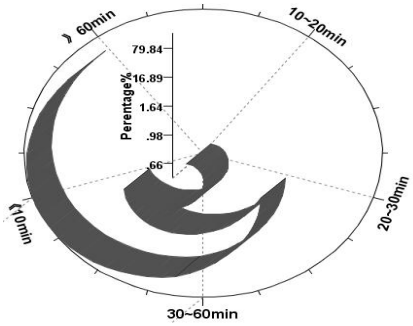

Figure 4 Time statistics student sports activities
In view of the above statistics, some conclusions made:
(1) The student is the carrier of education development of sports, and the improvement of the time of sports activities is the basic measure to guarantee the students' sports behavior.
(2) The physical health of students is the most basic link in the sports development system, and the promotion of student sports activities can help drive the overall development of the whole system.
5.1 Students' exercise time arrangement
Based on the analysis of students' physical exercise time, the time arrangement of students' physical activity was calculated. In student sports activity schedule for statistics, found that the student's basic arrangement in physical education, sports activities are mainly school supervision and independently exercise, its duration is relatively long, 30 min ~ 1 h and 45 min ~ 1.5 h. Usually, students do physical exercises mainly in exams. The following questions can found for statistics:
(1) Students' physical exercise greatly affected by physical fitness test and its autonomous exercise time mainly arranged in PE class, with less leisure time;
(2) The students have less duration of physical exercise, and the main purpose of physical exercise is to improve the performance of physical fitness tests.
5.2 The students' attitude towards the achievement of sports scores
In the study of the sports attitude of students, the analysis of sports test scores was not included. As the gradual fusion of the physique health test students' comprehensive performance evaluation system, the status of sports is becoming more and more high, the student to the physical importance from the past does not matter to now also is very important.
Although the physical health test more and more important, but the join in the student's overall social discussion has never stopped, some people think it is necessary to do so, there is also a part of this action is not agree. Figure 5 is the relevant data from the student's perspective on physical fitness test to be included in the student's examination results.

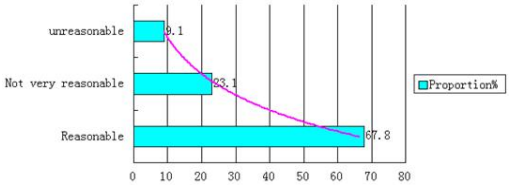

Figure 5 Students attitude towards physical examination results

Through the survey of students, it is obvious that most students think that it is reasonable to include sports test scores in the overall score, and only 9.1% of students are not quite sure about the practice. Reform of physical education are still don't do very thoroughly, physical test as part of the students' comprehensive ability, not by the student's attention and support, therefore, should strengthen the propaganda the importance of physical health test.

5.3 Effect of physical fitness test

It is important to investigate whether the health test reform has a small effect and should investigated from the most fundamental student groups. Students' sports awareness and physical activity change are very good indicators. In order further, observe the physical health test after implementation, the effect of sports development in student community aimed at students' sports awareness and sports behavior, exercise time three statistics, statistical results are as follows in figure 6. Students in sports consciousness and behavior, the change of physical exercise time three aspects are big, basic over 80%, the proportion of no big change is less than 20%, and thus, sports test has obvious effect for students.

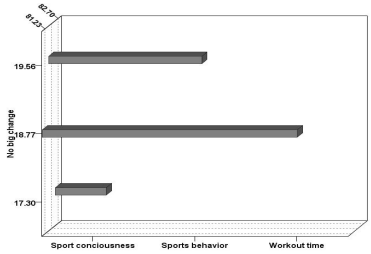

Figure 6: The effect of physical examination

As Figure 6, the following two conclusions and Suggestions proposed for the transformation of student sports attitudes:

(1) The transition of the students' sports attitude largely thanks to the implementation of the physical health test, physical health test into the student daily comprehensive results, from a certain side on stimulating the enthusiasm of the students in physical exercise, but also increased the proportion of school physical education;

(2) Compared the change of the student's sports behavior, proved that the physical health test should be brought into the students' comprehensive examination is a correct move, the measures to improve students' physical health, reduce the students are too thin, too fat, not health, to promote healthy growth of students.

6. CONCLUSION

Through the above research on the basic situation of student sports, the following conclusions can have obtained. the physical health of students is closely related to the physical fitness test. By investigating the physical health of Chinese students and the corresponding physical test scores. In addition, the use of SPSS software for X2 test analysis, finally found that Chinese student's physical health is poor, overweight, underweight, overweight, underweight, malnutrition of unhealthy phenomenon is more serious, from a certain extent, this also affects the student sports test results. so the sports test into student achievement and comprehensive evaluation system, is an important measure of comprehensive development for students. The students' physical time arrangement is the direct influence factor of their sports test scores. The survey found that the physical activity of Chinese students arranged in PE class, which mainly played a role in the supervision of the school and the independent exercise, and its duration was 30min ~ 1h and 45min ~ 1.5h, relatively long. In addition, in view of the physical tests, and has carried on the statistical analyses on the students' sports attitude change, through the study found that after the implementation of physical fitness test, the students' sports attitude change is very big, it also illustrates the physical health test into the student daily comprehensive results is a correct move.

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Research on the Microteaching of Social Sports Instruction and Management Specialty

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Abstract: This paper analyses and summarizes the composition and existing problems of practice teaching system of Social sports instruction and management specialty by using documentary material and logical analysis. Then it puts forward the corresponding improvement measures to each system, in order to provide certain theoretical basis for the more scientific and reasonable development and implementation of practice teaching, and to provide certain references for successfully cultivating modern compound talents.
Keywords: practice teaching; system; improvement measures

1. INTRODUCTION

As the development of society and science, competition is becoming increasingly fierce. There are also increasingly high social demands for contemporary college students' personal competence. The employment problems are becoming rather serious, esp. to students majoring in social sports instruction and management whose employment covers narrow fields. It is hard to find an ideal job to students who have no prominent skills and practice ability. Therefore, how to cultivate the compound sports workers with good foundation and wide knowledge to meet the demand of modern society, and how to determine its development plan of practice, which has become a problem to be solved [1].

National Teaching Guidelines for PE Course at Colleges and Universities that the Education Department promulgated in 2002 pointed out that the major task of college physical education is "focusing on national modernization and human beings' all-round development, insisting on the coordinated development between knowledge impartment, ability cultivation and quality improvement, even paying more attention to ability cultivation, ESP [2]. The cultivation of practice ability." This file shows the key point of the new college PE course reform will pass from theory to practice and the practice teaching in the completely teaching process is more and more important. This paper further analyses the practice teaching system of Social sports instruction and management specialty, finds out the deficiencies and puts forward the corresponding counter-policies, in order to provide certain theoretical basis for the more scientific and reasonable development and implementation of practice teaching.

2. RESEARCH METHODS

Documentary material, questionnaire, interviews, logical analysis, etc.

3. THE IMPLICATION AND SIGNIFICANCE OF PRACTICE TEACHING OF SOCIAL SPORTS INSTRUCTION AND MANAGEMENT SPECIALTY

Practice teaching and theory teaching are mutually connected and relatively independent. Practice teaching plays an irreplaceable role. A present, practice teaching has no clear definition. According to documentary material and interviews, combined with the discussion among researchers, it can be got that: practice teaching is constitution of teaching methods acquired through students' learning, practical operation, method application, with the purpose of developing their actual operation ability and innovation ability and improving their level of comprehensive qualities. Practice teaching of Social sports instruction and management specialty is an important part of colleges' sports teaching goal. Through practice teaching, teachers can help students grasp basic skills, improve their practice and innovation ability and strengthen their professional quality and employment competition, which is an important teaching link for the school to realize training goal of sports talents.

4.THE COMPOSITION AND EXISTING PROBLEMS OF PRACTICE TEACHING OF SOCIAL SPORTS INSTRUCTION AND MANAGEMENT SPECIALTY

According to documentary material and interviews, it can be summarized that practice teaching links of Social sports instruction and management specialty are skill-training program, teaching practice, graduation dissertation, programmer design, experiment, social practice etc.

4.1 Skill Training Program

Training simply implies practical training and learning. Skill course training is practical training and learning in the skill course which is the most important in the links of practice teaching and whose teaching effect is mainly related to the students. We should judge it from the students' learning outcomes.

According to research, we found that there are many shortcomings: 1) Students do not know perfectly about their learning objectives of the skill course. Students always put more emphasis on the learning of skill action, but ignore the learning of skill theory, which not only affects the study progress of the skill

action, but also affects the final quality they learn about the skill action. As a result, they will only know how to do the actions, but do not know how to explain them to their students when they begin their teaching career. 2) In regard to the condition of present teaching, students' subject status have not been reflected. Many students do not take an active part in the study of this course. And Students' initiation and positivity cannot fully be exerted. Students should take an active part in this course, which means they should not only take an active part in practice skill action, but also express their feelings and thoughts of the study, even explain the skill process. But the main problem of learning skill course is the serious lack of students' language expression, which is one of the main reasons that make many students only know how to do the action, but do not know how to explain it. 3) Teachers cannot play their leading role in their teaching and can't raise questions in accordance to specific conditions. And teachers often can't lead the students to think seriously and can't give full play to their students' imagination and creativity. These are all against the cultivation of creative talents, which are determined by the teaching objectives.

4.2 Educational Practice

Educational practice, as an important part of high-educational teaching, is one of the most important training stages. Through educational practice, it not only can cultivate students' professional quality in spoken language, etiquette, courseware, talent show, but also consolidate and broaden the scope of the theoretical knowledge that we have learned. Meanwhile, it can develop students' ability of analyzing the problem, and cultivate their problem-solving ability. It makes for practical innovation ability.

Through many surveys and studies, there are some shortcomings in the practice of Physical Education. 1) Students have no idea of the importance of education practice, which results in the situation that students don't have good understanding of the purpose of the educational practice, or lack in motivation, palter and some even don't take part in practice. 2) The time of practice is so short. The general practice time is about 6-7weeks, and the classes are arranged too many, which goes against students making summary. 3) The department advisers attach little importance to guiding the students. It is rare for faculty advisers to direct students. The contents are aiming at pre-class preparation. Thus, little attention is paid to attending classes, making comments and summary.

4.3 Graduation Thesis (design)

Graduation thesis is an important process of achieving the goal of cultivating and educating. Writing thesis can not only develop the students' abilities of applying their fundamental theories, professional skills and basic techniques comprehensively, but also help them to master the primitive method of scientific study. What's more, graduation thesis could improve students' capability of analyzing and solving problems. Thus, all sorts of students' qualities can be developed comprehensively. Through investigations and surveys we find that the main problems of writing a graduation thesis are:1) The contradictions between the time of writing the thesis and that of job hunting makes the students have no enough time, or don't make them concentrate on the paper so that the qualities of the paper are lower than expected. 2) There is the shortage of direction of the teacher. First, there are not enough teachers, and every teacher have too many students. Secondly, the student advisers have classes and they always have their own scientific projects. So they do not have enough time to guide their students to write a graduation thesis methodically. In this case the students will not achieve the purpose of improving their practice ability and innovation capability.

4.4 Programme Design

Programme design is an efficient method of devoloping students' practical application ability, independent thinking ability, integration analysis ability and innovation ability. But students seldom contact programme design except during the practice. So, we need to improve teaching program and interlude some programme design practice activity to improve the capacity of designing courses independently.

4.5 Experiment, Social Practice and Investigation etc.

Although experiments, social practice and investigations just play as auxiliary function in practical teaching, they are an integral part of practical teaching. First, through the experiment teaching, it not only enables students to deeply understand each organ's function of human body and human movement mechanism, etc., but also strengthens the training of experimental methods and skills thus enabling students to master the scientific experiment ability and modern experimental methods. Secondly, through social practice, students can accumulate social experience, improve communication ability, understand the advantages and shortcomings of themselves and find the aim for leering later. Moreover, by organizing some particular investigations, students can understand development conditions of things you need to learn, improve and develop it according to the president conditions and reach better teaching goals.

The shortcomings mainly include:1) Laboratory equipment is not enough, and funds are deficient; 2) There are few and even less chances of social practice and investigation.

5. SPECIFIC IMPROVEMENT MEASURES OF PHYSICAL EDUCATION MAJOR

For skill curriculum practice: firstly, it enhances students' understanding of the learning process and strengthens the study of skill theory. Secondly, it is necessary that teachers should fully mobilize the

positivity and initiation of students, and appropriately let them explain skill movement or analyses its theory. Then students' leading role can come into play. Finally, teachers' comprehensive quality level should be improved. Teachers should not only require profound knowledge and solid skills, but also good expression ability and competence of knowing students by observation. Only in this way can teachers design the questions combined with realities, effectively motivate students' positivity and initiation, and give full play to students' imagination and creativity.

For educational practice: emphasize the importance of social practice to the trainees; schedule the training period; strengthen the instructions and attach more weight to the attendance, the interpretation and the summary of the courses.

ACKNOWLEDGMENT

Deepen the reform of education and arrange a proper time for students to carry out the thesis or the project. Conflicts between thesis writing and job hunting could be avoided if the former is brought ahead, through adjusting the teaching schedule, to the fresh students or sophomores. Enhance the quality of teaching team and make the best of their instructions. First, adjust the number of teachers according to particular conditions. Second, organize more academic forums and exhibitions, etc. Besides, set up various awarding systems to motivate the teachers to upgrade their academic level. For the design of curriculum: Improve the educational plans and put course-designing activities into classes. For experiment, social practice, and investigation: Invest more money in the improvement of lab facilities, offer more opportunities for students to practice or investigate, and enrich the content of the curriculum.

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The Similarities and Differences between Taijiquan and Rumba Dance Are Tested

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Abstract: International association of frequent inevitably bring mutual penetration of culture, tai chi and with Chinese traditional culture with western culture in the development of sports dance in showing their own cultural characteristics, as a cultural carrier in mutual fusion. From the perspective of the origin development of sports, the author thinks about the similarities, to provide references for the training and expression of Chinese sports dance.
Keywords: Tai chi chuan; Rumba; Reference analysis

1. INTRODUCTION

Tai chi chuan two projects related to sports dance do not look, one belongs to the traditional Chinese martial arts, and one is from the west high art, since their origins to the development of the respective exists in different time and space, based on their own law of development of its cultural connotation is more and richer [1-3]. In the 1930s, when international standard dance was introduced into China, two projects began to intersect. By the 21st century, people have begun to look at the many similarities and similarities between the two projects that exist in different space-time.

2. THE SIMILARITIES AND DIFFERENCES BETWEEN TAIJIQUAN AND LOMBA DANCE CHARACTERISTICS

Taijiquan is comfortable, and without the player's action is always in a certain range, less than vertices, at the same time, the spirit of the taijiquan movement by the spirit of acme, subject to a state of gas and natural be in harmony are an organic whole, make the movement with a pale, quiet, loose, soft, round etc. Characteristics [4]. Taijiquan technical movements are heavy shoulder, elbow, wrist, chest, back, loose waist, real abdomen, and buttocks, round crotch. This kind of action appears in the appearance of soft, soft, soft, soft and soft, the movement coordinated, the stretch, inside and outside.

The movement characteristics of the rumba dance can be summarized as: stable swing, soft medium toughness, fast and slow union [5-7]. In modern rumba shoulders should remain calm spine straight, its key lies in the hips, stressed under the natural state of swing, the swing of the hip is naturally formed in order to keep the balance of the body center of gravity, rather than deliberately. The movement of the rumba is the movement of the back of the waist and the back of the abdomen, and then the legs and legs to the middle of the body. The overall feeling is to lift the air, control the upper body smoothly, the whole body movement is coordinated, and the arm part is ceaseless freely swing.

After careful study and comparison, it can be found that there are many similarities between Taijiquan and rumba dance in terms of movement. For example, the Taijiquan is exquisite in the action to loosen into the soft, the soft, the soft, the harmonious, the harmony, the inside and the outside; With the rumba dance in the movement of the stability of the pose, soft and tough, fast combination and so on. Comparing two similarities, we can put the Taijiquan training methods for reference to the training of the rumba, such not only can be in the dance movements and make unremitting, but also to a certain extent, adjust state of mind.

Practice basic posture, rumba body as far as possible to open, not lax muscles taut, spine straight, legs firmly pegged to the floor as far as possible to keep the body upright, to achieve "open, tension, straight, vertical" requirements. However, it is not clear exactly how to "open, stretch, straighten and stand". During the practice of Taijiquan, it is found that the body posture, the smell and the status of the practitioner are detailed in the book. After carefully comparison, will find that the requirements of the "heavy shoulder drop elbow" and practice Taijiquan demands of "virtual led top strength, gas heavy abdomen, chest, back," said very similar, namely, loose and unremitting, tight and not rigid body condition:

(1) "Virtual collar strength, air and heavy tantian". The top force request is the top 100 of the head of the head is gently raised, the 100 will cave and the perineum should maintain the vertical position, namely the body is on the waist as the axis. The main part of the gas is to use consciousness to guide the breath, the qi xuxu to the belly button, always with the breath, natural and natural fit.

(2) "Breast implants". It is a posture of relaxation of the chest, the joint of the shoulder, the two sides of the shoulder, and the two ribs. The back muscles stretch with two arms and try to loosen as much as possible. At the same time, notice that the chest muscles should relax naturally and not make them nervous. Combined with what is said above, rumba practitioners can through the dance teacher taught combined with tai chi training methods, in the request body "open, stretched, straight and stand, and practicing tai chi chuan requirements of" virtual led top strength, gas heavy abdomen, chest, back ". Practice your head straight. When do the action, will contain the chest a little at the same time, guarantee the shoulder sinking, nature extend arm, back muscles to do and not frozen, loose and tight, then the body will also lengthen, keep it upright. Then use abdominal breathing to sink the breath, and find that

the whole person presses the ground very compactly, and by adjusting the rhythm of the breath, you can make the movements look more natural.

3. THE SMELL THEORY OF TAIJIQUAN CAN GUIDE THE QUALITY OF THE RUMBA DANCE MOVEMENT

Taijiquan in practice, breathing in the "qi shen tian", and "adjust the heart, pranayama, adjust body" as its exercise principle. Pay attention to the exercise of the essence of qi, focusing on the internal work, and ask the exerciser to influence the physical activity with his own mental activities, so that the inner energy will gradually form under the constant action of "the guard". As far as I can, I will try to make the best of my life. To make the breath undulate, let the shallow deep into, by the table in, dredge the meridians, tongli joint, thus achieve "empty but not empty, not empty and empty, is the vacuum; Forgetful, forgetful, forget the high state of the deficiency of god.

When practicing Lombard, breathe in rhythm. On the weak tap, inhale and pat the air, the air intake time is shorter than a pat, the airtime is more than one shot, so that the breath reaches the maximum, and can leave more extended time for the strong shooting. As the breath extends, the breath can also sink to the position of the danfield. Breathing and muscle movement, on the other hand, are the principles of the action to exhale during high and low suction, let whole people sunk down slowly, at the foot of the center of gravity will be more and more stable, no matter how fast action or complex, also should adjust breathing is very regular.

The correct adjustment of the breath is to follow the movement of the change of the breath, can make the movement more vitality, and add the dance charm. When we practice the rumba, we tend to pull the body up with the help of the inhale when the fourth body hits the straight. Take a deep breath in the fourth beat. The second half of the beat makes the exhalation motion, which combines the breathing exercise with the one with the rumba dance.

Daily training and competitions often see players trying to magnify their movements through deep breathing, but it often backfires and the breathing becomes more rapid and uneven. For tai chi, however, the exercisers do not appear to be shortness of breath, no matter how big their movements are. Tai chi pays attention to "the opening and closing," breathing "is open, is xu li", is a process of inspiratory, open is a process of breath, we can through the way of "open" to make their own motion amplification extends outward. A complete breathing process is a complete process. Its exhalation, and then the diaphragm is going down, the inner abdominal pressure is increased, the center of gravity is going to go down, and the internal pressure is going to decrease. During the performance of the dancer, as the air sinks and the center of gravity sinks, the dancer will give a feeling of body and feet firmly nailed to the floor. At the same time, because of the decrease in the internal pressure of the chest, the chest can feel very comfortable. When we were doing a large line of action, deep breath, feel stretched very tight, if we will be from the chest-exhaled gas, will feel much action body and extends outward. When you inhale, when the diaphragm rises, the inner abdominal pressure decreases, the center of mass moves up, and the internal pressure increases. If we can better study tai chi's theory of opening and closing, can better adjust the dancers to breathe in the training game, such not only can reduce the inner pressure of performers, also can make dance moves more generous coordination. Thus, if we can learn from the theory of tai chi and apply it to our dance, it will make our dancers more professional.

4. THE CHANGE OF TAI CHI SPEED (FAST AND SLOW) AND STRENGTH (STRONG AND GENTLE) ARE THE SAME WITH LOMBARD

The rhythm of Taijiquan is natural, smooth, and soothing, and the practice is mainly reflected in the grasp of the movement, the "slow", "the ebb and flow", "the weight" and "the soft". The Taijiquan stresses the static braking, the soft ke just, borrows the small force to push hard, within the force push external force, never to win by the ungraceful force. When making a fist, you need to use the mind to guide the movement, with the waist as the axis, the movement; it is dynamic, fast and slow. Its strength, its softness; its foundation, with the action of virtual reality, the reality of virtual, open combine together, combine together. fully embodies the Chinese ancient philosophy in zoology, a balance of Yin and Yang, the cycle, cycle and harmonious unification of culture.

The action of Taijiquan is based on slow motion, the so-called "soft" and "slow" are the basic features of the Taijiquan movement, and the gentle and gentle movements are ready to be sent out and thunderstruck. The contradiction between the rigid and the soft, the dynamic and the static, the virtual and the reality constitute the rhythm of the harmony of Taijiquan. Gentle and graceful movements can arouse people's aesthetic feelings and pleasant emotions, so that people can enjoy beauty, beauty and beauty.

The rumba rhythm is fast and fast. Its feet move quickly, either fast or slow, with a half shot in place, while the swing of the hips is a trot, taking a two-beat slow pace. In fact, it's three steps in three, each step is a half pat step in place, and the buttocks are continuous left and right oscillation. This movement, which is the unity of the upper, the lower, the slow and the fast, forms the distinctive rhythm of the rumba dance.

The training of lunba stepping speed is an important part of technical training. The main factors that influence the pace of learners' step speed include muscle tightening, physical tension and relaxation of alternating adjustment ability, body weight transfer and distribution ability. Muscle relaxation, foot speed will also be faster; The transfer and distribution of the center of gravity can help the strength of the main foot, and speed up the driving speed of the main foot. The alternation of tension and relaxation reflects the ability of the dancer to coordinate the body, and the coordination ability is an important factor affecting the movement speed. Quick step out to dance moves to set aside more full extension of the time, at the

same time to enhance the dance movements, thus the speed step for rumba dancers perform wonderful degree has an important influence.

Thus, practicing tai chi chuan and the requirement of the fast speed and movement on the sofe, with the required "fast speed" practice when the rumba rhythm and movement on the loose and unremitting coincides with mine. Therefore, we can learn from the fast and soft power and the control method of the combination of taijiquan when practicing Lombard.

5.THE CONTRAST BETWEEN THE TRADITIONAL CHINESE CULTURE AND THE WESTERN DANCE CULTURE IN BOTH INTERNAL AND EXTERNAL CHINESE TRADITIONAL CULTURE AND RUMBA DANCE

Taijiquan is a kind of ancient labor in ancient China that has been continuously explored, created and developed gradually through long life practice. It is deeply influenced by Chinese traditional culture, which embodies the wisdom of Chinese philosophy, the artistic conception of aesthetics, the charm of art, and the spirit of literary chemistry, which is the treasure of Chinese culture.

Taijiquan originated in zhongyuan henan -- the core region of the Yellow River culture in our country, after over time of accumulation and development, assemble the masculinity of the taihang mountains, absorbs the feminine of Yellow River, was born the Yin and Yang are complementary, and flexibility, strengthen body and prolong life of taiji boxing. Based on traditional Chinese culture, Taijiquan has absorbed both Taoism, Confucianism and philosophy, and has been involved in traditional Chinese medicine to form a unique taiji culture system.

Tai chi chuan with the various elements and components of the Oriental traditional culture, the Oriental unique way of thinking, ethics, and code of conduct, aesthetic taste, and values in tai chi chuan has centralized embodiment. Taijiquan is based on traditional Chinese culture theory, so the development of Taijiquan must be the carrier of its unique cultural characteristics.

Rumba, the term "Rumba" is a form of music and dance in the West Indies. Rumba originated in Cuba, in Africa, Chile, Spain's folk dance and the combination of music and dance of Cuba has formed the modern rumba, with Latin American enthusiasm open cultural characteristics.

Lombardy is a kind of dance that expresses the emotion of men and women, the practice requires the unity of body and mind, the expression demands emotion, action, music all three perfect fusion. The emotional expression of Lombard can be expressed as romantic entanglements, as well as grieving departure, soft dance, graceful footwork, and the flirtation with which is the expression and expression of inner feelings. The movement of rumba is swaying, sexy and charming, the pace is beautiful and love, different body posture can express different emotion. Lombard's music also has warm and sad parting, and different actions with different music can express different emotions. Rumba is the essence and soul of Latin music and dance, and the absorbing rhythm and physical expression make rumba one of the most popular dances in the ballroom.

Although tai chi and rumba produced in different countries, with different culture, belongs to category of culture, different, but both are physical sports projects, require both inside and outside and repair, harmony.

6. CONCLUSION

Because the rumba belong to foreign dance, players in rumba training in our country, draw lessons from foreign mostly are the training methods and expression, so it has been difficult with the national characteristics of sports dance. Taijiquan is one of the representative of the Chinese martial arts, in practice, after many years of cultural accumulation and practice, to bring the accumulation of sublimation. People learn their native project rather than foreign dance, based on the characteristics of the two projects found the end of the same place. in our nation's own way of learning foreign dance training ways, because both sports and art is without borders, the different is just practice. On the training methods, there are many similarities between taijiquan and rumba, which can be used for reference and we should put the rumba training methods and training methods of traditional Chinese martial arts tai chi fusion for reference, have their own training methods and expression, form sports dance with national characteristics, national is one of the world.

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The Research on Face Recognition Based on Wavelet Transform and BP Neural Network

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Abstract: Time is always cruel to take away the beauty. This paper chose photos of 100 people in two different age groups, using wavelet multi-resolution decomposition and programming software for image processing, converted into input and then take the input into the BP neural network. Wavelet transform can highlight facial features for local analysis. BP neural networks can distribute information and store in parallel. As the proportion of training set samples to the total image data set increases, the recognition rate increases with the increase of 30%-60%-90%. The final recognition rate of the software can reach 98% while checking the reliability of the model. In order to test the reliability of the model. This paper randomly select the same proportion of the test set, the recognition rate is different. The model can be used to figure out what a person looks like after a few years, or to restore a person's youthful appearance. Besides, it also has a strong generalization, and can be applied to transaction security, looking for relatives and other areas.
Keywords: wavelet transform; multi-resolution; BP neural network

1. INTRODUCTION

Face recognition is a hot research field of computer technology. It belongs to biometric identification technology, which distinguishes organisms from biological features [1-2]. For the same person, there is always a lot of similarity between young and old faces if there is no facial trauma, or surgery to change the facial features.

This paper establish a reasonable mathematical model to accomplish the following tasks.First to predict the appearance in a few years later by a person in the young faces, then to restore the youthful appearance by a man in the picture when older. There is still much room for improvement in face recognition technology, and it needs to be improved for facial recognition technology of the same person at different age[3-4].

2. EXPERIMENTAL

2.1 STUDY AREA

Face recognition is a hot research field of computer technology. It belongs to biometric identification technology, which distinguishes organisms from biological features. Biometric technology mainly refers to the identification of biometrics through human biometrics. Human biological characteristics are usually unique, which can be measured or automatically identified and verified, hereditary or lifelong invariant, so biometric authentication technology has more advantages than traditional authentication technology.

2.2 METHOD

2.2.1 WAVELET TRANSFORM

Using wavelet multi-resolution decomposition method [5-6], the image signal can be decomposed into sub image signals with different spatial resolution, frequency characteristics and directional characteristics. First, the original image is decomposed in the first two layers to form four sub images of different frequency characteristics, as shown in Fig. 1. L stands for low frequency, and H stands for high frequency.

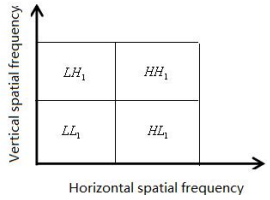


Figure 1. The sub images of different frequency characteristics

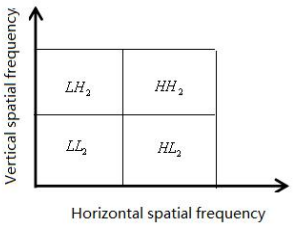


Figure 2 Two dimensional of decomposition of sub image

In the two-dimensional decomposition of second layers, according to the visual characteristics of human eyes, the decomposition of the analytic signal LL_1 is usually performed .Only when the sum of entropy of the four sub images decomposed is smaller than the entropy value of the original analysis signal, the analysis signal can be further decomposed into a new layer of analytical signals and detail signals. And the decomposition of the analytic signal LL_1 is shown in Fig. 2.

Thus, the entropy of the signal s is defined as:

$$H_{(s)} = \sum_{i=0}^{n} P_{(s_i)} \log_s P_{(s_i)} \tag{1}$$

The analysis signal LL_1 continues to decompose down to meet this condition. The Threshold is the threshold value.

$$HH_{(LL_t)} - \frac{1}{4}\left[H_{(LL_{t+1})} + H_{(HL_{t+1})} + H_{(LH_{t+1})} + H_{(HH_{t+1})}\right] > Thershold \tag{2}$$

In practice, the horizontal spatial frequency is inversely proportional to the vertical spatial frequency, and the two-dimensional spectrum of the actual luminance spectrum is a diamond spectrum as shown in Fig. 3.

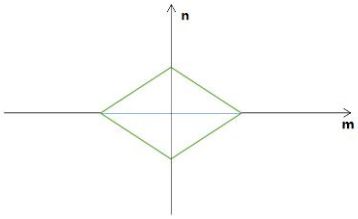


Figure 3 Two-dimensional spectrum of the actual luminance spectrum

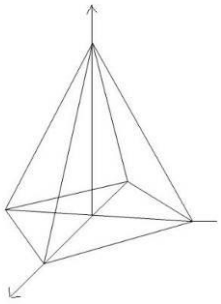


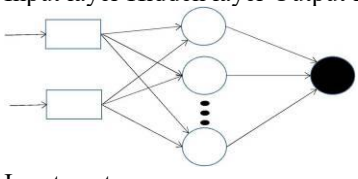
Figure 4 Two-dimensional spectrum of the actual image brightness signal

Similar to the amplitude frequency characteristic of the two-dimensional spectrum of the ideal image brightness signal, the amplitude frequency characteristic of the two-dimensional spectrum of the actual image brightness signal is rhombic pyramid shape, as shown in Fig. 4.

2.2.2 BP NEURAL NETWORK

Through wavelet transform feature selection of samples obtained by the resolution of images into vector form, eventually transformed into the form of vector as the input of BP neural network [7, 8]. The model structure of BP neural network:

Input layer Hidden layer Output layer



Input vector:

$$\vec{x} = [x_1, x_2, \cdots x_n], i = 1,2,\cdots n \tag{3}$$

Hidden layer:

$$h^{(l)} = [h^{(l)}{}_1, h^{(l)}{}_2, \cdots h^{(l)}{}_n], k = 1,2,\cdots s \tag{4}$$

Output vector:

$$\vec{y} = [y_1, y_2, \cdots y_n], j = 1,2,\cdots n \tag{5}$$

A random number that gives each link weights an interval (0,1).

$$h^{(l)} = f\left(net_{i^{(l)}}\right) \tag{6}$$

$$net_i^{(l)} = \sum_{k=1}^{s-1} W_{ij}^{(l)} \cdot h_j^{(l-1)} + b_i^{(l)} \tag{7}$$

$\mathrm{net}_{\mathrm{i}}^{(l)}$ is a layer of i neuron inputs.

For m training samples, $\{(x_1, y_1), (x_2, y_2), \cdots (x_m, y_m)\}$ p input samples and corresponding expected outputs are selected randomly.

$$d_p = (d_1, d_2, \cdots d_n) \tag{8}$$

The error function is defined using the batch update method:

$$E = \frac{1}{n}\sum_{i=1}^{n} E_{\mathrm{i}} \tag{9}$$

Training error for a single sample

$$E_{\mathrm{i}} = \frac{1}{2}\sum_{j=1}^{n}\left(d_j^{(i)} - y_j^{(i)}\right)^2 \tag{10}$$

The weights and offsets are updated at each iteration. For a single training sample, the partial derivatives of the output layer weights are obtained.

$$W_{ij}^{(l)} = W_{ij}^{(l)} - a \cdot \frac{\partial E}{\partial W_{ij}^{(l)}}$$

$$\frac{\partial E}{\partial W_{ij}^{(l)}} = -\left(d_j^{(i)} - y_j^{(i)}\right) f'_{(x)}\Big|_{x=net_j}^{b_i^{(i-1)}} \tag{11}$$

At the end of the model, the accounting calculates the global error function:

$$E = \frac{1}{2m}\sum_{i=1}^{n}\sum_{j=1}^{n}\left(d_j^{(l)} - y_j^{(l)}\right)^2 \tag{12}$$

The model is realized by using MATLAB, and the results obtained by MATLAB determine whether the network error meets the requirements. The model meets the requirements and can achieve the purpose of solving the problem.

3. RESULTS AND DISCUSSION

The question is based on the pictures of young people, who speculate on the faces of many generations, and restore their youthful appearance according to photos taken in old age. The international image database only has pictures of people with different facial expressions within the same age or even a few seconds.

Therefore, we chose to collect pictures of people in their youth and old age, 100 people, 100 sets of photos, 200 to establish an image database for

comparison, using MATLAB for image processing. [9]With wavelet multiresolution decomposition, the image is processed as follows.

Meanwhile, in order to be more specific, we selected pictures of men and women of the same age to identify.

The original images and processed images are shown in Fig. 5, Fig. 6, Fig. 7, Fig. 8. The x, y axis represents frequency information after decomposition.

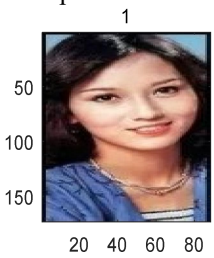


Figure 5. The original image

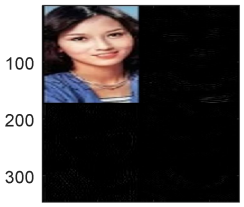


Figure 6. Processed image Figure

7. The original image

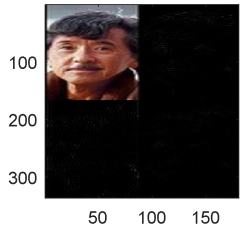


Figure 8 Processed image

Through the processed images, we could easily recognize the original image. As can be seen from the Tab.1, the greater the percentage of the training set in the total image database, the higher the recognition rate of the program. According to more young people in photos that several years later appearance, can also according to the old photos of the reduction of young people's appearance.

The input is based on the conversion of the image matrix processed image into vector form into the input layer, using MATLAB to run the program, and randomly selected training set samples from the total image database. For the results shown in Tab. 1. We also chose training set samples to detect this model, to obtain the recognition rate results as shown in Tab. 2.

Table 1 The recognition rate of different training sets

Percentage of training sets in total database	Recognition rate
30%	75%
60%	90%
90%	98%

Table 2. The recognition rate of different training sets

Percentage of training sets in total database	Recognition rate
30%	76%
60%	88%
90%	99%

We can also show the whereabouts of the activation function according to the results we obtained, and show more intuitively. The more samples of the training set, the higher the recognition rate.

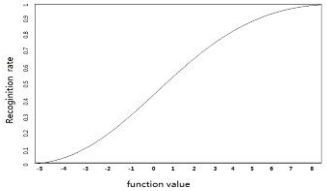


Figure 9 Activate the function position image

CONCLUSIONS

The model can be more accurate to identify people's the appearance after a number of years and restore youthful appearance, which is worthy of promotion in public security. China trafficking cases have occurred, the family can be inferred according to features in tracing, and this model could contribute to the family reunion. In terms of application performance, this model is worth popularizing.

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Application of Fuzzy Comprehensive Evaluation Model Based on Analytic Hierarchy Process in Shared Bicycle Problem

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Abstract: For the people of commute to work every day, the last mile between the subway station or bus station has been difficult to solve. A city subway and bus system is perfect, but cannot be "the last mile" problem perfect solution. The presence of a shared bicycle has solved this problem to a certain extent, however, there are still a lot of problems with the shared bicycle-operating model, and whether the current shared, cycling company model can be worth pursuing. In response to this problem, the fuzzy comprehensive evaluation model based on the analytic hierarchy process is established, the analytic hierarchy process calculates the weight of the index, and the fuzzy comprehensive evaluation model is used to solve the problem. With the help of Matlab software, taking Tangshan City as an example, the data were screened and analyzed, and the goal of sharing the bicycle model was evaluated.

Keywords: shared bicycle; Analytic Hierarchy Process; Fuzzy comprehensive evaluation

1. INTRODUCTION

Fuzzy comprehensive evaluation is a method based on fuzzy mathematics, applying the principle of Fuzzy Relation Synthesis, can be a comprehensive evaluation of some boundaries unclear, not quantitative factors. In the chemical tank, ammonia tank comprehensive evaluation involves a large number of complex phenomena and a variety of factors of interaction, and there are a lot of fuzzy phenomena and fuzzy concepts in the evaluation. Therefore, in the comprehensive evaluation, the method of fuzzy comprehensive evaluation is used to quantify the safety level of ammonia tank area, and good results are obtained [1-3]. The determination of the weight requires the knowledge and experience of the experts, has certain defects, uses the analytic hierarchy process to determine the weight coefficient of each index, and makes it more reasonable, more in line with the objective reality and easy to quantify, to improve the fuzzy comprehensive evaluation results.

2. EXPERIMENTAL

2.1 STUDY AREA

Fuzzy comprehensive evaluation is to quantify the fuzzy index (determine the membership degree)[3-5] which reflects the evaluation of things by constructing the hierarchical fuzzy subset and then use the fuzzy transformation principle to integrate the indexes.

2.2 METHOD

2.2.1FUZZY COMPREHENSIVE EVALUATION STEP

① Determine the factor domain of the evaluation object

Through our research on the market and the questionnaire survey found that the following factors are the important indicators of the development prospects of cycling, the establishment of factor set $u=\{u_1,u_2,u_3,\ldots,u_i\}$.

② Determine the level of reviews

$v=\{v_1,v_2,v_3,\ldots,v_i\}$ is a collection of level. Each level can correspond to a fuzzy subset.

③Create a fuzzy relation matrix *R*

After constructing the hierarchical fuzzy subset, we evaluate each factor from each factor, $u=\{u_1,u_2,u_3,\ldots,u_i\}$, that is, from the single factor to judge the membership of the class fuzzy membership of the membership and then get fuzzy relationship matrix:

$$R=\begin{bmatrix}R|u_1\\R|u_2\\R|u_3\\\ldots|\ldots\\R|u_4\end{bmatrix}=\begin{bmatrix}r_{11}&\cdots&\cdots&r_{1n}\\r_{21}&\cdots&\cdots&r_{2n}\\\cdots&\cdots&\cdots&\cdots\\r_{i1}&\cdots&\cdots&r_{in}\end{bmatrix} \quad (1)$$

In the matrix R, the ith row of the nth column represents the degree of membership of the v_n level fuzzy subset from the factor u_n. A judge in a factor u_n performance, is characterized by a fuzzy vector, and in other evaluation methods are mostly by an indicator of the actual value to describe, thus, from this perspective the fuzzy comprehensive evaluation requires more information.

④ Determine the weight vector of the evaluation factor

Determine the weight vector of the evaluation factor $A=(a_1,a_2,a_3,\ldots,a_n)$ in the fuzzy comprehensive evaluation:

The elements a_n in the weight vector A are essentially the membership of the fuzzy subordinate of factor u_n (the important factor for the comment).

This paper uses the analytic hierarchy process to

determine the relative importance order between evaluation indicators. Thereby determining the weighting factor and normalizing it before synthesis. Which is:

$$B = A \times R = (b_1, b_2, b_3, \ldots, b_n) \quad (2)$$

Or

$$(b_1, b_2, \ldots b_j) = (a_1, a_2, a_3, \ldots a_n) \times \begin{bmatrix} r_{11} & \cdots & \cdots & r_{1n} \\ r_{21} & \cdots & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{i1} & \cdots & \cdots & r_{in} \end{bmatrix} \quad (3)$$

Where b_1 is calculated from the nth column of A and R, It represents the degree of membership of the v_i level fuzzy subset as a whole.

5 Analysis of Fuzzy Comprehensive Evaluation Result Vector

The most commonly used method is the maximum membership principle, but in some cases, the use of some will be reluctant to lose a lot of information, or even come to the unreasonable evaluation results. A method of using a weighted average membership class is proposed and a plurality of items are evaluated and can be sorted according to their ranking.

2.2.2USING THE ANALYTIC HIERARCHY PROCESS TO DETERMINE THE WEIGHT COEFFICIENT

The steps of the analytic hierarchy process:

1 To determine the target and evaluation P factors of evaluation indicators

2 Construct judgment matrix

Judging the value of the matrix elements reflects the relative importance of each element[3], generally use 1-9 and its reciprocal scale method. However, when the importance of the mutual comparison factor can be explained by a meaningful ratio, the value of the corresponding element of the judgment matrix is taken. The judgment matrix is obtained:

$$S = (u_{ij})_{p \times p}. \quad (4)$$

3 Calculate the judgment matrix

Calculate the largest eigenvalue of the judgment matrix *S*: λ_{max}, and its corresponding eigenvector A, this feature vector is the importance of the evaluation factors, that is, the distribution of the weight coefficient.

4 Consistency test

for the consistency of the judgment matrix, consistency indicators $CI = \frac{\lambda_{max} - n}{n-1}$ are to be calculated,

Average random consistency index *RI.* It is a random method to construct 500-sample matrix, the construction method is to randomly fill the upper triangular items of the sample matrix with the scale and their reciprocals, the main diagonal of the value is always 1, corresponding to the transpose position of the corresponding position using the random number of the reciprocal. Then calculate the consistency index value for each random sample matrix, and obtain the average random consistency index *RI* value for these *CI* values on average. When the random consistency ratio $CR = \frac{CI}{RI} < 0.10$, It is considered that the result of the hierarchical analysis is satisfactory, that is, the distribution of the weight coefficient is reasonable, otherwise, the element value of the judgment matrix should be adjusted and the value of the weight coefficient should be reallocated.

Table 1. Satisfaction degree grading

Rated value	satisfaction level	grade
$x_i < 10$	Not satisfied	the first
$10 \le x_i < 20$	general	second
$20 \le x_i < 30$	Quite satisfied	third
$30 \le x_i < 40$	satisfied	fourth
$x_i \ge 40$	very satisfied	fifth

3. RESULTS AND DISCUSSION

1 The selection of influencing factors[5]

Before we select the influencing factors, we first compare the advantages and disadvantages of the operation mode of the two cycling companies (steps).

The first (real name authentication): Bicycle is rented through the mobile app to share the car, open the app[1], the first use of the user that is to enter the registration interface, after verification of mobile phone number, also set up another identity authentication, the need for real names and ID card, submitted immediately after registration to complete. Among them, except for the ID card, students in the school can upload real names and school numbers, the background to review, after passing the certification certification success.

The second (to pay the deposit): after registration in the car before the need to pay a deposit

The third (looking for a vehicle): Open the patio app, you can clearly see the nearby vehicles, using the map can quickly find the vehicle.

The fourth (unlock operation): find the car after the next step is to unlock the operation, motorcycles cycling using electronic lock sweep code open mode, scan the car can automatically unlock the two-dimensional code; ofo is manually unlocked.

The fifth (travel process): Mobai cycling is difficult to ride [4] the problem is particularly prominent, because the design of small yellow car is relatively light using the ordinary chain drive, closer to the bicycle we usually use, no additional power generation device, So riding more comfortable, people's satisfaction is higher.

Sixth (fault reporting): bicycles have provided a vehicle warranty and illegal use of the reporting path, which is very important for the cycling cycle.

Seventh (deposit refund): When you think there will be a period will not be used to share the bike can choose to refund the deposit, in the refund deposit this step, shared cycling companies have done a

quick refund.

The above seven points are the necessary steps to ride, so select the seven indicators as the influencing factors, namely real name certification, pay the deposit, find the vehicle, unlock operation, cycling process, fault declaration, deposit refund 7 indicators as the impact of sharing the bicycle Can continue to develop factors.

This model takes Tangshan City as an example to design the questionnaires by arranging students and residents in the school. The questionnaires are distributed to the respondents and let them be completed independently and examine the validity of the questionnaires. 260 questionnaires were issued, from which 200 valid data were screened and the data obtained were more realistic. The students and residents surveyed have used bicycles and bicycles.

The index system includes seven indicators, such as real-name authentication, payment deposit, search vehicle, unlock operation, cycling process, fault declaration, deposit refund, etc., which are influenced by bicycle satisfaction. 5 levels: do not care, general, care, very concerned about, very concerned about. Through the questionnaire survey, respectively, the satisfaction of each indicator whether the people favor the bike of the degree of impact as shown in Tab 2.

Table 2. Indicators of satisfaction survey data table

index	Do not care	general	care	Very concerned about	Very very concerned about	More than mind
Verified	38	43	56	38	25	119
Pay a deposit	22	37	79	51	11	141
Looking for a vehicle	10	29	46	65	50	161
Unlock operation	27	57	62	33	21	116
Cycling process	14	23	49	61	53	163
Fault declaration	19	37	62	44	38	144
The deposit is refunded	2	19	53	65	61	179

Through the analytic hierarchy process, calculate the weight of the data obtained in Tab 3.

Table 3. Weight of each indicator

Comprehensive index	satisfaction level					Weights
	Not satisfied	general	Quite satisfied	satisfied	very satisfied	
A.Comprehensive index	38	43	56	38	25	0.1128
B. Pay a deposit	22	37	79	51	11	0.1254
C. Looking for a vehicle	10	29	46	65	50	0.1632
D. Unlock operation	27	57	62	33	21	0.1072
E. Cycling process	14	23	49	61	53	0.1664
F. Fault declaration	19	37	62	44	38	0.1470
G. The deposit is refunded	2	19	53	65	61	0.1837

Evaluate the comprehensive score:

$V_A = 22.56$ $V_B = 25.08$ $V_C = 32.64$

$V_D = 21.44$ $V_E = 33.28$ $V_F = 29.4$ $V_G = 36.74$

From the above, we can see that the evaluation criteria of the evaluation tab 1[6], the individual indicators have been reached to meet the needs of cycling, so the cycle can be shared under the model sustainable development.

4. CONCLUSINS

This fuzzy comprehensive evaluation model solves the weight by using the analytic hierarchy process, and clears the weight more accurately and accurately. The results show that most of the people are "satisfied" attitude to shared bicycles, and under the general situation, the current shared bicycle model is sustainable development.

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Scheduling and Analysis of Shared Cycles

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Abstract: With the arrival of the era of "the Internet", a transportation method of sharing bicycles has got an increased attention. It is particularly important to solve the problem of scheduling the system of shared bicycles in an effort to take advantages of the resources in an effective way. Then, with the consideration of the two factors of service quality and cost, the multi-objective constraint model with the largest satisfaction of average customers is established, with the establishment of the minimum cost and the generation of scheduling scheme by genetic algorithm. In accordance with the data of riding and demand, and with the data of idled bicycles on a million people level as the evaluation index, the fuzzy comprehensive evaluation method is used to obtain the satisfaction degree of the shared bicycles in each region. And on the increase of 100 bicycles, how to better serve to explain. The established model can be applied to other leasing industries under certain conditions.
Keywords: Shared bicycle system; Multi-objective constraint model; Genetic algorithm; Optimal scheduling model; Fuzzy comprehensive evaluation

1. INTRODUCTION

In recent years, sharing of bicycles as the economy of energy conservation, environmental protection, low carbon and convenient and flexible way of green travel by the government and the community to promote [1]. It is very important to realize the balanced development of the whole system in the time and space distribution and scheduling optimization of shared bicycle. So it is of great research value and practical significance to explore and optimize the strategy of shared cycling. The data comes from the 2017 MathorCup University Student Mathematical Modeling Challenge Title B.

2. EXPERIMENTAL

2. 1 STUDY AREA

In this paper, we optimize the problem of resource scheduling for shared bikes. Firstly, we study the time and space distribution of shared bicycles. Secondly, we build the model to solve the optimal scheduling scheme of the shared bicycle, and select the appropriate evaluation index to get the satisfaction degree of the shared bicycle in each region. Finally, we add 100 to share the bike after how to put better instructions [2-5].

2. 2 METHOD

2. 2. 1 Sharing the time and space distribution of bicycles

For the riding data of the shared bicycle, we classify the data and get the maximum and minimum values (the difference = the maximum value - the minimum) in all the data. A total of 100 samples were randomly selected from the group of 1000 samples, and the sample data were obtained by analyzing each sample accurately. According to the law of large numbers, the sample can be inferred from the population. This is a problem of dynamic temporal and spatial distribution. From a certain point of departure, we discuss the distribution of vehicles arriving at different locations in different time periods. This location can be any of 1-10 locations [5-7].

According to the characteristics of the poor is divided into seven time periods 0-460, 460-560, 560-660, 660-760, 760-860, 860-960, 960 +, We randomly selected 100 sets of data to infer the distribution of vehicles. The distribution of bicycles in different regions is shown in Tab. 1.

Table1. The distribution of bicycles in different regions of different period.

Priod area	1	2	3	4	5	6	7	8	9	10
0-460	100	60	220	160	40	100	80	180	100	140
460-560	180	180	240	160	180	200	220	120	140	100
560-660	260	140	120	200	220	100	40	180	200	100
660-760	240	140	160	100	100	160	100	40	200	140
760-860	100	100	120	120	60	160	120	140	180	60
860-960	120	140	140	100	120	80	60	160	100	160
960+	200	300	320	280	260	240	320	240	140	240

According to Table 1 can be obtained Fig 1:

The histogram is a direct reflection of the number of vehicles distributed in each region at 960+ intervals, and the distribution of bicycles in each area over time can also be derived from the figure. The number of vehicles in a given period of time in each region is calculated by the sum of the columns, reflecting the degree of aggregation of the vehicle. Horizontal summation yields the number of all vehicles in different areas of a given time period, and the ratio of the number of data to the number of vehicles sought reflects the distribution density of the shared bicycle. The degree of aggregation of shared bicycles is shown in Tab. 2.

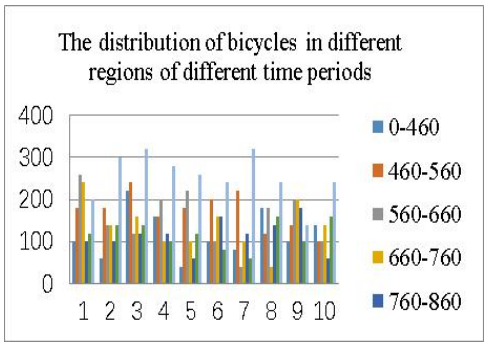


Figure1. The distribution of bicycles in different regions of different periods.

Shared cycling area in Fig 2 and Shared bicycle probability distribution in Fig3.

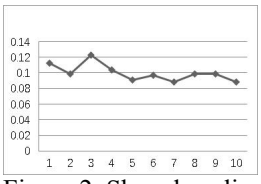
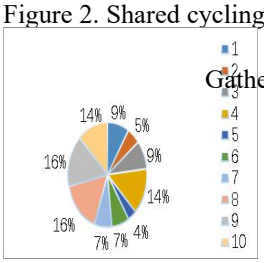


Figure 2. Shared cycling area



Gathering area

Figure 3 Shared bicycle probability distribution 2. 2.

Table 2 Cycling degree table

Degree of aggregation	0. 112	0. 099	0. 123	0. 104	0. 091	0. 097	0. 088	0. 099	0. 099	0. 088

2 Shared cycling scheduling optimization model

1) Construct the objective function.

The objective function of the scheduling model is mainly exressed by the formula

$$\text{Unit of time} = \frac{\text{Number of rents}}{\text{Unit of time}},$$

$$\text{Still rate} = \frac{\text{Number of return cars}}{\text{Unit of time}},$$ and

$q_i(T) = q_i(t_0) + \int_0^T (t)\,dt - \int_0^T \mu(t)$ constituted.

$$\max \quad S = \sum_{i=1}^{n} \rho_i S_i(t_i) \tag{1}$$

$$\min \quad Z = \sum_{i=1}^{n}\sum_{j=1}^{n}\sum_{k=1}^{m} c_{ij} x_{ijk} \tag{2}$$

formula(2)and formula(3)is the objective function of the model. Formula(2)indicating that the customer's customer satisfaction is maximized. Formula (3) indicates cost minimization. It is difficult to achieve the best of both. In order to facilitate the transformation of (2) and (3), building a new objective function.

$$MinZ' = Z - \lambda S \tag{3}$$

is a new objective function, Since $S \epsilon [0,1]$ is much smaller than Z, the transformation factor is introduced to enhance its sensitivity.

among them. ε is a constant. Set by policy makers based on experience and preferences: When the cost is paid, the value of ε is smaller; When the focus on social benefits, ε value is larger.

In summary, the objective function of the scheduling model is described in (2-1-5), and each symbol has the same meaning as before.

$$\min \sum_{i=0}^{n}\sum_{j=0}^{n}\sum_{k=1}^{m} c_{ij} k_{ijk} - \lambda s \tag{4}$$

2) Restrictions

①The carrying capacity of a shared bicycle on each dispatch vehicle is always greater than zero and less than the rated capacity of the vehicle.

$$0 \le \sum_{i=0}^{n} d_k(i) + d_k(n+1) \le Q_k \tag{5}$$

among them, $n = 0, 1, \ldots, n(k) - 1.$

②Number of vehicles participating in the dispatch(The number of vehicles starting from the parking lot) not more than m. among them,

$$i = 0 \tag{6}$$

③Vehicles are starting from the parking lot and eventually returning to the parking lot.

$$\sum_{j=1}^{n} x_{jk} = \sum_{j=1}^{n} x_{jjk} \le 1 \text{ among them}, i = 0; k = 1, 2, \ldots, m \tag{7}$$

④Flow control, that is, after the arrival of a scheduled transport service vehicle rental point to leave the lease point.

$$\sum_{i=0}^{n} x_{ijk} = y_{jk}, \text{ among them}, j = 0, 1, \ldots, n; k = 1, 2, \ldots, m \tag{8}$$

$$\sum_{j=0}^{n} x_{ijk} = y_{ik}, \text{ among them}, i = 0, 1, \ldots, n; k = 1, 2, \ldots, m \tag{9}$$

⑤The time t_j arriving at the lease point j is equal to the time at which the last lease point i is reached and the service is started

3) Genetic Algorithm Design for Scheduling Problem of Shared Bicycle Rental System.

In this paper, we use Matlab software to write algorithm. Generate the initial scheduling scheme. The specific implementation steps are as follows:

Step1:Enter the population size M, Genetic algebra m, Mutation probability P_m, Crossover probability P_c, Cost matrix c_{ij}, Leasing requirements d_i, Vehicle information and other required parameters.

Step2: The initial population is randomly generated by the coding method of the lease point and the parking lot.

Step3: Genetic algebra $G = 1$

Step4: It is judged whether or not G is greater than the pre-set genetic algebra m. If yes, turn Step10, otherwise, continue.

Step5: The objective function $f(x)$ of each individual in the population is calculated by scaling the objective function value. Calculate the fitness function of each individual:

$$\text{Fitness}(f(x_j)) = \frac{f(x)_{max} - f(x_i) + \alpha}{f(x)_{max} - f(x)_{min} + \alpha} \tag{10}$$

Where $f(x_i)$ is the objective function value of an individual. $\text{Fitness}(f(x_i))$ is the fitness function value for the individual. $f(x)_{min}$ is the minimum value of all individual objective function values in the population. $f(x)_{max}$ is the maximum value of all individual objective function values in the population. α is a positive real number and $\alpha \in (0,1)$. When the fitness value difference is large, the proportion of fitness is selected; When the fitness value difference is small, then choose to tend to compete with each other.

Step6: Use the roulette method according to the fitness value of the selection operation, select the M individuals to cross, mutation.

Step7: According to the crossover probability P_c to determine whether the cross operation. If the condition is satisfied, the sequence crossover operator is used to cross the individual in the population.

Step8: And determines whether or not to perform the cross operation based on the mutation probability P_m. If the condition is satisfied, the mutation is performed on the individual in the population by changing the mutation.

Step9: Will all the newly generated individuals and the original individual as a new population so that $G = G + 1$, turn Step4.

Step10: Terminate the operation. The individuals with the greatest fitness obtained in the evolutionary process are output as the optimal solution.

2. 2. 3 The best delivery program

We will be 10 areas as the object of study, no matter which area, sharing the smaller the idle rate of bicycles, indicating the greater utilization of shared bicycles, the supply relative to the more adequate demand. The average number of shared single vehicles per million people is, the more the supply is relative to the demand, which reflects the degree of matching of the supply and demand of the shared bicycle. Therefore, we use the shared cycling rate and shared bicycle ownership as the evaluation index to construct the supply and demand matching model, and use the fuzzy comprehensive evaluation method to evaluate the degree of supply and demand matching.

We define: Shared cycling rate is S, The number of idle single vehicles is m, The total number of single vehicles in the market is N, Million people possession is G, The total number of shared bicycle vehicles is V, Population size is ∂, therefore:

$$S = \frac{m}{N} \tag{11}$$

$$G = \frac{V}{\partial} \tag{12}$$

The first step is to determine the weight of the evaluation. Set the index set A={a1, a2}, Corresponding weight set B={b1, b2}, In order to determine the weight set, set the strength set to {very strong, strong, slightly stronger, general}, The corresponding values are 4, 3, 2, 1. It can be considered that the partial Cauchy distribution function as the membership function of the evaluation is the most realistic. The large Cauchy distribution function is as follows:

$$f(x) = \begin{cases} \dfrac{1}{1 + a(x-b)^{-2}} & 1 \le x \le 3 \\ c \ln x + d & 3 \le x \le 5 \end{cases} \tag{13}$$

In the formula, a, b, c, d are undetermined coefficients. In fact, When the intensity is "very strong", the membership degree is 1, When the strength is "strong" when the membership is 0. 6, When the intensity is "slightly strong", the membership is 0. 4, When the strength is "general", the membership is 0. 1. According to these conditions, we determine the values to be determined as a, b, c, d are 0. 1238, 2. 3723, 0. 3715, 0. 3599. And then we were a, b, c, d four factors into the equation, the various factors of the membership value and normalized values as follows Tab. 3.

Table 3 The membership value of each factor and the normalized value

index	Shared cycling rate	Million people have the amount
Assigned value	strong	slightly stronger
Membership value	0. 6	0. 4249
Normalized value	0. 6269	0. 3731

According to the normalized value we get the weight vector (0. 6269, 0. 3731).

According to the data given in the title, we get 10 areas of cycling million people and cycling idle rate as follows:

Table 4 Indicator data for each region

area	Share the number of people with bicycles (vehicles)	Shared cycling rate
1	24	41%
2	26. 7	46%
3	31	53%
4	21. 4	39%
5	15. 8	34. 5%
6	14. 6	29. 8%
7	13. 4	25. 2%
8	25. 7	43. 5%
9	29. 6	49. 3
10	30. 1	51%

Comprehensive analysis of the above table data, we come to the ideal value: The more people share the number of people in the city, the more the "supply and demand match" of shared bicycle resources is. For the vehicle idle rate, the closer to 25%, "supply

and demand match" the higher the degree. We make the above table data and the ideal value is poor, and for standardization.

$$a' = \frac{a - a_{\min}}{a_{\max} - a_{\min}} \tag{14}$$

Finally, we use the weight evaluation vector obtained by the fuzzy evaluation to evaluate the supply and demand matching in each region and we get their deviation from the evaluation score, the evaluation score closer to 0, the supply and demand match. The higher the evaluation score, the higher the satisfaction. As shown in Tab. 5.

Table 5 Matching Evaluation of Supply and Demand

area	1	2	3	4	5	6	7	8	9	10
Deviation from the evaluation score	0. 602	0. 76	1	0. 46	0. 14	0. 07	0	0. 7	0. 92	0. 95

And then put into the amount of 100 shared bicycles, According to the proportion of satisfaction, we calculated 1-10 areas were put into the amount of 11, 14, 18, 8, 2, 1, 0, 13, 16, 17 vehicles.

4. RESULTS AND DISCUSSION

1) As can be seen from the above chart, the region 3 is the region with the highest degree of aggregation. In the same period of time, the number of riders distributed in the area 8, 9 distribution density of the largest.

2) When the maximum customer satisfaction is the target, consider the appropriate increase in the number of spare vehicles. When the minimum cost of transport is the target, the shared bicycle rental system will have a high quality of service to attract the public to take green traffic, thus alleviating the problem of the city.

The more people share the number of people in the city, the more the "supply and demand match" of shared bicycle resources is. For the vehicle idle rate, the closer to 25%. When reloading 100 shared bicycles, we calculated 1-10 areas were put into the amount of 11, 14, 18, 8, 2, 1, 0, 13, 16, 17 vehicles.

5. CONCLUSIONS

We use a random sampling method to obtain the time and space distribution of shared bikes by horizontal and vertical comparisons. By analyzing the characteristics of public bicycle system scheduling problem, the dynamic scheduling model of public bicycle system with the lowest scheduling cost and the highest customer satisfaction is established. The dynamic scheduling model of shared bicycle system is solved by genetic algorithm. The experimental results are feasible. Based on the guarantee of customer satisfaction, the algorithm reduces the running distance of the dispatching vehicle and solves the problem of the lack of the overall optimization result of the system caused by the optimization of single target scheduling. It is of great significance to the shared bicycle system dispatching work. The evaluation of the degree of satisfaction of the ten locations in the 10 regions was evaluated by the sharing rate of the shared bicycles and the number of people who shared the bicycles. The improvement of the multi - level fuzzy comprehensive evaluation model can introduce the fuzzy behavior index, quantify the sub - factors of the index layer, and obtain the membership degree of each behavior index and the evaluation result by the membership function, so that the evaluation result is objective and practical. In addition, the quality of the scheduling plan depends to some extent on the exact estimation of the potential user's demand for the service point, which requires further exploration.

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Prediction of Si Element Content Based on Coal Injection and Blowing Data

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Abstract: In this study, we first analyze the index variables of four-dimensional blast furnace data and find that there is no linear relationship between the data, and the RBF neural network prediction model is established. Parameters (x1, x2, x3, x4) can be used as the input parameters of the model, and the [Si] content y is taken as the output parameter, the content of [Si] element in the molten iron at the next time (after 2 hours) and the next time (after 4 hours) was obtained by training. Using the unselected data set as the verification sample, the one-step prediction model is used to measure the accuracy of the [Si] content and the accuracy of the temperature rise and fall direction, the mean square error of the one-step prediction value of the [Si] element content and the actual value of the next moment is 0. 0087, the prediction accuracy of furnace temperature rises and fall of 97. 5%; Similarly, the two-step prediction accuracy of [Si] element content of the and temperature rise and fall direction was tested, the mean square error of 0. 0134, furnace temperature prediction accuracy up to 84%. The RBF neural network prediction model is very accurate.
Keywords: dynamic prediction of silicon content; RBF neural network; genetic algorithm; BP neural network

1. INTRODUCTION

In the iron and steel metallurgy blast furnace smelting molten iron process industry, high quality low consumption, green environmental protection and other issues are important indicators which were used to assess the best production effect. Its specific indicators such as molten iron production, energy consumption, hot metal quality and so on are related to the control of intermediate indicators - furnace temperature. In the actual smelting process, the percentage of iron [Si] element content is consistent with the change direction of furnace temperature. Therefore, the accurate predictive control modeling of [Si] elements is particularly important in the optimization and prediction of smelting process.

2. ESTABLISHMENT AND LEARNING PROCESS OF PREDICTION MODEL BASED ON RBF NEURAL NETWORK [Si] CONTENT

The radial basis function neural network is a forward network containing the input layer, the hidden layer and the output layer [1-3]. Each element of the input layer is an independent variable of the target problem. Each node in the hidden layer equivalents to the neuron, and the non-linear mapping of the elements of the input layer is made by the radial basis function. Since the transformation function of the hidden layer of the radial basis network is the Gaussian function of the local echo, the training time of the network is shorter than which of the BP neural network. The output layer of the radial basis function network is applied to the mapping result of the hidden layer, and the linear weight combination is used. The dynamic model needs to realize the [Si] content prediction, so the output result y is the silicon content of the molten iron. The structural the principle shown in Fig. 1:

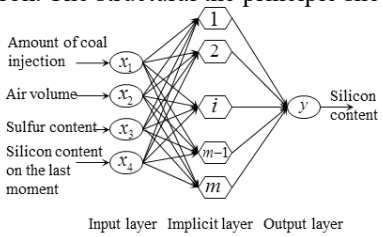

Figure 1 Radial base network diagram

According to the learning steps and algorithms of the radial basis network, and use the four-dimensional blast furnace data set, the prediction process of the RBF neural network [Si] content prediction model is shown in Fig. 2.

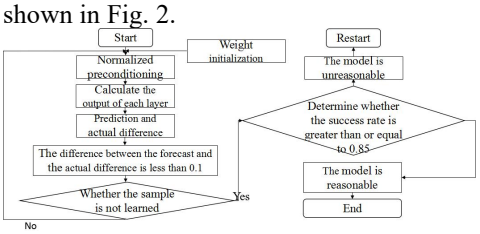

Figure 2 Predictive flow chart of silicon content prediction model based on RBF neural network

2. 1 SELECTION OF DATA SAMPLE SET

In order to achieve the goal of approximating the objective function [2], it is necessary to provide a set of reliable sample data for RBF network training learning and prediction result detection and evaluation. Among the 1000 sets of data given from the four-dimensional blast furnace data table, 1 to 800 groups were selected as learning samples and 801 to 1000 groups were used as the test samples. The maximum number of training sessions of the network

was selected as 15000, the learning rate is 0. 01, and the training precision is 10^{-8}, which is the function of the Newrbe function in MATLAB data processing software [3-7]. Since the two-step prediction is a further training on the basis of one-step prediction, the one-step prediction result can be used as the sample data selection library of the two-step prediction model.

2. 2 NORMALIZATION OF DATA

As the dimensions of the variables in the data given in the four-dimensional blast furnace data sheet are inconsistent, it's easy to lead to the the network into the sick while it's working, so the data in the four-dimensional blast furnace data table need to be normalized. The triggering function of the radial basis function neural network is Gaussian function [4], and it is necessary to ensure that the values of each node should be kept between [0, 1]. Therefore, under the premise that the law of changement is not changed, the variables that are normalized by relational formula (1) are used as the input vector values of the input layer, and the parameter values are effectively normalized.

Normalized relationship:

$$x = \frac{X - X_{\min}}{X_{\max} - X_{\min}} \tag{1}$$

Where x is the sample value after normalization, and $x \in [0,1]$, X is the initial data value, $X_{\min}$ and $X_{\max}$ are the minimum and maximum values of the initial data, respectively.

2. 3 RBF NETWORK LEARNING

Due to the transfer between the hidden neurons of implicit layers should be passed by Gaussian function, the transfer function of the network is shown in (2),

$$\varphi_i(x) = -e\frac{\|x - c_i\|^2}{r_i^2} \tag{2}$$

Where $x \in \mathrm{R}^m$ is the radial base network input; $c_i \in \mathrm{R}^m$ is the data core of the first implicit layer neurons; r_i is the constant. The weights of each neuron layer of the implicit layer are the transposed values of the input vector. The threshold is,

$$b = \frac{[1 - \log(0.5)]^{0.5}}{spread} = \frac{0.833}{spread} \tag{3}$$

Where spread is the expansion coefficient [5].

The input vector of the Gaussian function is,

$$k_i^q = \sqrt{\sum_j (\omega_{1ji} - x_j^q)} \times b_{1i} \tag{4}$$

Where x_j^q is the input vector; ω_1 is the weight vector; b_1 is the threshold.

The input value of the output layer is the weighted value of the output value of the implicit layer. Based on the corresponding relation $b_1 = 0.833 / c_i$ in the MATLAB toolbox and the linear property of the excitation function [6], the output relation can be obtained as follows,

$$y^q = \sum_{i=1}^{n} r_i \times \omega_{2i} \tag{5}$$

3. PREDICTION RESULTS

Radial Basisics neural network through learning, according to the data presented in the four-dimensional blast furnace variable data table, we can get a step prediction of [Si] element content value, the training results shown in Fig. 3.

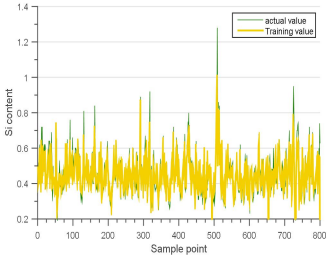

Figure 3 step prediction of silicon content training effect

It can be seen from the figure that the silicon content in the blast furnace fluctuates with time and has no monotonicity in general, and the predicted value agrees well with the actual value, which indicates that the RBF network has good training effect. The radial basis of the neural network studied again, and the two-step prediction is made by one-step prediction. The training results are shown in Fig. 4.

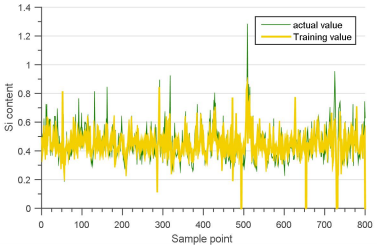

Figure 4 two-step prediction of silicon content training effect

4. [Si] CONTENT DYNAMIC PREDICTION MODEL TEST RESULTS

4. 1 DATA PREPROCESSING

Due to the rise and fall of the furnace temperature direction cannot be recognized by the RBF neural network has been learned, so the furnace temperature rise and fall direction of 0-1 quantification, the furnace temperature which has rised than the previous record time is recorded as 1, which has decreased compared with the previous temperature is recorded is 0.

4.2 [Si] CONTENT OF THE RESULTS OF THE TEST

The remaining 200 sets of data in the four-dimensional blast furnace data table were substituted into the one-step prediction model in 4. 1

to carry out the test results, and the results of [Si] content prediction were plotted, as shown in Fig. 5.

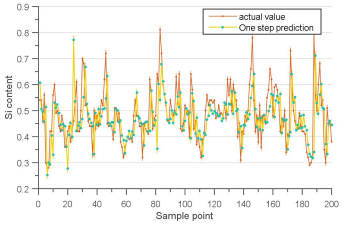

Figure 5. silicon content prediction results test

It can be seen from the figure, using the four-dimensional blast furnace data observed by the factory, RBF networks can approximate implicit nonlinear or linear relationships in the learning process, in line with the requirements of the dynamic forecasting model [7], for the actual value Very high hit rate.

4.3TEST RESULTS OF FURNACE TEMPERATURE PREDICTION

The prediction results of 80 sets of data in the four-dimensional blast furnace data table are compared with the one-step prediction model in 4. 1, and the prediction of [Si] content prediction and furnace temperature rise and fall is shown in Fig. 6.

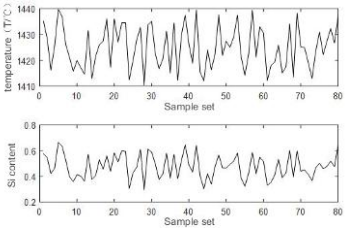

Figure 6 Si element content prediction and furnace temperature rise and fall prediction comparison

One-step prediction and two-step prediction of temperature trends and actual temperature trends are shown in Fig. 7.

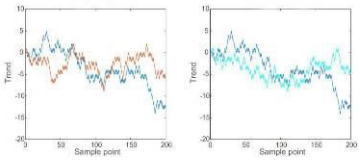

Figure 7 Temperature rise and fall trend

4.4FEASIBILITY ANALYSIS OF DYNAMIC PREDICTIVE CONTROL

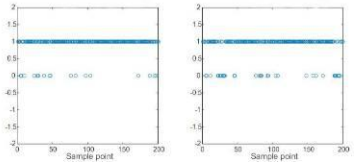

Figure 8 Si element content of the one-step prediction model, two-step prediction model error

The one-step prediction model and the two-step prediction modelof [Si] content is compared with the actual value, and the error analysis is obtained as shown above.

Obviously, the two-step prediction model is more error-prone than the one-step prediction model, and it is difficult to explain the actual situation. The [Si] content at the next moment in the model hypothesis is closely related to the individual variables at the previous time (2 hours ago), and is not significantly related to the upper time (4 hours ago).

5. CONCLUSION

It is feasible to forecast the Si element content based on the neural network using the coal injection and blowing data. The prediction accuracy of the model is high, and the relationship between the temperature, the quality of steel and the content of silicon in molten iron is in good agreement with the actual data of the four-dimensional blast furnace variables, which is in accordance with the theory of blast furnace metallurgy.

If we can collect data in many ways and increase the scope of data sets, we can further improve the accuracy and practical usability of this model, provide a feasible basis for the realization of online forecasting, and provide the theoretical basis to guarantee metallurgical enterprises' benefits.

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The Spatiotemporal Scheduling Analysis of Shared Cycles Based on Goal Optimization

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Abstract: The popularity of shared bicycles solves the problem of the last kilometer of the residents' trip. However, how to optimize the spatiotemporal scheduling of shared bicycles becomes the urgent problem what a bicycle company need to solve. In order to solve the scheduling problem of shared bicycles, this paper takes 10 districts of a town as the object of study. The goal is divided into profit income, user's satisfaction and scheduling difficulty according to the importance degree. The optimal scheduling scheme of bicycle is obtained in different time and space, and the functional area of 10 regions is deduced by using the method of multi-objective optimization.

Keywords: Shared bicycles; Spatiotemporal Scheduling; Multi-objective optimization

1. INTRODUCTION

1.1 At different times in different regions, the number of bike sharing which increase and decrease

In the absence of specific location under the premise. Investigate the increase and decrease in bicycles in ten different regions of a city in five different time periods. The statistical results are shown in the Tab. 1. [1].

1.2 INVESTIGATE THE BIKE REQUIREMENTS OF TEN DIFFERENT REGIONS OF A CITY IN FIVE DIFFERENT TIME PERIODS.

The statistical results are show in the Tab. 2.

1.3 TRAVEL TIME BETWEEN DIFFERENT AREAS

1.4 COMBINED WITH 1. 1, 1. 2, 1. 3 THREE PARTS OF THE CONTENT TO SUM UP

There are a lot of areas closer to area 8, and the number of bicycles used in Area 8 is the largest. It may be in the bustling city center. Area 1, 5, 9 is the farthest away from zone 8 and the number of bicycles to be used is small, and the area may be in the edge of the city [2-4]. The number of bicycles in area 7 is relatively large, close to the city center. The number of bicycles is stable and may be in the residential area of the town. The number of bicycles used in the area 2, 3, 6, 10 is small. And the distance between the area 9 and the other areas is different, may be the city's secondary residential and secondary functional areas. As shown in Fig. 1. [3]

Table 1 The number of bicycles used in different areas varies over time

period	Regions / Times	1	2	3	4	5	6	7	8	9	10
6~9hour	Issue	224	249	235	251	253	262	236	309	261	246
	Arrivals	200	243	233	247	242	232	240	264	244	240
9~12hour	Issue	264	271	310	308	304	272	286	327	251	279
	Arrivals	267	251	314	302	309	293	280	331	271	273
12~15hour	Issue	222	234	239	253	245	275	250	232	248	233
	Arrivals	229	250	223	245	226	281	247	253	247	246
15~18hour	Issue	162	187	175	176	180	198	182	193	184	185
	Arrivals	177	191	180	185	189	180	181	197	182	188
18~21hour	Issue	130	157	132	206	134	123	137	147	122	149
	Arrivals	118	160	140	126	125	138	141	154	123	160

Table 2 Urban residents share bicycle demand table

Start area \ End area	1	2	3	4	5	6	7	8	9	10
1	0	240	119	123	145	126	115	127	112	102
2	135	0	225	129	120	126	139	127	121	140
3	125	132	0	251	110	117	126	137	158	126
4	116	115	148	0	261	144	132	141	124	119
5	128	133	124	116	0	273	138	120	103	132

6	158	128	143	140	144	0	244	132	140	116
7	129	140	125	146	135	138	0	237	116	135
8	134	168	145	134	142	139	145	0	244	128
9	105	122	129	138	123	143	114	119	0	237
10	138	108	131	136	121	113	144	243	134	0

Table 3 The time from one area to another

Start area	Within 6 minutes	6 to 12 minutes	More than 12 minutes
1	-	2, 4, 5, 6, 7, 8, 10	3, 9
2	3, 4, 9	1, 7, 8, 10	5, 6
3	2, 6, 8	5, 10	1, 4, 7, 9
4	2, 5, 6, 8, 9	1, 10	3, 7
5	4	1, 3, 6, 7, 10	2, 9, 8
6	3, 8, 9	1, 2, 4, 5, 7	10
7	6, 8	1, 2	3, 4, 5, 9, 10
8	3, 4, 6, 7, 10	1, 5, 9	无
9	2, 4, 6, 10	-	1, 3, 5, 7, 8
10	8, 9	1, 2, 3, 4	5, 6, 7

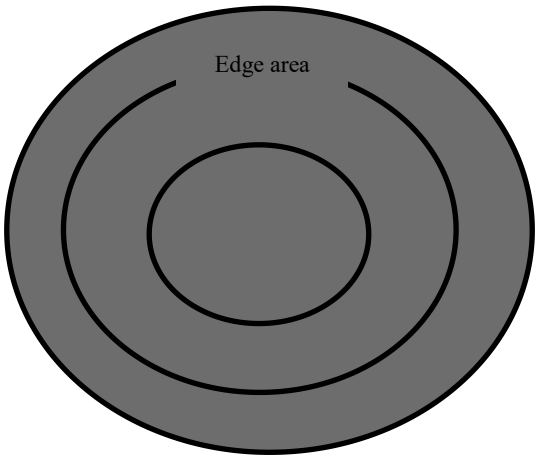

Figure 1 The distribution of different regions in the city

2.MULTI-OBJECTIVE PROGRAMMING MATHEMATICAL MODEL

2. 1 DEFINITION OF VARIABLES

s stands for departure;

c stands for area code, indicates 10 areas;

g stands for destination; d indicate the code of the time period, represents five time periods;

a_c^{all} stands for the daily net increase in the number of bicycles from 0:00 to 24:00 in the area c;

a_c^{all} stands for the net increase in the number of bicycles at the period d in the area c;

$x_{c,d}$ stands for the number of bicycles in the area c at the beginning of the period d;

$n_{c,d}$ stands for the demand for bicycles at the period d in the area c;

$s_{c,d}$ stands for the number of bicycles departure at the period d in the area c;

$g_{c,d}$ stands for the entry number of the bicycles at the period d in the area c.

2. 2 THE ESTABLISHMENT OF THE MODEL

2. 2. 1 SELECT THE TARGET

The goal 1: Get a higher profit

Bicycles are charged for 5 to 20 minutes per ride. Therefore, a limited number of bicycles must have a high utilization rate in one day (one-time period) to get a higher profit.

The goal 2: Improve customer satisfaction

It's helpful to improve customer satisfaction to provide users with convenience. The convenience of the user is mainly reflected in the cycle of a certain time, a region on the relationship between supply and demand.

The goal 3: Reduce the cost of scheduling

Due to the different needs of users in different regions, the number of bicycle distribution in different regions will change every day. If not timely adjustment, it's will make the shared bicycle transport network out of balance. Therefore, the number of bicycles distributed at the end of each day is as close as possible to the number of bicycles in the early days of the next day to reduce the company's loss on the schedule. [4]

2. 2. 2 AIMS FUNCTION

The goal 1: Get a higher profit: with the optimization factor p_1;

The goal 2: The degree of stability supply and demand: with the optimization factor p_2:

The goal 3: The degree of stability of the number of bicycles at the beginning: with the optimization factor p_3.

The assignment of the optimization factor (decision makers can decide subjectively):

$$p_1 = 0.4; p_2 = 0.35; p_3 = 0.25;$$

$$Minz = p_1 \times d_1^- + p_2 \times d_2^+ + p_3 \times \left(d_3^+ + d_3^-\right) \quad (1)$$

2. 2. 3 RESTRICTED CONDITION

$$s.t.\begin{cases} \sum_{c=1}^{10} x_{c,1} \le 1000 \\ \sum_{d=1}^{5}\sum_{c=1}^{10} \min\left(x_{c,d}, n_{c,d}\right) \times s_{c,d} + d_1^- \le A \\ \sum_{d=1}^{5}\sum_{c=1}^{10} \left| \frac{n_{c,d} - x_{c,d}}{n_{c,d}} \right| - d_2^+ = 0 \\ \sum_{c=1}^{10} \frac{a_c^T}{x_{c,1}} + d_3^- - d_3^+ = 0 \end{cases} \tag{2}$$

Condition 1: Hard constraint, the total number of bicycles should not exceed 1000;

Condition 2 : The number of bicycles used per day is no more than the total daily demand N in each region;

Condition 3 : The user demand $n_{c,d}$ and the number of bicycles $x_{c,d}$ difference as small as possible;

Condition 4 : The net increase in the number of bicycles is as small as possible at the beginning of the first period after a time period T in the area c.

2. 3 THE SOLUTION OF THE MODEL

2. 3. 1 THE VALUE OF EACH QUANTITY IN THE MODEL

$x_{c,d}$ stands for unknown quantity, the iterative relationship is as follows:

$$x_{c,2} = x_{c,1} + a_{c,1}$$

$$x_{c,3} = (x_{c,1} + a_{c,1}) + a_{c,2}$$

$$x_{c,4} = ((x_{c,1} + a_{c,1}) + a_{c,2}) + a_{c,3}$$

$$x_{c,5} = (((x_{c,1} + a_{c,1}) + a_{c,2}) + a_{c,3}) + a_{c,4}$$

$x_{c,1}$ unknown;

$x_{c,2} = x_{c,1} + a_{c,1}; x_{c,3} = x_{c,2} + a_{c,2}; x_{c,4} = x_{c,3} + a_{c,3}; x_{c,5} = x_{c,4} + a_{c,4}$

$s_{c,d}^T$: The number of bicycles issued at the period d in the area c:

$$s_{c,d}^T = \begin{bmatrix} 224 & 249 & 235 & 251 & 253 & 262 & 236 & 309 & 261 & 246 \\ 264 & 271 & 310 & 308 & 304 & 272 & 286 & 327 & 251 & 279 \\ 222 & 234 & 239 & 253 & 245 & 275 & 250 & 232 & 248 & 233 \\ 162 & 187 & 175 & 176 & 180 & 198 & 182 & 193 & 184 & 185 \\ 130 & 157 & 132 & 206 & 134 & 123 & 137 & 147 & 122 & 149 \end{bmatrix}$$

$g_{c,d}^T$:The number of bicycle income at the period d in the area c:

$$g_{c,d}^T = \begin{bmatrix} 200 & 243 & 233 & 247 & 242 & 232 & 240 & 264 & 244 & 240 \\ 267 & 251 & 314 & 302 & 309 & 293 & 280 & 331 & 271 & 273 \\ 229 & 250 & 223 & 245 & 226 & 281 & 247 & 253 & 247 & 246 \\ 177 & 191 & 180 & 185 & 189 & 180 & 181 & 197 & 182 & 188 \\ 118 & 160 & 140 & 126 & 125 & 138 & 141 & 154 & 123 & 160 \end{bmatrix}$$

The number of net growth in bicycles at the period d in the area c $a_{c,d}$:

$$a_{c,d} = g_{c,d} - s_{c,d}$$

The number of times a daily bicycle is used:

$$A = 12843$$

The data in Tab 2 is converted into a matrix form, assigned to $n_{s,g}$:

The proportion of cycling needs at the period d in the area c $p_{c,d}$:

$$p_{c,d} = \frac{5 \times s_{c,d}}{\sum_{d=1}^{5} s_{c,d}} \tag{3}$$

$p_{c,d}$ obtained by Equation 6, according to the use of the ratio is divided into five sub-access requirements matrix:

$f_{s,g}$ indicates the number of bicycles required for the first period from the departure point s to the arrival ground g: $n_{s,g} \times p_{c,1} = f_{s,g}$

$s'_{s,g}$ indicates the number of bicycles required for the second period from the departure point s to the arrival ground g: $n_{s,g} \times p_{c,2} = s'_{s,g}$

$t_{s,g}$ indicates the number of bicycles required for the third period from the departure point s to the arrival ground g: $n_{s,g} \times p_{c,3} = t_{s,g}$

$f'_{s,g}$ indicates the number of bicycles required for the fourth period from the departure point s to the arrival ground g: $n_{s,g} \times p_{c,4} = f'_{s,g}$

$f''_{s,g}$ indicates the number of bicycles required for the fifth period from the departure point s to the arrival ground g; $n_{s,g} \times p_{c,5} = f''_{s,g}$

The number of cycling needs at the period d in the area c:

$$n_{c,1} = \sum_{g=1}^{10} f_{s,g}(s=i); n_{c,2} = \sum_{g=1}^{10} s_{s,g}(s=i);$$

$$n_{c,3} = \sum_{g=1}^{10} t_{s,g}(s=i); n_{c,4} = \sum_{g=1}^{10} f'_{s,g}(s=i); n_{c,5} = \sum_{g=1}^{10} f''_{s,g}(s=i);$$

2. 3. 2 OUTPUT THE RESULT

See Tab. 4, Tab. 5

$$x_{1,1} = 54, x_{2,1} = 135, x_{3,1} = 92, x_{4,1} = 152, x_{5,1} = 100$$

$$x_{6,1} = 56, x_{7,1} = 136, x_{8,1} = 168, x_{9,1} = 93, x_{10,1} = 46$$

$$d_1^- = 33, d_2^+ = 1.834, d_3^+ + d_3^- = 2.566$$

Table 4 Optimization of Cycles in Different Regions

Area	1	2	3	4	5
The number of bicycles that should be served at time scale 0	54	135	92	152	100
Area	6	7	8	9	10
The number of bicycles that should be served at time scale 0	56	136	168	63	46

Table 5. Target completion

The goal 1: The largest frequency of charges: $y = A - d_1^-$	12811
The goal 2: The Positive deviation of the degree of stability supply and demand d_2^+	1. 834
The goal 3: The sum of positive and negative deviations: $d_3^+ + d_3^-$	2. 566

2. 3 RESULT ANALYSIS

According to the results of the optimization model, the number of bicycles allocated in eighth regions and fourth regions was 168 and 152 respectively. The number of both of them is in the top two of the deployment. It shows a large number of people flow and complex traffic environment in the region, which is consistent with the conclusion that the 8, 4 regions is in the center of the town in the inferential statistics.

The first area, the sixth area, the ninth area, the tenth area should be deployed vehicles were 54, 56, 63, 46. Their number is the least. The first area and the ninth area are in the urban fringe area, the distance is far, the staff is small. The number of bicycles should be deployed at least in the data statistics inference. Because the sixth area and the tenth area of the bicycle transmission and distribution ratio stable, the ecosystem is running well without the need to manage, and the transmission and distribution of vehicles in the residential area. It can be further inferred that the sixth area and the tenth region in the town of the secondary residential area.

The second area, the third area, the fifth area, the seventh area should be deployed vehicles about 100, and their number is moderate. It can infer that the seventh region is the main neighborhood and the second region, the third region, the fifth region belongs to the urban secondary area. The number of the second regional deployment of bicycles is similar to the urban secondary zone. It reflects that the number of bicycle revenue and expenditure ratio and the stability of the characteristics.

4. CONCLUSION

The optimization scheme of bicycle's number at 0 moments in different regions derived from mathematical model of Multi-Objective Programming. It can meet the needs of cyclists in different regions to the greatest extent, with the most profitable premise, and the number of bicycle deployed after a cycle can be minimized. This distribution can be extended to the use of similar circumstances in these ten regions of the shared bicycle scheduling problem.

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Development of Yingshan South of Wudang Martial Arts Culture Market under the Background of New Policy Supply-Side Reform

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Abstract: By means of literature review and interview survey, this paper studies how to develop the Yingshan South of Wudang Martial Arts cultural market under the new policy of supply side reform. The purpose is to provide a theoretical basis for the development of Yingshan South Wudang Martial Arts cultural market. This article through the interpretation of the supply side reforms of the new deal and break the Yingshan South Wudang Martial Arts value, the development of the Yingshan South Wudang Martial Arts cultural market, should take deep excavation of South Wudang Martial Arts cultural tourism resource, make good use of South Wudang signs. Improve the quality of South of Wudang Martial Arts culture, draw lessons from other martial arts cultural market development experience. Meet the diverse needs of tourist's measure conclusion. This is to not only carry forward the South of Wudang martial art, but also play a positive role in driving the development of the culture market industry.
Keywords: Supply-side reform; Yingshan South Wudang; martial arts culture; market development

1. INTRODUCTION

The report of the 18th national congress of the communist pointed out that accelerating the transformation of the mode of economic development, so that the cultural industry has become a pillar industry of the national economy [1]. In January 26, 2016 the central financial work-leading group of the Twelfth Meeting, general secretary Xi Jinping stressed that the fundamental purpose of the supply side structural reform is to improve the level of social productivity, implement the development thought of taking people as center. Under this background, the Yingshan South Wudang should be in accordance with the supply side of the new deal reform policy, enhance their brand culture, and strengthen the formation and promotion of South Wudang Martial Arts system, to promote the development of martial arts Culture in Yingshan market. But at present, in China's economic system reform and political system reform imbalance, the unbalanced, uncoordinated and unsustainable development, innovation ability is not strong, the unreasonable industrial structure problem, etc. , in regard to the development of the Yingshan South Wudang martial arts cultural market, was particularly outstanding. In order to solve these problems, we must keep pace with the times, and we must seek them from the development of the South of Wudang cultural market under the new policy framework of the state supply side.

2.SUPPLY-SIDE REFORM NEW POLICY INTERPRETATION

Nowadays, "relying on domestic demand, especially consumer demand", "[1]" to "develop cultural economy and build economic culture" [2], is one of the important tasks of China's socialist economic construction. The reform policy of the supply side is the countermeasure to this goal. The supply-side reform is from the point of improving supply quality; promote structural adjustment by way of reform. the correction factor allocation distortion, expand the effective supply, improve the supply structure of the changing needs of adaptability and flexibility, improve the total factor productivity, to better meet the needs of the masses, and promote the sustained and healthy economic and social development. Supply-side reform means to promote economic development by freeing up productive forces and improving competitiveness. Under this background, the Yingshan South Wudang martial arts, to give full play to their own advantages, through the creation of high quality of martial arts market supply to meet consumer demand, in order to improve the martial arts culture market, the release of industrial value.

3.THE VALUE OF YINGSHAN SOUTH OF WUDANG MARTIAL

In Tai chi, Xing Yi Quan, Eight diagrams Palm as the main body of the Wudang martial arts, martial arts experience innovation, enrich the accumulation of deep, eventually forming a large Chinese martial arts school, Wudang, known as the "North of Shaolin, South of Wudang", has important historical value.

In 2002, You Xuande adhering to Sanfeng founder's "five hundred years will open the South pulse" teachings, came to Wujia Mountains of Yingshan County, created a Taoist shrine in the South Wudang Mountains, continue to carry forward the Wudang martial arts, started a new situation of the inheritance and development of Wudang martial arts. South of Wudang was sited selection Wujia Mountains of

Yingshan County, is the result of careful consideration. Wujia Mountains of Yingshan County as a green pearl in Central China, a post peak day. the waves, the flying cloud of mist, on Wudang Wu's practice of great momentum, richly endowed by nature, great and momentum, not only on the cultivation of Wudang Wu's advantage with richly endowed by nature; but also fully embodies the inaction of Taoism, contains the Wudang Martial Arts of self-cultivation as follows.

Yingshan South Wudang Martial Arts exercises, to health care for self-defense purposes, not only has nature adoration not yet advocating force, art is good for strength, conquering the unyielding with the yielding, win by striking only after the enemy had struck, lengthen one's life, and get rid of illness, wisdom and other features. but also has the distinctive characteristics of the Taoist culture, is a natural combination of military accomplishment and health care. Not only has the profound cultural heritage of traditional martial arts, but also contains profound scientific truth.

4. MEASURES FOR DEVELOPING YINGSHAN SOUTH WUDANG MARTIAL ARTS CULTURAL MARKET

4.1 Deep excavation of South Wudang Martial Arts culture tourism resources

"For modern society, the traditional culture is a historical heritage, is an important component of the whole national culture and an important symbol of the existence of the whole nation." [3]The depth of excavation of South Wudang Martial Arts cultural tourism resources, pay attention to the characteristics of diversified products, the South Wudang Martial Arts as Yingshan tourist scenic spots to development and construction, eventually build a set of tourism, leisure, entertainment, sports, summer, skill in one of the martial arts market.

4.2 Make good use of South Wudang signs

"Market economy era, commodity wrestling, brand strategy is outstanding [4]." In the development of Yingshan South Wudang Martial Arts, during the same period, should make full use of the "South Wudang "this "gilded signboard", Wudang is equal to Shaolin in the long historical and cultural River, film and television works and frequent mention of Wudang culture and martial arts, high visibility. The Wudang Mountain is southern pulse of Wudang Mountain, can further develop Wudang Martial Arts cultural market in the vast central china. Make good use of "South Wudang "signs, combined with regional advantages, is a necessary means of development.

4.3 improve the quality of South of Wudang Martial Arts culture

In the supply side of the new policy reform background, development of Yingshan Wudang martial arts, it is necessary to emphasize the supply quality of Yingshan South Wudang Mratial Arts culture. This is to excavate and arrange the South Wudang Martial Arts culture, construct the system of Yingshan South of Wudang Martial Arts cultural system; the two is to rely on the Wujia Mountains central China Green pearl, borrow good tourism resources the development of Yingshan Wudang Martial Arts cultural market.

4. 4 Draw lessons from other Wushu culture market development experience

Yingshan South of Wudang started late, and its martial arts market has not yet formed. The development of Wudang Martial Arts cultural market can learn from the successful development experience of other martial arts culture market. Draw lessons from other martial arts culture market development experience, can walk a lot of detours, but pay attention to develop own characteristic, develop belong to the South Wudang mark of martial culture market.

4.5 Meet the diverse needs of tourists

"Tourism is an active and healthy lifestyle", [5], tourism leisure is a group choice for people to seek physical and mental health and improve their humanistic quality. The development of the cultural market should meet the diverse needs of tourists. Reform of the supply side does not mean that we completely ignore the demand side, but the supply side has changed, we must pay more attention to the demand side. The development of Yingshan South Wudang Martial Arts cultural market can provide different consumption for different groups of people, such as young people can carry out learning, athletic project, youth can carry out academic exchanges such as travel, martial arts folk culture tourism projects, in the elderly can carry out health care and health promotion activities etc.

5. CONCLUSION

The development of Yingshan South of Wudang Martial Arts to the present day, it is difficult to improve the skills, so the level to consider is mainly to improve its martial arts culture and its supporting industrial system. In the background of supply-side reforms, the development of Yingshan South Wushu cultural market is an advantage, if you can get the appropriate development, not only can promote the development of Yingshan county economy, but also to the central region of China to provide market development of Wushu culture paradigm.

We believe that the supply side reforms under the background, the development of Yingshan South Wudang Martial Arts culture market, should take deep excavation of South Wudang Martial Arts cultural tourism resource. Make good use of South Wudang signs. Improve the quality of South Wudang Martial Arts culture, draw lessons from other martial arts cultural market development experience. Meet the diverse needs of tourist's measure, which not only has positive significance of carry forward South Wudang Martial Arts. In addition, it has a positive

effect on the development of the local economy of Yingshan County.

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Research on Integrating Chinese Elements into Sports Dancing Works

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Abstract: This article made an intensive study of Sport Dancing works in the process of integrating Chinese elements with the methods of document research and logical analysis, which found that the Chinese elements like traditional music, clothing, props, and themes with Chinese characteristics are the key point to the development of Sport Dancing in China. Our country should promote the career of Sport Dancing by strengthening the study and integrating Chinese elements to provide theoretical basis to the works with Chinese characteristics.
Keywords: Chinese elements; Sport Dancing works; integrating

1. INTRODUCTION

Sport Dancing is a kind of sports that promotes people's social etiquette. Besides, it is recreational and competitive, which is a comprehensive discipline involving musicology, sports science, discology and theory. At present, our Chinese people dance in a musical milieu with western symphony in the high-level competition both at home and abroad so that they are easily limited by its inherent European and American culture [1]. It is obvious that Chinese people's understanding of sport dancing only stays in the stage of imitation and appreciation. The dialectical view and methodology in Marxism tell us that things change constantly and we are sure to reach the innovation stage after the long-term imitation stage [2, 3]. We inject fresh elements into sport dancing for foreign advanced culture in order to maintain its strong vitality in China. Therefore, the beginning point of the problem is to integrate the elements like Chinese national music, clothing, and culture into the Sport Dancing to make works with Chinese characteristics.

2. THE ANALYSIS ON INTEGRATING CHINESE ELEMENTS INTO SPORT DANCING WORKS

Chinese elements are the cultural achievements reflecting humanism and folk-custom with Chinese characteristics that are formed gradually in the process of integration, evolution and development during Chinese history, which are created and inherited by Chinese people. Chinese elements, including tangible symbols and intangible spiritual content, are the essence of traditional Chinese culture.

A series of outstanding Ballet works show the sanitization mainly from the aspects of props, language, clothing and music during the process of creation. That the beauty of the traditional Chinese shadowboxing (tai chi chuan) is integrated into the Sport Dancing makes new idea to its development. The Sport Dancing works integrated with Chinese elements are created from three aspects: dancing music, dancing costumes and themes. In a word, the sinicization of Sport Dancing is to create works combining Chinese traditional music, costumes and themes together under the premise of meeting basic requirement of Sports Dancing music beat and clothing.

Chinese elements are integrated in the creation of Sport Dancing works, and that needs the creative thinking. Professor Zhang Ping, director of the International Standard Dance Department of the Beijing Dance Academy, summarized the basic characteristics of the international standard dance performance as. It is based on modern dance or Latin dance, absorbing the elements of the other dancing forms to create a variety of themes and forms of the art works. International standard dance art performance shows social phenomena and human psychological activity directly or indirectly. Therefore, the diverse factors of the Sports Dancing performance show the importance.

As Table 1 shows that, the Sports Dancing in China is committed to the development of their own. From the major performances in the opening ceremony of the domestic association, we can clearly see that Chinese elements are integrated into the form of the artistic expression of Sports Dancing. The couple dance performance in the opening ceremony held by CEFA in Wuhan in May 2017 is based on the plot of the TV drama Red Sorghum, which is very popular in China. Besides, the music is the theme song of the drama, jiu er, to exaggerate the atmosphere. As to the costumes, the clothes in the Republic of China era is to portray the characters. Rumba is perfect on showing the love between couples so that the theme of the dancing works can be expressed to hit the spot, also, the Chinese elements helps a lot. Overall, the origin of art is different, but the development and the inheritance of art can be the duty of the whole world. Committing to the development of our own is the key point to keep the Chinese dancing field everlasting, as Table 1 shows.

Table 1 Chinese elements in the performing dance of the opening ceremony in Wuhan since 2016

association	type	music	costume	theme

WDC	Paso Doble	*The spirit of Chinese army*	military uniform	Peace and war
WDSF	Waltz	*The chill*	Modern clothing	Chinese classical Xian Xia
CBDF	Rumba	*jiu er*	Classical dancing clothing	Love and hatred
	Tango	*The night before*		
CEFA	Cha Cha Cha	*A Smile is Beautiful*	Xian xia costume	Love
	Rumba	*Beauty no more*		Sorrowful parting
	Jive	*Opposite girls sight*		

2.1 The integration of the traditional music

The speed and the beat of the Sports Dancing music has a normative. To integrate the Chinese music into the Sports Dancing works, you must find the traditional music, which meets the requirement of Sports Dancing music, or make some change to conform to it.

Chart 1 shows that the theme songs of the Chinese TV drama are always applied as the background music of Sports Dancing works. For example, the Vienna Waltz named Life after Life in the opening show held by WDSF in 2017 used the theme song The Chill of the drama Life after Life, Blooms over Blooms. During the CBDF association tour (Wuhan), the rumba in-group A of the 10-year-old used the theme song of the Mystic 9 as the background music. The whole field was full of the Chinese traditional elements, which aroused national spirit of the judges and audience. To integrate the Chinese elements such as the theme song of the popular TV drama into the creation of the Sports Dancing works can make the audience feel the real Chinese style rather than the exotic style.

2.2 The integration of clothes and props with Chinese features

China and western countries differ in many aspects like etiquette and cloth. Based on original style, we introduce Chinese elements to adapt the clothes of sports dancing. That means Chinese features are integrated into sports dancing works by clothes. The requirements of male clothes in sports dancing are as follows. The Modern Dance requires tailcoat, modern shoes and black socks while The Latin Dance requires Latin clothes, Latin shoes and black socks. There are the requirements of female clothes. The Modern Dance requires modern dress, modern shoes and white socks while The Latin Dance requires Latin shoes, Latin clothes and stockings (non-essential). The clothes of sports dance are much different from our traditional clothes. As Chinese culture is implicit, our clothes have the same style. However, foreign sports dance is to show the beauty of muscle line, so their clothes are thin. Therefore, when we adapt sports dance, we can introduce cheongsam and clothes in period of Republic of China. That will help us show Chinese features in works, affect national complex, enable sports dance more likely to be accepted by Chinese people and make Chinese players more representative in competition. In the year of 2017, the cloth style of sports dance transforms largely, which is sown by the fact that female clothes represented by Chinese cheongsam are gradually designed and be loved by many female dancers. In 2017's CBDF tour in Wuhan, the 8-year-old Latin group, who drew lessons from Juicer's clothes in the work of Red Sorghum, marked with Chinese features in sports dance.

Table 2 The Heichi group Latin dance with Chinese elements in competition from 2010--2016

Year	Nationality	The name of work	Rank
2010	China. Mingling Dance School	*Jasmine Flower*	The third winner
2011	China. Guangzhou Art School	*Dance of the Wind*	The first winner
2013	None	None	None
2014	The united states	*Europa Capitano*	The first winner
2015	None	None	None
2016	China. Beijing Dance Academy	*To Live*	The second winner

From Table 2 above, we can see there are Chinese team and American team, which means the American team, refers to Chinese clothes. In the trend of world culture, we must learn from each other make inclusive inheritance, which is the mainstream of world culture. Take the work To Live as an example. It was adapted and played by students and teachers by Beijing Dance Academy. On the theme of Syria war, they chose clothes with style of Republic of

China, with reference to Chinese tunic suits and cheongsams, which prevailed in war in the Republic of China, Anti-Japanese War and Civil War. This will make dance more representative by integrating Chinese features into dance clothes.

2.3 The integration of culture theme with Chinese features

There are 10 kinds of dance in international standard dance and each of them has its own charm. When different emotion is injected in different dance, works with unique features will be created. The dance with slow rhyme like Rumba, Waltz and Vienna Waltz should be used to express the theme of love, feminine beauty and sad parting; The cadence dance like Paso Double and Tango should be used to express serious theme; The dance with obvious rhythm and light steps like Foxtrot, Cha-cha-cha and Jive should be used to express happy theme; To express ardour style, we can choose Samba or Jive. In the process of adaption, we can introduce dance with pleasing style like Quick Step and Jive to enliven scene atmosphere. Overall, the principle of international standard dance is that as long as dance type is correspondent with dance theme, you can choose any one of them to express theme, tell your story and outlet for feelings. That is to say, the choice of dance type is not limited. The Chinese traditional culture is broad and profound and national tradition is even long-standing. Therefore, it is elegant to tell stories of Chinese culture with sports dance by drawing materials and defining work theme from them.

As dance works contain emotions, we adapt sports dance with Chinese elements and show a Chinese story to express Chinese spirit. The sports dance expresses emotions by dancers' performance after intercepting a fragment of a story. In chart 1, the dance for opening ceremony of WDC competition adopts national emotion of Anti-Japanese War. On the theme of ontology language of sports dance, the performers who have appropriate makeup express Chinese people's spirits by setting up the war's background, using specific equipment's, clothes, music and actions. The adaption of sports dance, in the premise of Chinese theme, is to convey our spirit with a story (dance works with multiple themes and forms). Sports dance are to show social phenomenon and people's psychology and to represent Chinese culture with body language.

3. CONCLUSION

The Sports Dancing work with Chinese characteristics is created mainly from three aspects: costume, music and theme. Based on Chinese traditional history and culture, mixed with traditional music and national costumes, the Chinese-style Sports Dancing will be more charming. Cultural heritage and inclusiveness make all of this possible; also, it is the trend of today's Sports Dancing and the very important unstoppable process. Only in this way can the Sports Dancing be further. Under the opportunity of globalization, we should seize the connotation of the traditional culture of our country, take the road of Chinese-style Sports Dancing, and elevate the national culture to a higher level. Through the Sports Dancing, people can see more works with Chinese characteristics so that they can see the charm of traditional Chinese culture and understand the real China.

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Comprehensive Evaluation of the Current Mode of Shared Bicycle

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Abstract: Since the implementation of bicycles since the implementation of negative news, its business model seems to be difficult to predict the current pattern of shared bicycles can continue to Shanghai, for example, according to the needs of residents, sustainability, the future pattern of three areas were studied. Travel time and cost are the main factors that affect the residents travel, according to previous year data to establish a linear regression model and gray prediction model to predict the 2016 public travel time and per capita GDP ratio, according to the real value of 2016 comparison can be seen shared bicycle Meet the corresponding market demand. The establishment of fuzzy hierarchical comprehensive evaluation model, analysis of the mobile of the operation of the class, the mobile of and ofo occupy more than Beaching market share, shared cycling company model can continue. The establishment of hierarchical model analysis of the shared bicycle company in different aspects of the standard, to solve the level of the total number of cycling bicycles overall ranking weight is much higher than Theo and Xiao Ming cycling, it can be speculated that the car will be shared cycling market, the ultimate winner of the market. Sharing the current pattern of cycling can continue to develop and the mobile mode is the best in the future.

Keywords: statistics; linear regression; gray prediction; fuzzy hierarchy comprehensive evaluation; analytic hierarchy process

1. INTRODUCTION

1.1THE IMPACE OF SHARD CYCLES ON CITIZEN TRAVEL TIME

Selected the 2012 - 2016 nearly five years of Shanghai people to get off work commute one-way average time as the object of study. As shown in Tab. 1.

Table 1 2012 - 2016 Shanghai people to get off work commute one-way average time

years	2012	2013	2014	2015	2016
Within 15 minutes	9.3	9.2	9.0	8.8	10.3
15-30 minutes(%)	16.4	15.2	14.6	13.9	17.2
30-44 minutes(%)	18.7	19.3	18.4	18.6	18.9
45-60 minutes(%)	24.2	24.4	24.7	24.9	23.7
60-90 minutes(%)	22.4	22.7	23.8	23.8	20.5
90 minute or more(%)	9.0	9.2	9.5	10.0	9.4
Average time(minutes)	50.4	50.8	51.5	52.6	51.2

The linear regression analysis of Shanghai citizens' average travel time from 2012 to 2015.

$$\hat{y_t} = a + bt \tag{1}$$

is also called the linear trend equation. Which represents the trend value of the time series [1-4].

The two unknown constants in the trend equation and b are obtained by the least squares method. The method is based on the smallest deviation of the least squares of the regression analysis, ie the minimum value. And then calculate the trend value of each period according to the determined trend line, so as to observe and describe the trend of the development of the phenomenon, and predict the future trend value. The least squares method can be used to fit the trend line or to fit the trend curve [5-8].

According to the requirements of the least squares method, we can get the standard solution equation of the total unknown an and b of the trend line:

$$\begin{cases} \sum y_t = na + b\sum t \\ \sum ty_t = na + b\sum t^2 \end{cases} \tag{2}$$

The time series with a trend line, so that meet the conditions: Actual observations y_i Trend value $\hat{y_t}$

$$\begin{cases} b = \frac{n\sum ty_i - \sum t\sum y_i}{n\sum t^2 - (\sum t)^2} \\ a = \sum \frac{y_i}{n} - b\sum \frac{t}{n} \end{cases} \tag{3}$$

Using matlab to do linear regression analysis, fitting diagram shown in Fig. 1:

Correlation coefficient:$r^2 = 0.9559$

$$y = 0.7300t + 49.5000 \tag{4}$$

According to (4), it can be seen that the forecast value of the average length of travel of Shanghai

residents in 2016 is 53.15 points, which is lower than the real value of 2016. Sharing bicycles to reduce the travel time of the public [7-10].

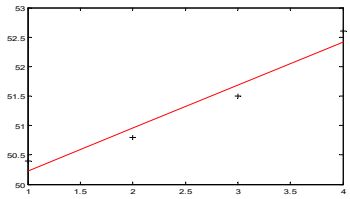

Figure 1 Linear regression fit graph

1.2 THE IMPACT OF SHARD BICYCLES ON PUBLIC TRAVEL EXPENSES

Taking the ratio of per capita travel consumption of Shanghai and the per capita GDP of Shanghai as the research object, the gray forecasting model is used to analyze the ratio (%) of resident expenditure and per capita GDP in Shanghai from 2009 to 2015. As shown in Tab. 2:

Table 2 Ratio of per capita travel consumption to Shanghai per capita GDP

years	2009	2010	2011	2012	2013	2014	2015	2016
program	5.3944	5.6053	5.4834	5.5922	5.6113	5.6424	6.0398	5.9529

(1) Establish a ratio of travel expenses and per capita GDP (%) of Shanghai citizens as follows:

$$x^{(0)} = \begin{Bmatrix} x^{(0)}(1), x^{(0)}(2), x^{(0)}(3), x^{(0)}(4) \\ , x^{(0)}(5), x^{(0)}(6), x^{(0)}(7) \end{Bmatrix}$$

$$= \begin{pmatrix} 5.3944, 5.6053, 5.4834, 5.5922, 5.6113, \\ 5.6424, 6.0398 \end{pmatrix}$$

$$x^{(1)} = \begin{Bmatrix} x^{(1)}(1), x^{(1)}(2), x^{(1)}(3), x^{(1)}(4), x^{(1)}(5) \\ , x^{(1)}(6), x^{(1)}(7) \end{Bmatrix}$$

$$= (5.3944, 10.9997, 16.4831, 22.0753$$

$$, 27.6866, 33.329, 39.3688)$$

(2) Generation of Neighbors for X (1)

$$Z^{(1)}(k) = \alpha x^{(1)}(k) + (1-\alpha)x^{(1)}(k-1) \quad (5)$$

In particular, we make the factor = 0.5, then the formula (5) becomes:

$$Z^{(1)}(k) = 0.5x^{(1)}(k) + 0.5x^{(1)}(k-1) \quad (6)$$

$$Z^{(1)} = \{Z^{(1)}(1), Z^{(1)}(2), Z^{(1)}(3), Z^{(1)}(4), Z^{(1)}(5), Z^{(1)}(6), Z^{(1)}(7)\}$$

$$= (5.3944, 8.1971, 13.7414, 19.2792, 24.8809, 30.5078, 36.3489)$$

(3) Constructs the data matrix B and the data vector Y

Let x (1) have a gray derivative of:

$$d(k) = x^{(0)}(k) = x^{(1)}(k) - x^{(1)}(k-1) \quad (7)$$

Then the GM (1, 1) gray differential equation model:

$$d(k) + \alpha z^{(1)}(k) = b \quad (8)$$

Can be changed to:

$$x^{(0)}(k) + \alpha z^{(1)}(k) = b \quad (9)$$

The time k = 1, 2, 3, 4, 5, 6, 7 into (9) where there is

$$\begin{cases} x^{(0)}(2) + \alpha z^{(1)}(2) = b \\ \cdots \cdots \\ x^{(0)}(7) + \alpha z^{(1)}(7) = b \end{cases}$$

Let $u = (\alpha, b)T$,

$$Y = (x^{(0)}(1), x^{(0)}(2), x^{(0)}(3), x^{(0)}(4), x^{(0)}(5), x^{(0)}(6)$$

$$, x^{(0)}(7))T, \quad B = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(1)}(3) & 1 \\ \cdots & \cdots \\ -z^{(1)}(7) & 1 \end{bmatrix}$$

, Then the matrix equation Y=Bu.

The parameter column u = (α, b) T is the least squares estimate $\hat{u} = (\hat{\alpha}, \hat{b})$ $T = (B^T B)^{-1} B^T Y$, The corresponding data (data see Tab 2), the use of MATLAB solution (procedures see Appendix 2): $u = \begin{pmatrix} -0.0137 \\ 5.3594 \end{pmatrix}$

α=-0.0137, b=5.3594.

From the formula (9) GM (1, 1) gray differential equation model can be obtained by changing the equation:

$$\frac{dx^{(1)}}{dt} + \alpha x^{(1)} = b \quad (10)$$

According to the value of the parameter column u, which is solved above, the whitening equation of the GM (1, 1) model is obtained by combining the formula (10) $\frac{dx^{(1)}}{dt} - 0.0137\, x^{(1)} = 5.3594$

The time response is: $x^{(1)}(k+1) = \left(x^{(0)}(1) - \frac{b}{a}\right) e^{-ak} + \frac{b}{a}$

$$\begin{cases} x^{(1)}(k+1) = \left(x^{(0)}(1) - \dfrac{b}{\alpha}\right) e^{-\alpha k} + \dfrac{b}{\alpha} = \\ 396.59148 e^{0.0137k} - 391.19708 \\ x^{(0)}(k+1) = x^{(1)}(k+1) - x^{(1)}(k) \end{cases} \quad (11)$$

Therefore, the forecast value of residents' travel expenses and per capita GDP in Shanghai in 2016 is: $x^0(8) = 6.02227\,(\%)$.

It can be predicted that the per capita travel consumption of Shanghai people in Shanghai in 2016 is 6.0223% and the real value is 5.9529%. It can be said that the sharing of bicycles saves the residents' travel expenses.

2. SHARE CYCLING MODE PERSISTENCE

In the analysis of "the existing company model of shared bicycles can continue" problem, from the company's business model, management model, profit model three angles, the shared bicycle of the existing company model is able to continue qualitative and quantitative analysis. The evaluation

model of fuzzy mathematics is used to evaluate and rank the evaluation objects according to the size of the comprehensive score. According to the value of the fuzzy evaluation set, the level of the object is evaluated according to the maximum membership degree.

Select the "company model is sustainable" problem of relevance indicators, the establishment of evaluation index system, select the results shown in Tab. 3:

Table 3 Evaluation Index System

Level 1 indicators	Level 2 indicators			
Operating mode	funds	sales	technology	produce
Management mode	Administration	Quality Control	Personnel management	Risk Management
Profit model	deposit	cost	pricing	service

The three main models in the existing company model of shared cycling are analyzed by AHP: operational model, management model, secondary model of profit model and their next level of index weight are determined. There are many different types of shared bicycles, with the most representative of the company model and the business model to study the "company model is sustainable" problem. First of all, to mobike company model as the research object. "Operation mode" of the four evaluation indicators are: capital, sales, technology, production, were recorded as: A, B, C, D, the weight were set to, as shown in Tab. 4:

Table 4 "Operational model" indicator weight table

	A	B	C	D	
A	1	4	6	8	0.58
B	1/4	1	4	6	0.24
C	1/6	1/4	1	5	0.13
D	1/8	1/6	1/5	1	0.05
	1.54	5.42	11.2	20	

Calculate the consistency ratio of the four indicators of the "operational model"

$$AW = \begin{bmatrix} 1 & 4 & 6 & 8 \\ \frac{1}{4} & 1 & 4 & 6 \\ \frac{1}{6} & \frac{1}{4} & 1 & 5 \\ \frac{1}{8} & \frac{1}{6} & \frac{1}{5} & 1 \end{bmatrix} \begin{bmatrix} 0.58 \\ 0.24 \\ 0.13 \\ 0.05 \end{bmatrix} = \begin{bmatrix} 2.72 \\ 1.21 \\ 0.54 \\ 0.19 \end{bmatrix} \quad (12)$$

The largest eigenvalue:

$$\lambda_{max} = \frac{1}{4}\left[\sum_{i=1}^{4} \frac{(AW)_i}{W_i}\right] = 4.15 \quad (13)$$

Consistency indicators:

$$CI = \frac{\lambda_{max}-n}{n-1} = \frac{4.15-4}{4-1} = 0.05$$

(14)

According to the average randomness of the table: RI (n = 4) = 0.89, then the consistency ratio: CR = CI / RI = 0.05 / 0.89 = 0.06 <0.1, so the consistency of matrix A is acceptable, the weight of the "mode of operation" is 0.58, 0.24, 0.13, 0.05; and so on, the weights of the "management model" indicators are 0.56, 0.26, 0.12 and 0.06; the weights of the "profit model" indicators are 0.58 and 0.24 respectively, 0.12, 0.06; and each matrix is passed the consistency test.

According to the same analysis method, we can get the index weight of the shared bicycle model, the management mode and the profit model, and the result is 0.31, 0.12 and 0.57, and the consistency test is adopted.

This paper stipulates that the results of the evaluation are divided into four types: the company model can run well, the company model can run, the company model can run basically, the company model cannot run four grades, determine the proportion of the results of the evaluation, so that the evaluation results are comparable.

(1) Determine the set of factorsU= {U1Operating mode, U2Management mode, U3Profit model}

U_1= {funds, sales, technology, produce}

U_2 = {Administration, Quality Control, Personnel management, Risk Management}

U_3= {deposit, cost, pricing, service}

To determine the comment set V = {good run, can run, the basic run, cannot run}

Provisions 100-90 is divided into good, 89-75 quantile can run, 74-60 is divided into basic operation, 59-0 cannot be divided into.

The evaluation grade is quantified by one point, and the evaluation level vector $H = \{1, 0.8, 0.5, 0.3\}$(2)Determine the weight vector

$A_1 = \{0.58, 0.24, 0.13, 0.05\}$

$A_2 = \{0.56, 0.26.0.12, 0.06\}$

$A_3 = \{0.58, 0.24, 0.12, 0.06\}$

$A = \{0.31, 0.12, 0.57\}$

Create a single factor matrix

In the evaluation process, according to Tab. 1 to determine the shared bicycle company model is able to continue to evaluate the indicators to determine the sub-indicators of the sub-assessment of the sub-good run, can run, the basic operation, not running.

According to the percentage of the corresponding factors, the fuzzy evaluation matrix is established as follows:

$$R_1 = \begin{bmatrix} 0.6 & 0.3 & 0.1 & 0 \\ 0.4 & 0.5 & 0.1 & 0 \\ 0.8 & 0.2 & 0 & 0 \\ 0.8 & 0.2 & 0 & 0 \end{bmatrix} \quad (15)$$

$$R_2 = \begin{bmatrix} 0.6 & 0.3 & 0.1 & 0 \\ 0.8 & 0.2 & 0 & 0 \\ 0.4 & 0.5 & 0.1 & 0 \\ 0.6 & 0.4 & 0 & 0 \end{bmatrix} \quad (16)$$

$$R_3 = \begin{bmatrix} 0.6 & 0.4 & 0 & 0 \\ 0.8 & 0.2 & 0 & 0 \\ 0.4 & 0.5 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \quad (17)$$

For a comprehensive evaluation

$$B_1 = A_1 \cdot R_1 = \{0.59, 0.33, 0.08, 0\}$$

$$B_2 = A_2 \cdot R_2 = \{0.63, 0.30, 0.07, 0\}$$

$$B_3 = A_3 \cdot R_3 = \{0.64, 0.34, 0.02, 0\} \quad (18)$$

(5)Level factor set $U = \{U_1, U_2, U_3\}$, Weights $A = \{0.31, 0.12, 0.57\}$

Let the total single factor judgment matrix be:

$$R = \begin{bmatrix} 0.59 & 0.33 & 0.08 & 0 \\ 0.56 & 0.32 & 0.12 & 0 \\ 0.63 & 0.30 & 0.07 & 0 \end{bmatrix} \quad (19)$$

For two comprehensive evaluation

$$B = R \cdot A = \{0.57, 0.31, 0.12, 0\}$$

Evaluation results

According to the principle of maximum membership, whether the shared cycling company model can continue to evaluate the results: $\max\{0.57, 0.31, 0.12, 0\} = 0.57, M = B \cdot H^T =$

$$\{0.57, 0.31, 0.12, 0\} \begin{bmatrix} 1 \\ 0.8 \\ 0.5 \\ 0.3 \end{bmatrix}$$

The level of the company is capable of running.

Similarly, according to the fuzzy comprehensive evaluation model analysis, whether the shared bicycle model can continue to evaluate the results M = 0.64, corresponding to the grade of the company model for the basic operation.

4. FUTURE PATTERN ANALYSIS

In order to analyze the pattern of shared bicycle companies, we build a hierarchical model based on existing information. This model takes the six criteria of "post-maintenance", "cost", "number of bicycles", "popularity", "user population" and "profit model" as the criterion layer. mobike, Xiao Ming cycling, ofo small yellow car as a program layer,

The judgment matrix of the criterion layer is shown in Tab. 5:

Table 5 Criteria matrix for the criterion layer

A	B1	B2	B3	B4	B5	B6
B1	1	1	1	4	1	1/2
B2	1	1	2	4	1	1/2
B3	1	1/2	1	5	3	1/2
B4	1/4	1/4	1/5	1	1/3	1/3
B5	1	1	1/3	3	1	1
B6	2	2	2	3	3	1

The decision matrix of the scheme layer is shown in Tab. 6:

Table 6 Judgment matrix of the program layer

B1	C1	C2	C3	B2	C1	C2	C3	B3	C1	C2	C3
C1	1	1/4	1/2	C1	1	1/4	1/5	C1	1	3	1/3
C2	4	1	3	C2	4	1	1/2	C2	1/3	1	1/7
C3	2	1/3	1	C3	5	2	1	C3	3	1	1
B4	C1	C2	C3	B5	C1	C2	C3	B6	C1	C2	C3
C1	1	1/3	5	C1	1	1	7	C1	1	7	9
C2	3	1	7	C2	1	1	7	C2	1/7	1	1
C3	1/5	1/7	1	C3	1/7	1/7	1	C3	1/9	1	1

The results of the hierarchical total sort are shown in Tab. 7:

Table 7 Overall Ranking

Criteria	post-maintenance	cost	Bike numbers	reputation	user	Profit model	Total sort

Criteria layer weights		0.1507	0.1792	0.1886	0.0472	0.1464	0.2879	Weight
Solution layer single sort weights	mobike	0.1365	0.0974	0.2426	0.2790	0.4667	0.7986	0.3952
	Xiao Ming	0.6250	0.3331	0.0879	0.6491	0.4667	0.1049	0.2996
	ofo	0.2385	0.5695	0.6694	0.0719	0.0667	0.0965	0.3052

According to the total ranking weight, the highest number of bicycles bicycles, shared the cycling market in 2016, the mobike and the ofo occupy 80% of the market share, according to the total ranking weight can be seen in the more comprehensive competitive advantage

5. CONCLUSION

This paper gives the results of the study of shared cycling based on residents 'needs, corporate continuity and future pattern. Shared bicycles save the time and cost of residents' travel, and solve the "last mile" problem. Accounting for more than 80% of the market share of the business and maintenance of the company's operating level are able to run above, sharing the current pattern of cycling can be sustained. mobile will lead the future of the shared bicycle industry.

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Prediction Model of Silicon Content in Molten Iron Based On Extreme Learning Machine

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Abstract: The process of the ironmaking process is a time series of the process parameters collected is a high-dimensional large data time series. Its influencing factors are hundreds. In this paper, 1000 sets of molten iron silicon content [Si] data as a mathematical modeling analysis and the basis of mathematical excavation. Calculate the silicon content of the molten iron from the next furnace by previous smelting data. First, randomly selected 950 furnace data as a training set to establish the limit learning machine model to learn. And then use the remaining 50 sets of data as a test set for the test of the model, Finally, the predicted value of the silicon content is compared with the actual value, and the accuracy of the model is calculated using the formula.
Keywords: Extreme learning machine; silicon content of molten iron; Simulation test

1. INTRODUCTION

The process parameters acquired by the ironmaking process in chronological order are a high-dimensional large data time series. It has hundreds of factors. The ultimate production index of output, energy consumption, hot metal quality and other indicators are related to the smelting process of a controlled intermediate index - iron content of molten iron is closely related. The prediction of the [Si] time series after 2 hours or 4 hours is related to the control direction of the current blast furnace operating parameters. Therefore, the accurate prediction control modeling of [Si] becomes the key technology of smelting process optimization and forecast control.

2. THE BASIC IDEA OF ELM

The limit learning machine [1] is a fast learning method based on single hidden layer feedforward neural network [2], It is characterized by random selection of SLFNs hidden layer nodes and the corresponding node parameters. And it only needs to adjust the output weight of the network through the regularized least squares algorithm during the training process. Therefore, it can get a good network generalization performance with fast learning speed.

3. THE ESTABLISHIMENT OF THE MODEI

Implementation of ELM training and simulation testing can be divided into the following steps:

In order to make the established model have good generalization performance, it is required to have enough training samples and the samples are well represented. Therefore, in the collected 1000 sets of data, the paper randomly selected 950 groups for ELM training. The remaining 50 sets of data were used as test samples for one-step prediction. Using MATLAB, we get a one-step prediction of the silicon content of molten iron. As shown in Fig. 1:

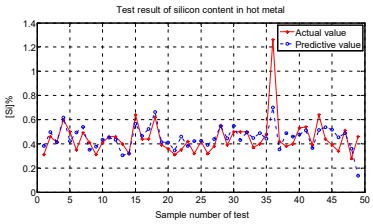

Figure 1 One step prediction result

Fig. 1 shows that the limit learning machine model can better predict the silicon [Si] content in molten iron [3]. In order to achieve the quantitative description of the forecast results, the model of the one-step prediction results for analysis and processing.

We get a one-step prediction error of the silicon content of molten iron [4]. by comparing the one-step prediction value of the test sample with the true value. The needle diagram shown in Fig. 2:

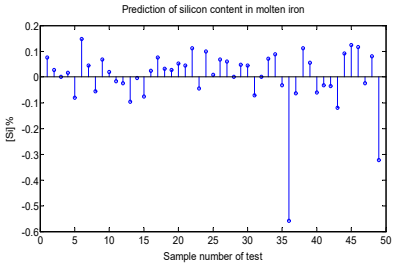

Figure 2 One step prediction error diagram

4. THE EVALUATION OF THE MODEL

According to the one-step prediction error diagram of the silicon content of molten iron, it can be found that the error value of one-step prediction is mostly in the interval (-0. 1, 0. 1). That is, the prediction of silicon content of molten iron is high.

So the definition of x for the molten iron silicon content, 1 for the prediction of success, 0 for the prediction failed, as follows:

$$X=\begin{cases}1 & |x|\geq 0.1\\ 0 & |x|<0.1\end{cases}$$

The success rate of numerical prediction:

$$P(X)=\frac{\text{the number of 1}}{\text{the total number of test samples}}$$

The numerical success rate of one - step prediction of silicon content of molten iron is $P(X)=0.836735$

5. CONLCUSIONS

$P(X)=0.836735$ indicates that the numerical prediction of the one-step prediction model has a higher success rate. To sum up, ELM can be very good to achieve the prediction of silicon content of molten iron. And it can be widely used in the smelting industry.

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Wine Evaluation System Based on Gray Relational Analysis

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Abstract: The quality of the wine to determine the general is to invite a group of wine tasters to taste the wine, scoring, In this article, we on the evaluation of wine data which come from the two groups of wine tasters, the use of univariate analysis of the differences between the two groups of data analysis, and then use the gray correlation analysis of wine grape of the physical and chemical indicators and the quality of wine to do correlation analysis, According to the 16 main indexes selected, the K-means clustering analysis of 27 wine samples was carried out. The wine was divided into six grades, and then the relationship between the wine and grape and the physical and chemical indexes of wine was analyzed by gray correlation analysis. The impact of the quality of wine on the quality of the wine through the physical and chemical indicators of the impact of the quality of wine according to the weight of the establishment of the grading mechanism for the wine, the results of the scoring and the results of the tastes of the results of the difference analysis, according to the analysis of quantitative indicators There was no significant difference between scoring and tasting.
Keywords: Univariate analysis; K-means; Gray correlation degree

1. ANALYSIS OF THE VARIANCE OF ONE-WAY ANOVA

1.1 PRINCIPLE ANALYSIS

Let the single factor G have r levels, respectively, $G_1, G_2, G_3, \cdots G_r$, at each level $G_i \ (i = 1,2,3,\cdots r)$, to examine the indicators can be seen as a whole $X_i \ (i = 1,2,3,\cdots r)$ under the $X_i \ (i = 1,2,3,\cdots r)$ level of independent tests $G_i \ (i = 1,2,3,\cdots r)$ Under n_i independent tests, the sample is recorded X_{ij}, $(i = 1,2,3,\cdots r \quad j = 1,2,3,\cdots n_i)$, and $X_{ij} \sim N(\mu_i, \sigma^2)$ and independent of each other. The sample observations X_{ij} are subject to a normal distribution.

1.2 ESTABLISH A HYPOTHESIS

Combined with the results of a comparison between the two groups of wine tasting evaluation results whether there is a significant difference, the group can be set to factor G has two levels, Factor $G_i \ (i = 1,2)$ in each tasting of the tasting sum, and then $G_i \ (i = 1,2)$ groups of 10 tastes of the total score for the average, as the indicators to be investigated, recorded as $X_i \ (i = 1,2)$ and $X_i \sim N(\mu_i, \sigma^2)$, in the level of $H_i \ (i = 1,2)$ will be wine tasting The score of 27 (or 28) wine samples is taken as six independent tests, and the sample is recorded as X_{ij}, $(i = 1,2 \quad j = 1,2,3,\cdots n_i)$. As a sample overall, the problem can be transformed into a problem where the different levels of the G factor have a significant effect on the population .[1-3]

Assuming that the test is $H_0: \mu_1 = \mu_2$, the alternative is assumed to be $H_1: \mu_1, \mu_2$ unequal.

Because $X_{ij} - \mu_i = \varepsilon_{ij}$, remember $\mu = \frac{1}{n}\sum_{i=1}^{2} n_i \mu_i$, $n = \sum_{i=1}^{2} n_{ij}$, $\alpha_i = \mu_i - \mu$, $i = 1,2$ then.

mathematical model:

$$\begin{cases} X_{ij} = \mu + \alpha_i + \varepsilon_{ij}, i = 1,2, j = 1,2,\cdots, n_i \\ \sum_{i=1}^{2} n_i \alpha_i = 0 \\ \varepsilon_{ij} \sim N(0, \sigma^2), \text{Each} \varepsilon_{ij} \text{ is independent of each other; } \mu_i \text{ and } \sigma^2 \text{ unknown} \end{cases} \quad (1)$$

So the original hypothesis is written as:

$$H_0 : \alpha_1 = \alpha_2 = 0 \quad (2)$$

1.3 CONSTRUCT STATISTIC

It can be seen from $X_{ij} = \mu + \alpha_i + \varepsilon_{ij}$ that if the test hypothesis is true, then the fluctuation of X_{ij} is purely randomness; if the test hypothesis is false, the fluctuation of X_{ij} is caused by the i-th level and randomness. Thus, it is necessary to construct a quantity to describe the fluctuation between X_{ij} and to cause the above two causes of the fluctuation to be expressed in the other two quantities, which is the square sum decomposition method in the variance analysis.

Note:

$$\overline{X}_{ij} = \frac{1}{n_i}\sum_{j=1}^{n_i} X_{ij}, \overline{X} = \frac{1}{n}\sum_{i=1}^{r}\sum_{j=1}^{n_i} X_{ij} \quad (3)$$

Lead into:

$$S_r=\sum_{i=1}^{n}\sum_{j=1}^{n_i}(X_{ij}-\overline{X})^2=\sum_{i=1}^{r}\sum_{j=1}^{n}(X_{ij}-\overline{X}_{ij})^2+\sum_{i=1}^{r}\sum_{j=1}^{n_i}(\overline{X}_{ij}-\overline{X})^2=S_E+S_A \quad (4)$$

For:

$$S_A=\sum_{i=1}^{r}n_i(\overline{X}_{ij}-\overline{X})^2=\sum_{i=1}^{r}n_i(\alpha_i+\overline{\varepsilon}_{ij}-\overline{\varepsilon})^2 \quad (5)$$

$$S_E=\sum_{i=1}^{r}\sum_{j=1}^{n_i}(X_{ij}-\overline{X}_i)^2=\sum_{i=1}^{r}\sum_{j=1}^{n_i}(\varepsilon_{ij}-\overline{\varepsilon}_{ij})^2 \quad (6)$$

If 1 is established, 2 reflect random fluctuations, if 3 is not established, 4 also reflects the different levels of A effect 5. From the numerical point of view, when 6 is established, 7 and when 8 is not established, this ratio will be much larger than 1.

So the construction statistics: 9

Table 1 The observed value of 10, into the statistics F, can be obtained F value

Source of variance	sum of square	Degrees of freedom	Mean square	F
factorA	S_A	r-1	$MS_A=\frac{S_A}{r-1}$	$F=\frac{MS_A}{MS_E}$
deviationE	S_E	n-r	$MS_E=\frac{S_E}{n-r}$	
sumT	S_F	N-1		

The observed value matrix into mat lab, calculated the corresponding red wine on the table in the data as shown below:

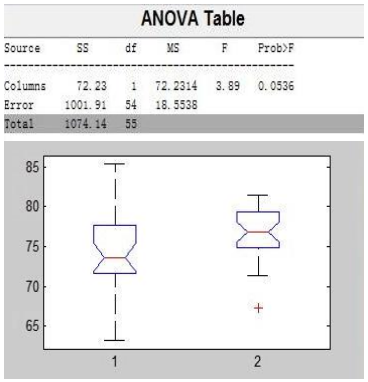

Figure 1 Calculated the corresponding red wine on the table in the data

From the calculation results show that the red wine p = 0.12, the same can be white wine p = 0.0536. At the significant level of $\alpha=0.05$, both satisfied p> α, so accept the original hypothesis, factor G in the two groups of different levels on the overall no significant impact, that the evaluation of the two groups of judges no significant difference.

2.GRAY CORRELATIVE DEGREE DATA ANALYSIS AND K-MEANS CLUSTERING OF WINE GRAPE

2.1 PRINCIPLE ANALYSIS

The degree of relevance is a measure of the magnitude of the correlation between things and can quantitatively describe the relative variability of things or factors, that is, the magnitude of the change, the direction and the speed. In this paper, the gray relational analysis method was used to analyze the physical and chemical indexes of wine grape and the quality of wine. [2-4] According to the correlation degree, the physical and chemical indexes of grape were screened and the 16 indexes with high correlation with wine were selected for further analysis.

Cluster analysis is a kind of multidimensional statistical method based on data mining technology. It is a multivariate statistical method to study how to study the object (sample or index) according to the characteristics of multiple aspects. In this paper, the most classic clustering algorithm is selected The K-means algorithm for a given sample capacity of 27 sets X and the number of categories K, K-means is to search for an optimal K partition for set X, that is divided into K groups, the sum of squares of squares is the cumulative distance squared of the samples in the group to the group mean.

2.2 THE ESTABLISHMENT OF THE MODEL

(1) DATE SCREENING AND PROCESSING

The wine grape was graded according to the physical and chemical index data of the wine grape combined with the grading data of the first grape quality. In this paper, the physical and chemical indexes of wine grape were first screened by correlation analysis.

The physical and chemical indicators of wine grapes were averaged

First calculate the mean value of each index of wine grape, respectively, with the original value of the original number of columns to remove the average number of columns. And then calculate the absolute difference between the comparison series and the reference series at the same time. Finally calculate the correlation coefficient.

Through the mat lab we get the wine with a high degree of relevance of the wine grape indicators for the total flavonoids, total phenol, tannin, malic acid, flavones, solid acid ratio and other 16 kinds of ingredients (see Fig. 2), so ignored The remaining 14 factors on its impact, select the relevance of the big 17 for further analysis.

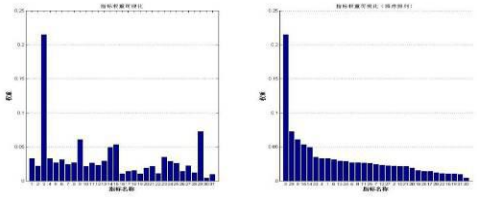

Figure 2 The wine with a high degree of relevance of the wine grape indicators

(2) THE ESTABLISHMENT OF THE MODEL

Given a set X with a sample size of 27 and the number of categories 5, the K-means method is to search for an optimal K division for set X, that is divided into five groups, so that the square sum of squares in the group reaches the minimum The square sum of the internal deviations is the square of the cumulative distance from the sample to the group mean. The clustering criterion function is: $J_e = \sum_{i=1}^{k} \sum_{u \in I_i} \|u - c_i\|$. The sum of the squares of errors between the samples u of the five subsets and the sum of the squares of these classes is derived from all five classes, so that the smallest clustering is usually called the minimum variance division, which makes all the samples in the clustering domain The square of the center distance is the smallest (Euclidean distance).

K is the number of clustering patterns, $c_i(0)$ for i initial clustering centers, $i = 1,2,\cdots k;$ ε The threshold is calculated for the stop. According to the principle of minimum European distance, the sample will be classified as the nearest center.

$$c_j(t+1) = c_j(t) + \frac{1}{M_j + 1}\left[u - c_j(t)\right] \tag{7}$$

$$J_{ej}(t+1) = J_{ej}(t) - \Delta J_{ej}(t) = J_{ej}(t) - \frac{M_i}{M_i - 1}\left\|u - c_i(t)\right\|^2 \tag{8}$$

$$J_{ej}(t+1) = J_{ej}(t) - \Delta J_{ej}(t) = J_{ej}(t) - \frac{M_j}{M_j - 1}\left\|u - c_j(t)\right\| \tag{9}$$

Moving a sample from a subset to another subset, determining the quality of the cluster, using MATLAB for the center and the criterion function after 12 iterations. As can be seen from the data, the grape sample 23 is one of the best, belonging to a grade, the grape sample 12 is the worst, belonging to the sixth grade.

Analysis of the Relationship between Physical and Chemical Indicators by Gray Relational Analysis

Based on the physical and chemical indexes of wine grape and wine, the physical and chemical indexes of wine grape were used as reference series, and the relationship between them and the physical and chemical indexes of wine was analyzed to find out the relationship between the physical and chemical indexes Several groups, analysis of its positive and negative correlation, you can get wine and grape wine and the physical and chemical indicators of the link between

3.1 STANDARDIZATION OF DATA

The average number of the original series is obtained separately, and then all the data of the series are divided by the average of the series, and a multiple of the number of the data is obtained. Can be obtained, the two groups of processed matrix, wine and grape of the physical and chemical indicators of matrix A and wine physical and chemical indicators matrix B.

3.2 CALCULATE THE ABSOLUTE DIFFERENCE BETWEEN THE COMPARISON SERIES AND THE REFERENCE SERIES AT THE SAME TIME

The physical and chemical indexes of wine grape were used as reference series, and the physical and chemical indexes of wine were used as the comparison series. After the treatment $\{x_0(t)\} = \{x_{01}, x_{02}, \cdots, x_{0n}\}$ (10)

The comparison of the number of references to the reference number is shown in p

$$\{x_1(t),\ x_2(t), \cdots,\ x_p(t)\} = \begin{Bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{p1} & x_{p2} & \cdots & x_{pn} \end{Bmatrix} \tag{11}$$

Which can be obtained wine grape of the physical and chemical indicators and all the physical and chemical indicators of wine between the absolute difference between the table.

3.3 CALCULATE THE CORRELATION COEFFICIENT

The absolute value of the difference between the value of the kth comparison sequence (k = 1, 2, ..., p) and the reference sequence is denoted by $\Delta_{0k}(t) = \left|x_0(t) - x_k(t)\right|,\ t = 1,2,\cdots,n$: n for the kth comparison sequence, The minimum number of $\Delta_{0k}(t)$ and the maximum number of $\Delta_{0k}(\max)$ are sums. . Thus, the degree of correlation between the kth comparison sequence and the reference sequence at time t (often referred to as the correlation coefficient) can be calculated.

3.4CALCULATE THE DEGREE OF CORRELATION

Using the correlation coefficient table to find the correlation value of the correlation coefficient of each period in each period, and then sorting the degree of association respectively to get the corresponding indicators of the corresponding indicators of wine and wine. By observing the positive and negative correlation between the two, we can get the influence of the physical and chemical indexes of wine grape on the physical and chemical indexes of wine.

According to the degree of relevance, the physical and chemical indicators of wine can be explained by grape indicators:

(1) Wine and wine grapes in the tannins have a strong correlation, the wine anthocyanin's (flavonoid compounds) mainly from the wine grapes in the grape total flavonoids.

(2) The DPPH semi-suppressed volume in the wine mainly comes from the peel of the grape. At the same time, the DPPH free radical content, PH value and treatable acid content in the wine grape also have some influence on it. Therefore, increasing the content of wine grape peel has an important effect on the increase of DPPH semi-suppressed volume in wine.

4. ANALYZE THE INFLUENCE OF PHYSICAL AND CHEMICAL INDICATORS ON THE QUALITY OF WINE

4.1 EFFECTS OF PHYSICAL AND CHEMICAL INDICATORS ON WINE QUALITY

Still use the gray relational analysis method, the wine of the scoring situation as a reference series, respectively, the physical and chemical indicators of wine and wine grape of the physical and chemical indicators as a comparison sequence, according to the 3.1 method can be obtained in two groups of physical and chemical indicators and wine The quality of the link between the analysis of those indicators on the wine which aspects of the impact of large, to determine the color of wine, taste and other quality were controlled by those indicates.

4.2 DEMONSTRATE THE USE OF PHYSICAL AND CHEMICAL INDICATORS TO EVALUATE THE QUALITY OF WINE

With the conclusion of 4.1, through the physical and chemical indicators of wine on the quality of wine according to the weight of the index to establish the grading mechanism of the wine, the wine taste, color and other nine scores to score, scoring results and wine tasters score results Using the one-way ANOVA to make the difference analysis, the results of the red wine grading were compared with the results of a group of scoring. The score of the white wine was compared with the two groups, and the test statistic F was less than F0.05, there is no significant difference between the scoring results of the indicators and the results of the winemakers, and it can be proved that the quality of the wines can be evaluated by the physical and chemical indicators of grapes and wines.

5. SUMMARY

The wine evaluation system established in this paper is based on the k-means clustering and gray relational analysis method. The evaluation and scoring of 27 kinds of wines can be realized. The results of scoring and tasting are not Significant differences. As a result of the training of a qualified tasting staff need to spend a lot of money and time, the use of evaluation system gradually replace the artificial evaluation of the wine industry is the development trend.

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Comparative Study on the Prediction of Silicon Content in Hot Metal of Blast Furnace Based on BP Neural Network and Extreme Learning Machine

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Abstract: According to the problem that the silicon content of molten iron cannot be detected directly on the line, the BP neural network prediction model and the extreme learning machine prediction model are established, and the collected data are normalized and trained and simulated respectively. The results show that the prediction accuracy of BP neural network model is higher than that of the extreme learning model, and it is concluded that the BP neural network prediction model can predict the silicon content of molten iron more accurately and has good guiding significance for the actual regulation of blast furnace temperature.
Keywords: Iron content of molten iron; BP neural network; Extreme learning machine

1. INTRODUCTION

In recent years, the dynamic prediction of silicon content in molten iron has been mainly focused on data-driven modeling. For example, time series based forecasting model, chaos model, SVM prediction model and so on. These models have some effects on the prediction of silicon content in blast furnace [3], but there are still many shortcomings. For example, the chaotic model can comprehensively consider the ironmaking process and production data characteristics, but the iron content prediction model [4-5] only use the historical data of silicon content, it is difficult to achieve better prediction results. Based on the abundant data, this paper proposes a BP neural network prediction model and a limit learning machine forecasting model. Using the processed data [6] as a sample for training and simulation prediction, BP neural network can predict more accurately [7] molten iron [Si] content, the actual control of the blast furnace temperature has a good guiding significance.

2. ESTABLISHMENT AND SOLUTION OF BP NEURAL NETWORK MODEL STRUCTURE

2.1 DETERMINATION OF MODEL STRUCTURE

BP network learning algorithm is a teacher learning algorithm, which puts the sample into the neural network, then gets the actual output of the network. If the error between the output value and the desired output does not meet the accuracy requirement, the error is propagated backwards from the output layer to adjust the weights and thresholds so that the error between the output of the network and the desired output is gradually reduced until the accuracy requirement is satisfied. According to the Kolmogorov theorem, a 3-layer network with n input nodes, 2n + 1 intermediate node, and m output nodes can accurately represent any mapping. The model consists of input layer, hidden layer and output layer, as shown in Fig.1:

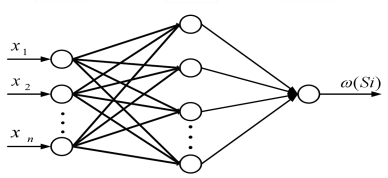

Figure 1 BP neural network structure

The determination of input layer node:

In order to simplify the problem and to predict the silicon content of molten iron effectively, this model analyzes the correlation with the silicon content of molten iron in combination with the collected data. Three parameters are selected as the input nodes of the neural network model, namely, the silicon content of molten iron, the amount of coal injected and the amount of blast.

The determination of implicit layer node:

The number of hidden layer neurons represents the degree of non-linearity between the network input and the output. The number of neurons will affect the network in the input layer to extract valuable features, the network may not train out, poor fault tolerance; but too many neurons to make learning too long, and the error is not necessarily the best. According to Kolmogorov theorem, the number of hidden layer nodes in this model is 7.

The determination of output layer node:

The number of neurons in the output layer depends on the system requirements for network functions. In this model, the silicon content of molten iron is predicted, and the output variable is the silicon content of molten iron, that is, the number of neurons

in the output layer is 1.

Therefore, the BP neural network model structure is: 3-7-1.

2.2 PRODUCTION OF SAMPLE SET

During the network training, select a set of reliable samples from the collected data. The accuracy of the sample data plays an important role in the establishment of the neural network, the fitting ability of the neural network, the accuracy of the learning and the accuracy of the prediction.

2.2.1 DATA NORMALIZATION

In order to avoid the influence of the input variable units on the neural network model. The input and output parameters need to be normalized. In this model, the Sigmoid function is used as the excitation function. For each parameter, the parameters are converted to [0, 1] . For the input layer, The linear transformation of (1).

$$x = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}} \tag{1}$$

The molten iron content of the molten layer in the output layer is in the range of [0, 1], so no normalization is required. According to the above method, the original value of the sample is transformed into the sample value, then the training sample set is obtained.

2.3 NEURAL NETWORK LEARNING

2.3.1 THE DETERMINATION OF LEARNING PARAMETERS

The learning rate η and the impulse coefficient α are two parameters that can be selected for learning. The selection of the two sizes directly affects the convergence stability and learning efficiency of the network. Reasonable choice of η and α can avoid or reduce the oscillation of the system error. After several training, this model takes η = 0.6, α = 0.7.

The "temperature control" coefficient γ is also an optional parameter for learning. The activation function of the node is changed to the Sigmoid type function controlled by "temperature", that is, the temperature coefficient γ is added on the basis of the Sigmoid type function, then the excitation function is adjusted as shown in (2).

$$f(x) = \frac{1}{1+\exp(-\chi/\gamma)} \tag{2}$$

2.3.2 BP NEURAL NETWORK LEARNING ALGORITHM AND PROCESS

The purpose of BP neural network learning is to obtain the final weight matrix. The process shown in Fig. 2.

After entering the sample set, calculate each sample as follows:

Calculate the actual output value of each node layer by layer;

For hidden layer nodes:

$$O_{pi} = f(net_j) = \frac{1}{1+\exp(\sum \omega_{ij} - \theta_j)} \tag{3}$$

For output layer nodes:

$$O_{pk} = f(net_k) = \frac{1}{1+\exp(\sum \omega_{jk} o_{pj} - \theta_k)} \tag{4}$$

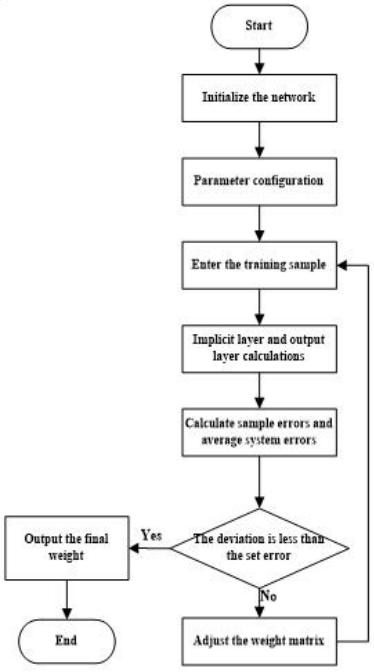

Figure 2 BP neural network process

Calculate the individual sample output error:

$$E_p = \frac{1}{2}\sum_{p=1}^{n}(t_{pk} - o_{pk})^2 \tag{5}$$

Calculate the system average error:

$$E = \frac{1}{pe}\sum_{p=1}^{pe} E_p \tag{6}$$

Adjust the weight and threshold of the output layer:

$$\delta_k^p = o_k^p(1-o_k^p)(Y_{pk} - o_k^p) \tag{7}$$

$$\Delta\omega_{jk}(t) = \frac{1}{pe}\sum_{p=1}^{pe}\left\{\eta o_p^k + \alpha\left[\Delta\omega_{jk}(t-1) - \Delta\omega_{jk}(t-2)\right]\right\} \tag{8}$$

$$\Delta\theta_k(t) = \frac{1}{pe}\sum_{p=1}^{pe}\left\{\eta\delta_k^p + \alpha\left[\Delta\theta_k(t-1) - \Delta\theta_k(t-2)\right]\right\} \tag{9}$$

Adjust the weight and threshold of the hidden layer:

$$\delta_j^p = \sum_k \delta_k^p \cdot \omega_{jk} \cdot o_{pj}(1-o_{pj}) \tag{10}$$

$$\Delta\omega_{ij}(t) = \frac{1}{pe}\sum_{p=1}^{pe}\left\{\eta\delta_j^p o_{pj} + \alpha\left[\Delta\omega_{ij}(t-1) - \Delta\omega_{ij}(t-2)\right]\right\} \tag{11}$$

$$\Delta\theta_j(t) = \frac{1}{pe}\sum_{p=1}^{pe}\left\{\eta\delta_j^p + \alpha\left[\Delta\theta_j(t-1) - \Delta\theta_j(t-2)\right]\right\} \tag{12}$$

After adjusting the weights and thresholds of the output layer and the hidden layer, the system returns to step three for the next iteration calculation.

2.4 MODEL PREDICTIVE SIMULATION

Randomly collected from the production process 1000 sets of data, and the data were normalized. Take 950 sets of data for training, with 50 sets of data to verify the rationality. BP neural network prediction output and expected output shown in Fig. 3, BP network prediction error shown in Fig. 4.

Fig. 3 can be obtained in the case of stable furnace conditions, and the predicted value can be better to track the actual value.However, there is still a slight error between the predicted value and the actual value in the case of large fluctuations. But the overall

tracking effect is quite satisfactory. From Fig. 4, BP network prediction error is basically within ± 0.08, so the overall prediction is better.

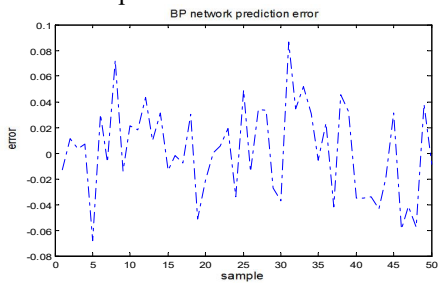

Figure 3 BP network prediction output

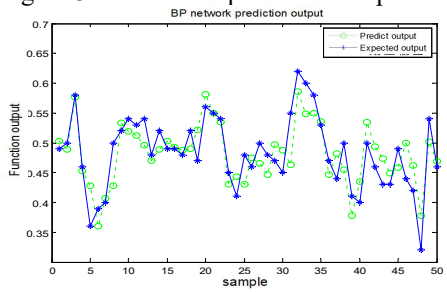

Figure 4 BP network

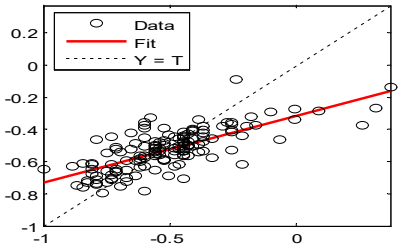

Figure 5 BP neural network

3.CONSTRUCTION AND SOLUTION OF EXTREME LEARNING MACHINE MODEL

3.1 PRINCIPLES OF EXTREME LEARNING MACHINES

Extreme learning machine is a new type of fast learning algorithm. For a single hidden layer neural network, the ELM can randomly initialize the input weights and get the corresponding hidden node outputs:

For a single hidden layer neural network, it is assumed that there are N arbitrary samples (x_j, t_j):

$$x_j = [x_{j1}, x_{j2}, ... x_{jn}]^T \in R^n, t_j = [t_{j1}, t_{j2}, ... t_{jm}]^T \in R^m \tag{13}$$

For a single hidden layer neural network with L hidden nodes can be expressed as:

$$\sum_{i=1}^{L} \beta_i g(w_i x_j + b_i) = o_j, j = 1,2,...,N \tag{14}$$

Where g(x) is the activation function, $w_i = [w_{i1}, w_{i2}, ..., w_{in}]^T$ is the input weight of the i hidden layer unit. b_i is the offset of the i hidden layer. $\beta_i = [\beta_{i1}, \beta_{i2}, ..., \beta_{im}]^T$ is the output weight of the i hidden layer unit. $w_i x_j$ represents the inner product of w_i and x_j.

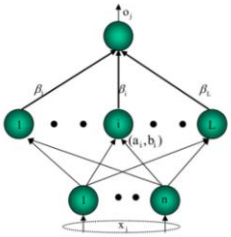

Figure 6 Extreme learning machine single hidden layer neural network structure diagram

3.2 LEARNING OBJECTIVES

The objective of single-hidden neural network learning is to minimize the output error, which can be expressed as:

$$\sum_{j=1}^{N} \| o_j - t_j \| = 0 \tag{15}$$

That exists w_i、x_j and b_i :

$$\sum_{i=1}^{L} \beta_i g(w_i x_j + b_i) = t_j, j = 1,2,...,N \tag{16}$$

Matrix representation:

$$H \cdot \beta = T \tag{17}$$

Where H is the output of the hidden layer node, β is the output weight, and T is the desired output

$$H(w_1,...,w_L,b_1,...,b_L,x_1,...,x_N) = \begin{bmatrix} g(w_1x_1+b_1) & \cdots & g(w_Lx_1+b_L) \\ \vdots & \cdots & \cdots \\ g(w_1x_N+b_1) & \cdots & g(w_Lx_N+b_L) \end{bmatrix}_{N\times L} \tag{18}$$

$$\beta = \begin{bmatrix} \beta_1^T \\ \vdots \\ \beta_L^T \end{bmatrix}_{L\times m} \quad T = \begin{bmatrix} t_1^T \\ \vdots \\ t_N^T \end{bmatrix}_{N\times m}$$

In order to be able to train a single hidden neural network, we want to get $\hat{w}_i, \hat{b}_i$ and $\hat{\beta}_i$, that:

$$\left\| H(\hat{w}_i, \hat{b}_i) \cdot \hat{\beta} - T \right\| = \min_{w,b,\beta} \left\| H(w_i, b_i) \cdot \beta - T \right\| \tag{19}$$

Where $i = 1,2,...,L$, it is equivalent to minimizing the loss function

$$E = \sum_{j=1}^{N} \| \sum_{i=1}^{L} \beta_i g(w_i x_j + b_j) - t_j \|_2^2 \tag{20}$$

3.3 LEARNING METHODS

The basic gradient-based learning algorithm requires that all parameters be adjusted during the iteration. In the ELM algorithm, once the input weights and the bias of the hidden layer are randomly determined, the output matrix H of the hidden layer is uniquely determined.

3.4MODEL SIMULATION PREDICTIO ANALYSIS

The training and simulation of the model are carried out with the previously prepared sample set. And the test results of the test set of silicon content comparison chart, as shown in Fig. 7, and the error change map, as shown in Fig. 8

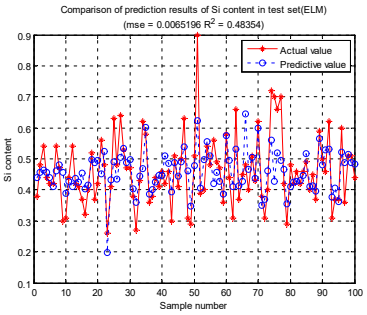

Figure 7 Comparison of predicted and measured

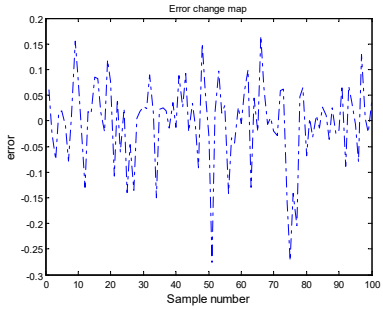

Figure 8 Test set of silicon content error values of silicon content in the test set change map

From Fig. 7 can be obtained in the case of stable furnace conditions, the forecast value can be better track the actual value. However, in the case of large fluctuation, the error between the predicted value and the actual value is large, indicating that the tracking effect is not very good. From Fig. 8, the limit learning model error range is large, the error is basically between ± 0.25.

Table 1 Comparison of BP neural network and ELM model predictions

Method	Root mean square error	Determine the coefficient
BP neural network	0.08	0.73429
ELM	0.16	0.48354

Compared with ELM prediction model, BP neural network has better advantage. First, the BP neural network improves the problem encountered by the ELM, that is, the predicted value is difficult to track the relatively large fluctuations in the silicon content value. The stability of the BP neural network model is much better than that of the ELM, and the decision coefficient of the sequence of the actual target sequence and the predicted value sequence is also improved from 0.48354 to 0.73429, which shows that the BP neural network model has a good effect. Therefore, it is concluded that the BP neural network prediction model has a better guiding significance for blast furnace operation.

4. CONCLUDING

In this paper, a data driven prediction model based on BP neural network is proposed. The model is superior to the ELM in terms of root mean square error and the coefficient of determination of the actual target sequence and the sequence of the predicted value. It shows that it can better reflect the change of silicon content in blast furnace molten iron, especially for some furnace of the furnace. BP neural network model can also track the change of silicon content in time, and has a good guiding significance for the actual regulation of blast furnace temperature.

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Analysis and Evaluation of Mobile PubMed APP's Market

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Abstract: First of all, according to the survey data of mobile research products, the correlation analysis method is used to analyze the Spearman correlation coefficient between variables, and several influencing factors are selected. Second, do factor analysis, the main factors that affect the development of mobile research products are the expectations of the mobile PubMed APP product type of tutoring class which colleges have taken part in wanted channels of PubMed study the wanted type of PubMed review products Every day spent on the total length of PubMed review time total time of every day spent on personal computer and mobile PubMed APP. Then, targeted product hours, species, function these three aspects collect sort out price. Use data fitting, get most PubMed review product's price distribution5000-7000yuan.Next, adopted Gray prediction, by identifying the degree of dissimilarity of each factor, establish the corresponding differential equation, we find that the probability of potential possession ratio of 0.30 or more is relatively large, and PubMed potential market share of mobile terminal products on the rise. at last, taking Beijing as the research object, Use the comprehensive evaluation, found that the mobile side of PubMed products more popular than the unpopular degree. Thus it can be drawn from it is feasible to launch in Beijing.

Keywords: Correlation analysis; Factor analysis; Data fitting; Comprehensive evaluation method

1. INTRODUCTION

2017 Chinese postgraduate entrance examination last year, an increase of 13.56 percent year on year, indicating a new round of PubMed exam hot arrival. PubMed product line also will rise. A well-known PubMed site in order to gain insight into the mobile market research products market share and development trend, conducted an online survey. Through the survey data, explore the main factors that affect the development of mobile research products and estimate its price and market share, choose a city which have relatively large number of colleges and universities as a research object, taking full account of economic, social conditions and the characteristics of postgraduate education, evaluate the feasibility of product launch mobile end PubMed product.

2. METHOD AND RESULTS

To analyze the relationship between the development of mobile research products and the problems investigated, we put "the average time spent on the mobile PubMed APP" as the main factors affecting the development of mobile research and development products. Using correlation analysis, the Spearman correlation coefficient analysis is performed between the relevant variables, by exploring, we elect "the average time spent on the mobile PubMed APP" correlation with the degree of several variables as a large factor in mobile terminal product development impact study section. Analysis of these factors, calculate the score matrix, the correlation coefficient summarizes the major, get main factors that affect the development of mobile PubMed products [4].

Due to the relationship between "the average time spent on the mobile PubMed APP" and the information given by the student is nonlinear, unknown distribution [1]. Generation, most commonly used access to information channels, type of tutoring class which colleges have taken part in nd other 15 information known as the impact of mobile product development of the initial factors. Using SPSS to find "the average daily spend on mobile PubMed the length of study time" and the correlation coefficient between the factors, get 15 preliminary factors related to it.

Get to a conclusion:

Table 1 KMO and Bartlett Detectiona

Enough Kaiser-Meyer-Olkin Amount		.647
Bartlett Spherical Detection	Approximate χ^2	7061.184
	df	105
	Sig.	.000

In KMO, probability is less than the 0.000 significance level, reject the original hypothesis, there are significant differences with the matrix, KMO is 0.647, it' s suitability for factor analysis.

From the above table, component 1 to 5 are larger eigenvalues, indicating that the five main components of the contribution rate are relatively large, so we can extract ingredients 1, 2, 3, 4 and 5 as the main component.

Table 2 Cumulative variance table

Ingredients	Initial Eigenvaluea			Extract squares and Load		
	Total	Variance %	Accumulate %	Total	Variance %	Accumulate %
1	2.409	22.588	22.588	2.409	22.588	22.588
2	1.748	16.393	38.981	1.748	16.393	38.981
3	1.512	14.178	53.159	1.512	14.178	53.159
4	1.122	10.520	63.679	1.122	10.520	63.679
5	.774	7.258	70.937	.774	7.258	70.937

Table 3 Ingredients score coefficient matrix

	Ingredients				
	1	2	3	4	5
Generation	.000	.008	-.001	.022	.045
Access to Information	-.003	.000	.002	.004	-.018
The way to get information	.023	-.002	.018	-.027	.139
Tutoring class Type	.281	-.012	-.831	.508	-.037
Tutoring class' Features	.001	.000	.000	.000	.001
Preparation period	-.022	.008	.030	.039	.122
Studying time	-.018	.005	.012	.144	.743
Learning channels	-.091	.024	.042	.219	-.535
Study on PC	-.099	.055	.190	.484	.168
Development trend on PC	.037	.002	-.010	.001	.015
Wanted Mobile PubMed APP	.824	.051	.537	.196	-.112
Expect Mobile PubMed APP	.011	.000	-.005	-.012	.025
APP Advantage	.000	.000	.000	.000	.000
Expectations of APP	.002	.988	-.078	-.138	.016
Studying Time On APP	-.121	.059	.149	.500	-.099
Extraction Method: Principal Component Analysis					
a.: The coefficients have been standardized					

According to the component score coefficient matrix, the main factors are screened out, and the main factors are summarized and summarized, which affect the main factors of mobile research products:

①the expectations of the mobile PubMed APP product

②type of tutoring class which colleges have taken part in wanted channels of PubMed study total time of every day spent on personal computer and mobile PubMed APP.

The development of the product will affect the price of the product. It is necessary to estimate the reasonable price range of the developed products, and summarize the length of the course (hereinafter referred to as "class"), product type and product function from the main factors influencing the development of the mobile research products Will affect the price of mobile research products. Based on these three aspects of the mobile side of the product research price collection and finishing, and then use MATLAB to select the data fitting and analysis, you can estimate the mobile side of the reasonable price range of Kaoyan products.

By the collection of data and finishing, mobile research products of the hours (section) and price (yuan) as shown in the table4.

Set the time for the t (section), the price is y (yuan)

Table 4

Classt(Section)	20	30	40	50	60	70
Price y(yuan)	4000	7200	9000	10000	11000	12000

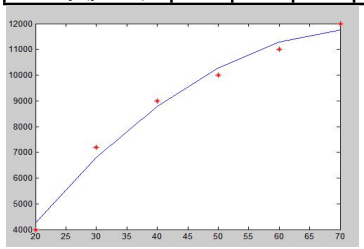

Figure 1 class time fitting curve

Collecting data and finishing available, mobile side PubMed product function (a) and price (yuan) as shown in the table:

Table 5. Function and price relationship

Function()	1	2	3	4	5	6	7	8	9	10
Price	3288	3388	3488	3588	3688	3888	3988	4088	4188	4288

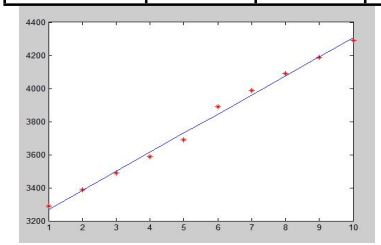

Figure 2 Performance function fitting curve

Similarly, by collecting data and sorting available, the relationship between the type (a unit) and the price (yuan) of the mobile end entrance examination product is shown in the table6.

Table 6 Type and price relationship

product type	Dictionary products(a)	Dictionary products(b)	Recording course products	Webcast curriculum products
Price (yuan)	953	999	1110	1230

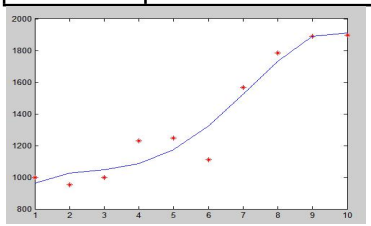

Figure 3 Product Type Fitting Curve

Obtained by data fitting comprehensive analysis

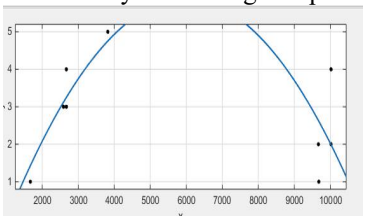

Figure 4 Comprehensive analysis of data fitting

Analyze data after data fitting, as shown in Figure 5, When the mobile terminal training postgraduate products at reasonable price is 5000-7000-yuan price of the product.

The potential market share of the product has two characteristics: quantity and quality.[2-3] The main factors influencing the development of the research and development of the mobile end of the research and development of the research and development of the research on the potential market share of the product are the " "Is a manifestation of the quality characteristics of the potential market share of the product, because these" manifestations "contain uncertainties, so we use gray prediction to predict these representations, resulting in mobile market research products potential market share.

Using MATLAB to Draw the Fitting Curve of Its Quantitative Characteristics

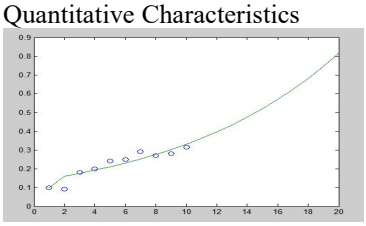

Figure 5 Quantitative feature fitting curve

By observing the quantitative feature fitting curve of the mobile research products, it can be concluded that the potential market share of the mobile research products is increasing with the quantitative characteristics as the market share evaluation standard, and the occupancy ratio is 0.30 The probability of the above is relatively large.

Table 7 Market share of mobile research products based on quantitative characteristics

years	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
ratio	0.10	0.09	0.18	0.20	0.24	0.25	0.29	0.27	0.28	0.31

Table 8 Market share of mobile research products based on quality characteristics

years	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
ratio	0.03	0.03	0.05	0.09	0.09	0.10	0.15	0.17	0.21	0.20	0.25	0.29	0.27	0.28	0.31

Using MATLAB to Draw the Fitting Curve of Its Quality

By observing the quality curve of the developed products, it can be seen that the potential market share of the mobile research products is increasing with the quality characteristics as the market share evaluation standard, and the occupancy ratio is above 0.30 Probability is relatively large.

Therefore, the integration of the market shares of the number and quality of the two characteristics of the analysis, we can see that the mobile market research products, the potential market share is an upward trend, and the occupancy ratio of 0.30 or more probability is relatively large.

Beijing's economic prosperity, people can afford the price of the product, and Beijing education is very developed, we put Beijing as a product operation market. According to the main factors have been used, the use of comprehensive evaluation method to explore the mobile research products in this city is feasible.

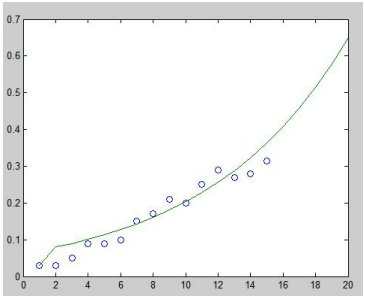

Figure 6 Quality characteristic fitting curve

Based on the fuzzy comprehensive evaluation to take the evaluation factors:

X=[economicA1 Social situationA2 Characteristics of PostgraduateA3 Education Tutoring class typeA4 PubMed study channelsA5 The average time of studyA6 FeaturesA7]

Y=[very popular、More popular、unpopular]

Through the online questionnaire survey, 2050 valid questionnaires were obtained, and 500 samples were randomly selected as samples. Among them, the results of the survey on the mobile research products showed that 150 people indicated that the mobile research products were "very popular" and 125 were mobile End PubMed products "more popular"; 225 people said the mobile side of Kaoyan products "unpopular".

The results are as follows:

A1=(0.3 0.25 0.45) A2=(0.60 0.30 0.10) A3=(0.40 0.20 0.40)

A4=(0.60 0.30 0.10) A5=(0.50 0.40 0.10) A6=(0.60 0.30 0.10) A7=(0.50 0.40 0.10)

$$R=\begin{bmatrix}A_1\\A_2\\A_3\\A_4\\A_5\\A_6\\A_7\end{bmatrix}=\begin{bmatrix}0.30 & 0.25 & 0.45\\0.60 & 0.30 & 0.10\\0.40 & 0.20 & 0.40\\0.60 & 0.30 & 0.10\\0.50 & 0.40 & 0.10\\0.50 & 0.40 & 0.10\\0.50 & 0.35 & 0.15\end{bmatrix}$$

Get fuzzy matrix:

Determine A: Determine the weight of the seven factors in the total judgment.

Confirmed by the study, get factor weight:

A=(0.20, 0.20, 0.15, 0.10, 0.15, 0.10, 0.10)

$$B=A\bullet R=(0.20,0.20,0.15,0.10,0.15,0.10,0.10)\bullet R$$

$$=(0.475,0.305,0.490)$$

From the results obtained, APP in Beijing a great chance of successful operation.

3. CONCLUSIONS

In this paper, the relevant analysis method and factor analysis method, the research data of the Kaoyan product processing, the impact of the development of mobile research products, the main factors for the development of research on the mobile side of the expected, reported the type of college entrance examination classes, Of the tendency of the channel and in the mobile side of the study for the study of the tendency of the product, spent every day studying in the study of the total length of time and spent each day in the PC and mobile side of the study period. Then, by using the method of data fitting, the price of the mobile research products is distributed in the range of 5000-7000 yuan, and the potential market share of the mobile research products is forecasted by the gray forecast method, and the potential occupancy rate is 0.30 The probability of the above is relatively large. Finally, taking Beijing as the research object, using the comprehensive evaluation method, it is found that the popularity of Kaoyao research products is more popular than the unpopular degree, which is feasible in Beijing.

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Research On ‘Dose Shared Bike Platform Can Solve Last Mile Problem

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Abstract: This paper mainly studies the emergence of shared bicycles whether solve the "last mile problem" or not, through the analysis of the background, we do a brief description of the "last mile problem" and shared bicycle industry background. In this paper, probabilistic statistical theory is used to derive the probability distribution function of trip distance, and the reasonable distance of the model is verified by fitting the travel distance data of Wenzhou citizens, to quantify and non-linear regression of relevant factors such as city scale, city shape and the traffic structure, etc. The general form of the probability distribution function of the travel distance, the model gives reasonable theoretical proof and derivation, calculated for maximum trip distance interval probability in city traffic, and judged whether can solve the problem of "last mile" according to the trip distance interval.
Keywords: last mile; probability density distribution function; nonlinear regression

1. INTRODUCTION

With the born of domestic and international green, low-carbon travel concept, “bicycle sharing” this emerging project is booming. Bicycle sharing reflects the awakening of people's ecological environment and their own health. Foreign metropolis such as New York is already developing bicycles public transportation. He calls the public bike system as a new public transporting outside the subway and bus, not only that the New Yorkers will become more longevity, and tens of millions of foreign tourists will get convenient, cheap transport. More importantly, this is an effective way to reduce traffic congestion and improve urban air quality significantly. In addition, there are domestic personal-lead bike sharing plans. For example, ofo shared bikes, is a student entrepreneurship program at Peking University campus. As the main means of transport in the university is a bicycle, about one-third of the graduates in the graduation season will leave their bicycles on the campus. Since old cars can't be sold or brought home inconvenient, there will be many bicycles abandoned. Many bicycles are Abandoned, and every half of the freshmen will buy a bike. Which led to the problem of bike full of suffering, and often caused a lot of students cannot find their own bike, not lost, just forgot bikes ‘location. In addition, Campus bikes are also suffering from "buying a car, repairing a car and losing a car" and other pain points. Based on the above practical problems, Zhang Siding and his classmates of Peking University founded the of bicycle shared bike platform (ofo platform), aiming to improve and solve this problem. Inspired by Uber and Airbnb, the ofo shared cycling project was began running at Peking University in September 2015. Ofo calls on teachers and students to transfer their bikes to ofo, adding the "ofo sharing bike" in return for all the free use of shared bikes. The ofo team also launched the iconic "little yellow" bike - the body color is uniform and painted yellow.

As commuters commute every day, the "last mile" distance between a subway station and a bus stop has been a hard nut to crack. Even a city subway and bus system is perfect, cannot solve the "last mile" problem perfectly. Bicycles that are excellent in short distance travel just make up for defects at the end of the traffic. A few years ago, there was a government led shared bicycle on the streets of Beijing, but its "borrowing" and "return" had to be dependent on specific bike points and fixed bike piles, so flexibility and convenience were limited. Since the second half of 2016, a large number of sharing bikes is in city streets: a bicycle can serve many people, can solve the problem of short distance travel, can alleviate the important function of traffic congestion, reduce vehicle emissions, but also can return blue sky to the city, and provides the solution of “last mile “problem

2. BRIEF DESCRIPTION OF"LAST MILE"

For the trip of people living in the city, whether work or go home, the "last mile" distance between a subway station and a bus stop has been a hard nut to crack. Walk too far, taxi is not worthwhile. By establishing a function model, we can judge whether the current shared bicycle model can solve the "last mile" problem.

3.CALCULATION METHOD OF URBAN RESIDENT TRIP DISTANCE:

From the point of view of the stochastic theory, the travel distance from the departure point to the destination, “ X ” is a random variable. For vehicles that have travelled a distance “ s ”, [1] the probability of termination within the next distance Δs shall be in direct proportion to the distance traveled[4]. In the formula $\lambda s\Delta s + O(\Delta s)$, the probability λ is not

dependent on the constant of s and Δs, when $s>0$; $O(\Delta s)$ is as the higher order polynomial of Δs:

$$P\{s<X\le s+\Delta s \mid X>s\}=\lambda s\Delta s+O(\Delta s) \tag{1}$$

The left side of the equation is conditional probability, further converted[4]:

$$\begin{aligned}&P\{s<X\le s+\Delta s \mid X>s\}\\&=\frac{P(s<X\le s+\Delta s\bigcup X>s\}}{P(X>s)}\\&=\frac{P\{s<X\le s+\Delta s\}}{P(X>s)}\\&=\frac{F(s+\Delta s)-F(s)}{1-F(s)}\end{aligned} \tag{2}$$

So:

$$F'(s)=\lim_{\Delta s\to 0}\frac{F(s+\Delta s)-F(s)}{\Delta s}=\lambda s[1-F(s)] \tag{3}$$

The traveling distance density function $F(0)=0$ can be obtained by solving the linear differential equation with initial conditions.

Established model:

$$f(s)=\lambda s e^{(-0.5\lambda s^2)} \tag{4}$$

Among them λ is the fixed value, according to the actual situation of the numerical value.[2] Through the data statistics and calculation of bike sharing in Wenzhou, the city land size, shape and structure of city city road traffic as a vehicle to travel the three factors from the model parameters, the regression constants can be:

$$\lambda=0.00116\sqrt{S}+0.118\sqrt{\frac{S}{S_0}}-0.02439\lg\left[\frac{l_b}{l_c}\right]-0.0153 \tag{5}$$

According to the above analysis, the city land size, shape and structure of city road traffic as a vehicle to travel the three factors from the model parameters, using multivariate linear regression equation, namely type: S as city built area, S_0 used to represent the city land scale. In order to compare with the trip distance, the square root of the built-up area is used as a regression analysis of the influencing factors; the minimum circle area covering all the construction land is taken as the center of the city center. $\sqrt{S/S_0}$ As the city shape coefficient, namely the same actual land size (excluding water and other land) of the radius and the center of the city, can cover all construction with the minimum ratio of the radius of the circle; l_b for the taxi, pedestrian travel total travel proportion%; l_c for sharing bicycle travel total the percentage of travel, %.[3]

The construction of Wenzhou city's land area is 1637 km2; the minimum coverage radius of 25.7 km, on travel peak period the ratio of trip by bus and foot was 38%, compared to 7.8% by the sharing of bicycle, so it can be calculated according to the formula:

λ =0.025 723

Model image:

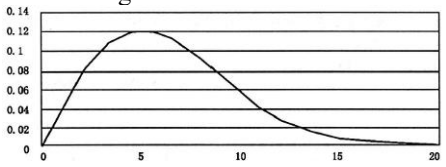

Figure 1 Theoretical probability density function image

Through the actual data processing and screening, the use of Matlab can get the use of shared bicycle in Wenzhou City:

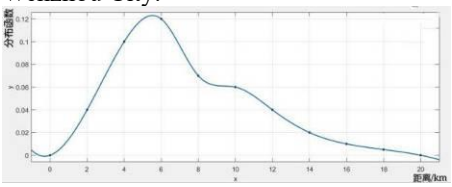

Figure 2 Shows the probability function image of the actual use of bicycles

According to the travel probability distribution of the cycling of the residents of Wenzhou, it can be concluded that the actual data can be well fitted with the model, so the model has strong feasibility, and the travel distance of the citizens is mainly distributed Short-range, so it can be concluded that sharing a bicycle can better solve the last mile problem.

4. CONCLUSION ANALYSIS

From the multivariate nonlinear regression equation image can be seen:

(1) The actual image basically conforms to the theoretical image, indicating that the density function is consistent with the probability function.

(2) from the actual image available 4-8km use the number of shared bicycles accounted for the largest proportion, indicating that the public prefer to use the bike to solve the "last mile" problem

(3) With the increase of the area of urban built-up area, the value decreases gradually, which is consistent with the larger the scale of urban land and the larger the average travel distance. The greater the shape coefficient of the city, the value also increases. The greater the shape of the city, it means that the more the shape of the city, the more the layout of the city radioactive development, the direction of distribution of the direction of the rules are very regular, the regression results consistent with the actual situation.

(4) the smaller the ratio of taxi, walking and shared bicycle travel ratio, the greater the value. Because in the "last mile" travel distance, the increase in the proportion of shared bicycle means that residents use the shared bicycle to enhance the volume, which is consistent with the actual situation.

5. CONCIUSION:

With the growing economic development, we are optimistic about the way this shared bicycle is

developed. Through our analysis of shared bicycle data, we established a model of bicycle travel distance, in order to visually see the impact of the current shared bicycle on urban residents. In the current society, the bike has an unparalleled advantage during the process of solving the "last mile “and create a clean city. Shared bicycle riding the share of the economic wind, with its easy to pay online, quickly "capture the people hearts." But in the meantime Shared bicycle creates the convenience to travel, also brought a lot of "inconvenient". The emergence of cycling chaos stop, illegal robbed of the phenomenon, is due to the shared bicycles and urban compatibility, urban slow traffic system is uncompleted. This paper focuses on the effectiveness of sharing bicycles in solving the "last mile" problem. Sharing bicycles has a positive impact on urban residents' travel and can effectively solve the "last mile" problem.

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Research on Personal Credit Evaluation Model Based on GA - BP Neural Network

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Abstract: In today's society, the economic system radiates the entire social life. With the rapid development of today's economy and the proportion of personal credit in the bank loan business, the establishment of an automated personal credit evaluation system which can scientifically identify the personal credit risk is directly connected with the bank's business. In order to construct a reasonable and trustworthy model, a large amount of data was extracted and a large number of customer information was extracted as a training set in the database. Due to its non-linearity, the BP neural network model was used to establish the personal credit evaluation model, the error is 9.37%. In order to ensure its credibility, the genetic algorithm had also been used to optimize the BP network caused the error rate dipped to 2.31%.

Keywords: personal credit evaluation; BP neural network; genetic algorithm; factor analysis

1. INTRODUCTION

From the bank's view on the personal credit assessments, they lost the developmental space of business. The international financial community generally believed that the corporate loans were nearly the same as wholesale businesses, which were both low interest rates and risk concentration. On the other hand, consumer credit is equivalent to retail businesses for their high interest rates and the risk diversification. In the bank's asset business, consumer credit content was extremely high. Due to the demand on expanding personal credit resources, a comprehensive personal credit assessment system was very important.

2. MODEL ESTABLISHMENT

2.1 Personal Credit Assessment Model

BP learning algorithm for adjusting the weight value of three-layer feed forward networks formula.:

$$\Delta w_{kj} = -\eta \frac{\partial E}{\partial w_{kj}} = -\eta \frac{\partial E}{\partial net_k} \frac{\partial net_k}{\partial y_{ji}} = \eta (d_k - o_k) o (1 - o_k) y_j$$

$$\Delta v_{ji} = -\eta \frac{\partial E}{\partial v_{ji}} = -\eta \frac{\partial E}{\partial net_k} \frac{\partial net_k}{\partial y_{ji}} = \eta \delta_{ji} z_i = \eta (\sum_{k=1}^{k} \delta_{ki} w_{kj}) y (1 - y_j) z_i$$

Similarly, we can get the formula to adjust the threshold:

By adjusting the weights and thresholds of the BP neural network, 80% of the original data was extracted by SPSS as the training set to obtain the personal credit risk assessment model (Tab.1). The network training chart built by MATLAB was shown below and the preliminary analysis of the neural network constructed by MATLAB is as follows. (Fig. 1,2)

$$\Delta \theta_k = -\eta \frac{\partial E}{\partial \theta_k} = -\eta \frac{\partial E}{\partial net_k} \eta \frac{\partial net_k}{\partial \theta_k} = -\eta \delta_{ok}$$

$$\Delta \gamma_j = -\eta \frac{\partial E}{\partial \gamma_j} = -\eta \frac{\partial E}{\partial net_j} \eta \frac{\partial net_j}{\partial \gamma_j} = -\eta \delta_h$$

Table 1 Extracting raw data as a training set

	Training set grouping and selection									
A9		A6		A3		A7		A4		
A91	1	A61	1	A30	0	A71	1	A40	0	
A92	2	A62	2	A31	1	A72	2	A41	1	
A93	3	A63	3	A32	2	A73	3	A42	2	
A94	4	A64	4	A33	3	A74	4	A43	3	
A95	5	A65	5	A34	4	A75	5	A44	4	
A14		A15		A12		A17		A45	5	
A141	1	A151	1	A121	1	A171	1	A46	6	
A142	2	A152	2	A122	2	A172	2	A47	7	
A143	3	A153	3	A123	3	A173	3	A48	8	
A144	4	A154	4	A124	4	A174	4	A49	9	
A1		A19		A20		A10		A410	10	
A11	1	A191	1	A201	1	A101	1			
A12	2	A192	2	A202	2	A102	2			
A13	3	A193	3	A203	3	A103	3			
A14	4	A194	4	A204	4					

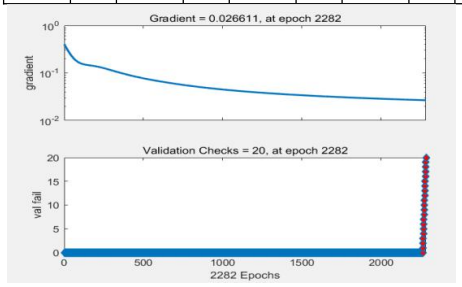

Figure 1 the network training chart

2.2 The Test Of Personal Credit Assessment Model

The remaining samples were tested and the GA-BP neural network model was established to localize the BP neural network. Now, most of the work on using GA for training neural networks are pre-fixed network topology. And then use GA to optimize the weight of NN, evolutionary training methods can be divided into two main steps:

First, determine the weight of the network connection.

Second, use GA to complete the evolution.

GA has a global optimization, the objective function does not depend on the gradient information or other characteristics, but its shortcoming is also obvious: On the one hand, when the genetic search quickly find the optimal solution near, it can not be precisely adjusted, that is, it does not have the ability to fine tune in the local search space. On the other hand, is the parameter of GA. If the population size, genetic operator is design improperly, it will produce precocious, slow evolution and so on. The idea of combining genetic algorithm with BP algorithm to train neural network is to optimize the initial weight by using genetic algorithm, and orate a better search space in solution space. Then, the BP algorithm searches for the optimal solution in this small solution space. This has overcome the BP algorithm is easy to fall into the local minimal, but also overcome the genetic algorithm in the case of large groups of convergence slow defects.

This model had been tested along with the remaining 20% of the data, and the error was tested by the MATLAB function var (a) ((a) on behalf of the neural network) in the result of 9.37%. After that, the original BP model was optimized by using MATLAB based on the establishment of the genetic algorithm model. Again, they used the MATLAB test to find that the error is reduced to 2.31%.

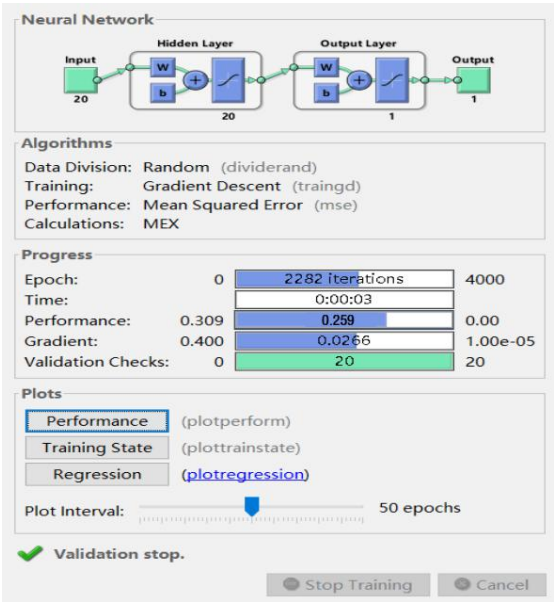

Figure 2 the preliminary analysis of the neural network

2.3 The Test Of The Test Model

The test proved that for most numerical optimization problems, the adoption of some specially designed genetic operators was more efficient than using the binary coding algorithm. As the real number of coding is natural, easy to be introduced to the relevant areas of knowledge and heuristic information to increase the search ability, so it is more and more widely used. In this paper, the coding of the problem was real coding.

The difference between arithmetic cross and discrete crossover can be used to borrow a geometric concept to give a description of the image: through two parent individuals X_A, X_B can be used to form an R_n (n-dimensional real space, determined by the number of loci in the individual) , The offspring generated by the discrete crossover are located at the apex of the hyper-cube, and the offspring generated by the arithmetic cross is located inside the hyper-cube. From this point of view, the search range of the arithmetic cross is larger than that of the discrete cross, and the local search ability of the arithmetic cross is stronger than the discrete crossover.

Genetic algorithms can be summed up into two computational processes: genetic operations (crossover and mutation) and evolutionary operations (selection). Genetic modeling simulates the process by which genes produce new offspring in each generation, and evolutionary operations are the process of continually updating populations by competing. In the non-consistency variation, the mutation operator is first connected with the evolutionary algebra, which makes the initial variation range larger. With the advancement of the algorithm, the range of variation is gradually reduced and plays a role of fine tuning on the BP neural network model The modification has a very good improvement.

2.4 The Establishment And Solution To The Lack Of Hierarchial Model

First, this paper used factor analysis to express each variable of the original observation with the sum of the linear function and the specific factor containing a few common factors. Starting from the study of the dependence of the relevant matrix, some of the complex variables were summarized as a few comprehensive factors. Mathematical model was expressed as a matrix in the form of $X = AF + E$, where F was a common factor and E was a special factor. In this paper, after the standardization of data, the principal component method was taken to extract the common factor, and used the variance to maximize the positive rotation.

Firstly, analyzed whether the original variable was suitable for factor analysis. Tab.2 is part of the original variable correlation coefficient matrix, because the variables were like these. Most of the correlation coefficient are higher, the variables were strong linear relationship. And from the Tab.3 Bartlett ball test and KMO test, the k is close to 0.6, sig. <0.05. So a conclusion can be drawn that factor analysis can be carried out.

Secondly, the AHP model was used for analysis. First, the 10 indicators were stratified, the decision problem was divided into two levels: the target layer D was CLASS, the criterion layer E; each layer had several elements: existing demand

deposits, credit records, savings accounts, working years, Guarantor, property status, housing situation, existing loan number, occupation type, number of dependent individuals. According to the correlation coefficient of the original variable, the principal component analysis method was used to extract the factor and specify three factors was extracted [12]. The analysis results were shown in the following Tab.4. Through the above factors extraction process, the selection of three common factors, the variance cumulative contribution rate was 88.127%, which was 87.871% of the original information. And the variance contribution rate assigned to each factor after rotation was more appropriate. This paper used these three factors as a comprehensive variable to evaluate each person's credit risk assessment.

Table 2 Part Of The Original Variable Correlation Coefficient Matrix

Correlation					
		A5	A2	A17	A19
A5	Pearson Con-variance of significant correlation square and cross product	1	.613**	.260**	.277**
			.000	.000	.000
		6.291E9	1.638E7	377631.181	306603.275
		7873702.16	20506.575	472.630	383.734
		800	800	800	800
A2	Pearson Con-variance of significant correlation square and cross product	.613**	1	.191**	.173**
		.000		.000	.000
		1.638E7	113606.795	1174.893	814.430
		20506.575	142.186	1.470	1.079
		800	800	800	800
A17	Pearson Con-variance of significant correlation square and cross product	.260**	.191**	1	.375**
			.000	.000	.000
		377631.181	1174.893	334.389	95.445
		472.630	1.470	.419	.119
		800	800	800	800
A19	Pearson Con-variance of significant correlation square and cross product	.277**	.173**	.375**	1
		.000	.000	.000	
		306603.275	814.430	95.445	194.220
		383.734	1.019	.119	.243
		800	800	800	800

Table 3 Test of KMO&Bartlett

Test of KMO&Bartlett		
Sampling sufficient degree of Kaiser-Meyer-Olin		.599
Spherical degree test	approximate	2726.338
	df	210
	Sig.	.000

In this paper, the variance maximum method was used to carry out orthogonal rotation on the factor load matrix, and the factor load matrix was obtained after 10 times. After analysis, the 20 variables were divided into 8 categories by the component score coefficient matrix and the component score con-variance matrix. After the correlation degree, 10 variables were screened and the remaining variables were used to represent the problem.

Finally, 10 variables obtained by factor analysis were used to calculate the weight of the criterion layer according to the data of 10 variables. The proportion of each variable was obtained according to the weight ratio, and the credit evaluation was carried out. The credit score is divided into six grades: AA, A, BB, B, CC, C correspond to 3.6-3.0, 3.0-2.4, 2.4-1.8, 1.8-1.2, 1.2-0.6 , A credit score of 0.6-0. Part of the table data as shown in the table below(Tab.5).

Table 4 Analysis results

Common factor variance		
A1	1.000	.899
A2	1.000	.900
A3	1.000	.812
A4	1.000	.816
A5	1.000	.806
A6	1.000	.898
A7	1.000	.900

A8	1.000	.906
A9	1.000	.942
A10	1.000	.869
A11	1.000	.863
A12	1.000	.866
A13	1.000	.811
A14	1.000	.898
A15	1.000	.841
A16	1.000	.841
A17	1.000	.883
A18	1.000	.859
A19	1.000	.840
A20	1.000	.838
CLASS	1.000	.876

Extraction method:principal component analysis

Table 5 Rating of the assessment

	sample	1	2	3	4	5	6
index							
A1		4	1	1	1	2	1
A3		4	2	2	2	0	0
A6		5	5	1	1	1	0
A7		5	5	4	1	2	0
A10		1	1	1	1	1	1
A11		4	4	3	1	1	2
A12		4	2	2	3	1	2
A15		3	3	2	2	1	1
A16		1	1	1	1	2	1
A17		4	3	3	1	1	1
CLASS		3.644805	2.83879	2.112534	1.432195	1.028812	0.43996
Rating level		AA	A	BB	B	CC	C

3. RESULT ANALYSIS

According to the principle of individual credit evaluation index, based on the domestic and foreign banks and credit evaluation institutions on the basis of index system, this paper built a suitable personal credit evaluation index system [3]. The experimental results show that the BP neural network model was proper to predict and realize the credit classification of customers, and the expected correct rate is achieved. The neural network method eliminates many human factors and ensures the objectivity of the results. By selecting the appropriate genetic operators and mutation operators, the genetic algorithm is used to optimize the BP network, which improves the network performance and the accuracy of the prediction results.

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The Research On Sharing Bicycles Under the Background of "Internet +" Era

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Abstract: With the advent of the era of "Internet +", the emergence of sharing bicycles has set off a craze for sharing bicycles. This article analyzes the development trend of the sharing cycle to solve the "last kilometer" problem and the company operation mode of the sharing cycle. For problem 1, based on the fuzzy synthesis evaluation model was constructed and combined with control variable method. With the different area and time, we analyze three index include vehicle flow situation, the number of people stranded in the morning and evening peak and the utilization rate of bicycle. Finally get the normalized formula. Plug in the data and get the last mile of the city is well solved. The effect of second-tier cities and third-tier cities is not significant. For problem 2, a continuous model based on gray prediction algorithm is established. Based on the data of existing bike sharing, the funds of the two companies, Ofo Bicycle and MOBIKE, are used to evaluate the sustainable development of bicycles. The revised original sequence prediction model was obtained by predicting the recent three groups of financing, then the residual test and the correlation degree test were executed. Finally, it is concluded that the Shared bicycle company model can be sustained in the short term, but its long-term development is also influenced by many other factors. Finally, reasonable analysis of the multi-polarization model that the sharing bicycle company may produce, and put forward some reasonable suggestions, such as strengthening management, improving users' credit system and establishing industry standard.

Keywords: Fuzzy comprehensive evaluation method; Grey prediction; Continuous analysis; multi-polarization

1. INTRODUCTION

For people living in cities, whether it's work or home, it's always difficult to get public transportation to the destination. It's too far to go and the taxi is too expensive. With the advent of the era of "Internet +", sharing the rise of economy, there are several companies relying on mobile Internet Shared cycling platform is established, using big data, intentions to solve the problem of "the last kilometer".

2. EXPERIMENTAL

2.1. Evaluation model based on fuzzy comprehensive evaluation method

2.1.1 Model preparation

The basic idea of the fuzzy comprehensive evaluation method is to use the membership function as a bridge to transform uncertainty into certainty in the situation.[1-2] This method quantifies the fuzziness and can be analyzed and processed through traditional mathematical methods, and evaluates the status of membership by a variety of factors. It is a method to judge things by fuzzy evaluation index. This method will control the minimum of the influence which the subjective factors of the information to the evaluation results. It is a comprehensive and objective method to integrate the evaluation results.

2.1.2 Solution of model

The paper analyses a first-tier city, a second-tier city and a third-tier city in three different regions. The same reason is that the more bikes the average person shares, the worse the traffic, and the more crucial the Shared bike is to solve the problem. According to the information analyzed, the basis of the evaluation model can be used to use the regional vehicle flow situation, the number of morning and evening peak retention and the utilization rate of bicycles. So there are:

$$\begin{cases} \varepsilon = \dfrac{V}{V_0} \\ \psi = \dfrac{S}{\gamma} \\ Y = \dfrac{\gamma}{\lambda} \end{cases} \tag{1}$$

Next, the three measures are used to determine whether a Shared bike can solve the last kilometer problem. First, the evaluation weight needs to be determined.[3] Set index $X = \{x_1 \quad x_2 \quad x_3\}$ level. Set strength to generally, a little strong, some strong, strong and very strong. It's used to determine the set of weights, and the corresponding value is 1, 2, 3, 4, 5. Through analysis, the dependent function of evaluation should adopt the larger Cauchy distribution function. The large cauchy distribution function is:[4]

$$f_x = \begin{cases} \dfrac{1}{1+a(x-b)^{-2}}, 1 \le x \le 2 \\ c\ln x + d, 2 \le x \le 5 \end{cases} \tag{2}$$

Which a, b, c, d are undetermined coefficients. In fact,

when the intensity is "general", the membership is 0.1. When the intensity is "strong", the membership is 0.6, when the intensity is "very strong", the membership is 1. Therefore, the value of the undetermined coefficients can be determined as 0.1324, 2.2435, 0.4013, 0.3566. These values are substituted into the equation and the normalized value table is shown below:

Table 1 data statistics of different cities

City type	City	Population (10, 000)	Sharing bicycles (10, 000)	Share Mobike (10, 000)	Estimated vehicle volume in 2016 (10, 000)	Projected release in 2017 (10, 000)
First-tier city	Beijing	2419	15	15	36	54
Second-tier city	Chengdu	1443	10	10	20	36
Third line cities	Tangshan	776	6	5	15	25

So we get the weight vector (0.4355, 0.2754, 0.2876). Secondly, data is processed, and the data obtained from the first, second and third-tier cities are as follows:

Table 2 statistics of bicycle indicators in different cities

index	Vehicle situation	flow	The number of people stranded in the morning and evening peak (10, 000)	Cycle utilization
Beijing	crowd		84	69.10%
Chengdu	crowd		68	59.66%
Tangshan	good		20	61.66%

According to the data, the higher of the cycle use ratio, the more likely it is to solve the problem. In order to reduce the error, the actual data and the ideal values are reduced and standardized.

$$a' = \frac{a - a_{\min}}{a_{\max} - a_{\min}} \quad (3)$$

Fuzzy comprehensive evaluation is used to get the weight vector of three regional evaluations, into their deviation evaluation scores as follows: (known deviation evaluation score is smaller, the greater the chance to solve the problem of last kilometer).

Table 3 Cycling deviation assessment form in different cities

City	Beijing	Chengdu	Tangshan
Deviation evaluation score	0.2371	0.3085	0.6954

Therefore, in the first-tier cities in Beijing, the deviation from the evaluation score is the smallest, and the "last mile" problem has been solved to a great extent in this city. The problem of second-tier cities with Chengdu as an example is well solved, but it is still inadequate compared with first-tier cities. In the case of Tangshan, the third-tier cities get the largest deviation evaluation scores, indicating that the emergence of the sharing cycle has not solved the problem very well.

2.2 A persistent prediction model based on gray prediction

2.2.1 Preparation of the model

The gray theory thinks that the behavior of the system is hazy, the data is complicated, but it is ordered after all, and it has the whole function.[5-6] In gray system theory, use less or don't exactly a representation of the behavior characteristics of gray system set up after the original data sequence for generating transformation, a term used to describe the gray system internal things in the process of continuous change model. At the same time, gray theory is established to generate data model, not the original data model. Therefore, gray prediction is a method to predict the system with uncertain factors. At the same time, the gray prediction test usually has residual test, correlation test and post-test.[7-9]

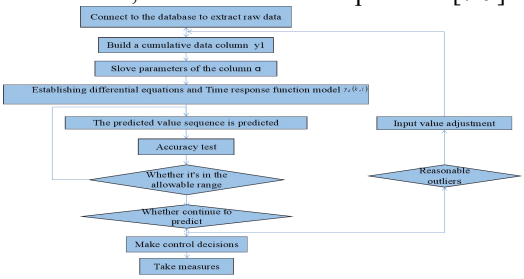

Figure 1 flow chart of gray prediction algorithm

The persistent prediction model can predict whether the operation mode of the enterprise can be continuously developed in the short term based on the existing enterprise development situation. A good prediction scheme for the problems studied. In establishing the model, the first thing to find a prediction of the evaluation indexes, through the check data and filter, learn the discretion of the company raised on behalf of the company's market value and influence, etc., so finally chose raised as the final judgment Shared bike company mode can sustainable development indicators. The amount of a company's financing represents the company's market

value and influence, etc. The following table is the amount of financing that the two share bike companies have published in recent years.

Table 4 status of financing of Ofo bicycle company

Time	Financing rounds	The investor	raise
2015.3	An angel round	Only capital hunting	Millions of yuan
2015.12	The Pre - A round	Oriental hong road (honghe fund), only hunting capital	RMB 9 million
2016.2	A wheel	Jinsha river venture capital, eastern hongdao (honghe fund)	RMB 15 million
2016.8	A + wheel	Empty real fund angel investors	RMB 10 million
2016.9	B wheel	Jingwei China, jinsha river venture capital, only hunt capital	Tens of millions of dollars
2016.9	C1 wheel	Didi chuxing strategic investment	Tens of millions of dollars
2016.10	C2 wheel	Mainly from Coatue, xiaomi, shun as capital, citic industry fund leads	Us $130 million

Table 5 status of the financing of Mobike bicycle company

Year	Financing rounds	The investor	raise
2015.10	A wheel	JOY Capital	Millions of dollars
2016.8	B wheel	Panda Capital, JOY Capital	Tens of millions of dollars
2016.8	B + wheel	Xiang feng investment led, innovative panda capital and investment	Tens of millions of dollars
2016.9	C round	Hillhouse capital, huaping investment group, sequoia capital, qiming capital	Us $100 million
2016.10	C + wheel	Hillhouse capital, huaping investment group, sequoia capital, qiming capital, etc. Meituan CEO wang xing	Did not disclose
2017.1	D round	Hua ping investment, ctrip, hotel and so on	Us $215 million

3. SOLUTION OF MODEL

Table 6 the amount of financing of a bicycle company at different time periods

Ofo (unit 10, 000)						
year	2015.9	2015.12	2016.3	2016.6	2016.9	2016.12
raise	400	900	1700	1200	1345.4	87453.6
Mobike (unit 10, 000)						
year	2015.9	2015.12	2016.3	2016.6	2016.9	2016.12
raise	1345.4	6727.2	16818	67272	114730	144630

The original number of Ofo bike financing is listed as:

$$X^{(0)} = (400,900,1700,1200,1345.4,87453.6)$$

To establish GM(1, 1) model. (1), (2) and (3) get the prediction model

$$\hat{X}^{(1)}(k+1) = (400 - 13884.461)e^{-0.0007185266k} + 13884.461$$

Finally, the forecast value of the financing of Ofo bicycle company is obtained.

Year	Predictive value(ten thousand yuan)
2017.3	67882.1
2017.6	97454.5
2017.9	125010.6

The original number of Mobike financing is listed as:

$$X^{(0)} = (1345.4,6727.2,16818,67272,114730,144630)$$

The GM(1, 1)model is also established, and the prediction model is

$$\hat{X}^{(1)}(k+1) = (1345.4 - 2602.187)e^{-0.00451067k} + 2602.187$$

Finally, the predicted value of the financing of the motorcycle company was obtained

Year	Predictive value(ten thousand yuan)
2017.3	148534.1
2017.6	184629.7
2017.9	218825.4

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A Probe into the Sharing of Cycles in the Background of "Internet+"

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Abstract: Quietly born shared bicycle, in people's daily life occupies an important position, also led to extensive discussion of the community. The distribution of the text, to study the satisfaction of its users, fuzzy comprehensive evaluation model based on entropy method. Select the number of adjustable bicycle, personal demand, riding distance, APP software familiarity and other four factors as the evaluation index, then, the weighting weight of each evaluation factor is obtained by entropy weight method, through the fuzzy comprehensive evaluation and normalization, the fuzzy evaluation vector of the satisfaction degree of the shared bicycle in each region is obtained, Finally, we analyze the degree of bicycle satisfaction in 10 regions.
Keywords: Entropy method, Fuzzy comprehensive evaluation, Least squares method

1. INTRODUCTION

Shared cycling refers to a time-sharing leasing model for bicycle sharing services such as campus, subway station, bus stop, residential area, business district and public service area. Sharing a bicycle is a new type of shared economy that has attracted more and more attention. Because of its low-carbon travel concept, the government is in good faith for this new thing.

2.ESTABLISHMENT OF FUZZY COMPREHENSIVE EVALUATION MODLE BASED ON ENTROPY METHOD

2.1 Preparation Of The Modle

Shared bicycles access to urban public transport network, to get through the city traffic "last mile" for a useful exploration to improve the bike in urban traffic in the commitment rate, so that people can easily complete the city short trip, belong to public transport Innovation model. In an effective solution to the "walking tired, bus crowded, driving block, hit your car, " the distress at the same time, is still in the initial stage of the shared bicycle market, products, users frequently.

Analysis of shared cycling "satisfaction" [1], the need for users and enterprises from two angles, before and after the call to the individual satisfaction with a quantitative analysis. The fuzzy comprehensive evaluation method [2] is based on the membership degree theory of fuzzy mathematics, qualitative evaluation of quantitative evaluation, in the entropy method [3] to analyze, can clearly and systematically solve the satisfaction of a fuzzy, difficult Quantify the problem.

2.2 The Establishment Of The Modle

2.2.1 determine the set of factors for passengers' satisfaction wish shared cycing

According to the time and space distribution of the shared bicycle in 10 regions, the number of cycling, the individual demand, the riding distance and the APP software familiarity are set as the measure factor.

Set the evaluation factor set to: $u_1 = (x_1, x_2, x_3, x_4)$ .The establishment of passenger satisfaction with the quality of the evaluation of the collection.

In order to better illustrate the degree of satisfaction with the use of shared bicycles by passengers, according to the data from the 2015~2016 shared cycling software market analysis report, we divided the measure of satisfaction into four grades, namely, the evaluation set:

Table 2 Passenger satisfaction with the quality of the evaluation of the classification of the level

Serial number		*A*	*B*	*C*	*D*	*E*
1	Adjustable number of bicycles	≤ 5	$5 < t < 10$	$10 \le t < 20$	$20 \le t < 30$	≥ 30
2	Riding distance	≤ 0.05	$0.05 < \lambda_1 \le 0.1$	$0.1 < \lambda_1 \le 0.2$	$0.2 < \lambda_1 \le 0.3$	> 0.3
3	Personal needs	≤ 0.01	$0.01 < \lambda_2 \le 0.1$	$0.1 < \lambda_2 \le 0.2$	$0.2 < \lambda_2 \le 0.3$	> 0.3
4	APP software familiarity	≤ 0.05	$0.05 < \lambda_4 \le 0.2$	$0.2 < \lambda_4 \le 0.4$	$0.4 < \lambda_4 \le 0.5$	> 0.5

The membership function of the descending trapezium distribution, the individual demand, the riding distance, the sub rate function of the appendage of the APP.

Through the evaluation factor membership function, single factor evaluation, and then establish a fuzzy relation matrix. According to the actual survey data available passenger riding distance of the subordinate,

that is, fuzzy evaluation matrix:

$$R_1 = [0.419 \quad 0.780 \quad 0.382 \quad 0.206] \tag{1}$$

2.2.2 establish the weight set of evaluation factors

Due to the different factors such as the number of cycling units, the individual demand, the riding distance, the APP software familiarity and other factors have different effects on the satisfaction degree of the passengers, the indicators should be given different weights. According to various factors on the degree of satisfaction of passengers, the principle of weight to determine the size of the weight.

Calculate the proportion of the indicator value for item i under item j:

$$p_{ij} = \frac{r_{ij}}{\sum_{i=2}^{m} r_{ij}} \tag{2}$$

Calculate the entropy of the j-th indicator ej:

$$e_j = -k\sum_{i=1}^{m} p_{ij} \cdot \ln p_{ij} \text{ and, } k = \frac{1}{\ln m} \tag{3}$$

Calculate the entropy of the j-th index wj:

$$w_j = \frac{1 - e_j}{\sum_{j=1}^{n} 1 - e_j} \tag{4}$$

Determine the comprehensive weights of the indicators Bj:

$$\beta_j = \frac{\alpha_j \omega_j}{\sum_{i=1}^{m} \alpha_i \omega_i} \tag{5}$$

Calculate the weight of C1, C2, C3, C4 respectively, 0.342, 0.281, 0.213, 0.164, that is, the implementation of the subsidy program in the evaluation of the weight of the weight of each set:

$$\omega_1 = [0.342, 0.281, 0.213, 0.164] \tag{6}$$

2.3 Fuzzy Comprehensive Evaluation

The weight of the metric index factor is combined with the single factor matrix to obtain the fuzzy synthesis result S, and the number of schedulable bicycle is taken as an example.

$$S_1 = \omega_1 \times R_1 = (0.143, 0.219, 0.081, 0.034) \tag{7}$$

Similarly, the fuzzy comprehensive evaluation results of other evaluation factors were obtained. The fuzzy comprehensive evaluation matrix is:

Riding distance

$$S_2 = (0.349, 0.149, 0.107, 0.049) \tag{8}$$

Personal demand

$$S_3 = (0.162, 0.401, 0.249, 0.057) \tag{9}$$

APP software familiarity

$$S_4 = (0.324, 0.318, 0.158, 0.058) \tag{10}$$

And then obtains the first-level fuzzy evaluation matrix $S = (S_1, S_2, S_3, S_4)'$ of the passenger's satisfaction of riding and cycling, and then performs the fuzzy matrix composite operation and normalization according to ω_1 to obtain the fuzzy comprehensive evaluation vector of the satisfaction degree of the passengers to the shared bicycle.

$$Y_1 = \omega_1 * S = (0.39\ 0.38\ 0.28\ 0.17\ 0.06) \tag{11}$$

Similarly, the fuzzy comprehensive evaluation method can be used to obtain the fuzzy comprehensive evaluation matrix of the evaluation factors of the passenger's satisfaction with the quality of the vehicle before the subsidy scheme is not implemented:

The number of dispatchable bicycles

$$S_1' = (0.168 \ 0.070 \ 0.034 \ 0.012) \tag{12}$$

Riding distance

$$S_1' = (0.168 \ 0.070 \ 0.034 \ 0.012) \tag{13}$$

Personal demand

$$S_2' = (0.328 \ 0.217 \ 0.092 \ 0.040) \tag{14}$$

APP software familiarity

$$S_4' = (0.087 \ 0.113 \ 0.097 \ 0.331) \tag{15}$$

The fuzzy evaluation vector of the satisfaction degree of the shared bicycle is obtained by the composite operation and the normalization of the fuzzy matrix.

$$Y'_1 = (0.347\ 0.298\ 0.186\ 0.169) \tag{16}$$

2.4 Fuzzy Comprehensive Evaluation Model Based On Entropy Weight Method To Obtain The Results Of The Degree Of Cycling In Each Region

It is necessary to establish a set of factors for the satisfaction of the cycling of the bicycles, and to establish the weight set of the evaluation factors. The influence of the factors such as the number of cycling units, the individual demand, the riding distance, the familiarity of the APP software and other factors have different effects on the satisfaction degree of the passengers. The indicators should be given different weights. Based on the entropy method, the fuzzy comprehensive evaluation model is used to obtain the satisfaction degree of the cycling in each region.

Table 2 The degree of cycling in each area

Each area	1	2	3	4	5	6	7	8	9	10
Result	A	C	B	E	B	A	C	D	B	B

2.5 Optimization Modle Of Bike Delivery Based On Nonlinear Constrains

According to the complexity of riding data and the needs of users to use, to collect data, the establishment of non-linear model.

2.5.1 putting the optimization objective function

Based on the sum of the satisfaction degree of 10 regions and the maximum objective function[4], the nonlinear optimization model of the number of bicycles is established. For the N region (N = 1, 2, ..., 10) there are:

$$\max z = \sum_{k=1}^{4} r(k)Q(k)(1+r_t)^{-(t-1)} + \sum_{k=5}^{9} r(k)Q(k,x)(1+r_t)^{-(t-1)} \tag{17}$$

$$\mathrm{r}(k) = [P - T - c(k)]w \quad (k = 1,2.....9) \tag{18}$$

2.5.2 Model Constraints

Constraints include user requirements and decision variable constraints.

The demand constraint is that the cycling demand $C(z)$ is not greater than the amount of cycling that can be used after delivery:

$$\frac{\sum_{k=1}^{4} c(k)Q(k) + \sum_{k=5}^{9} c(k)Q(k,x)}{\sum_{k=1}^{4} Q(k) + \sum_{k=5}^{9} Q(k,x)} \le C_Z \tag{19}$$

$$\sum_{k=1}^{4} I(k) + \sum_{k=5}^{9} i(k)x(k) \le I_z \tag{20}$$

Decision variable constraints for 10 decision variables to meet the upper and lower bound constraints, ie

$$Qb(k) \le x(k) \le Qu(k) \quad (\mathrm{k} = 1,2,3,4) \tag{21}$$

$$xb(k) \le x(k) \le xu(k) \quad (\mathrm{k} = 5,6,7,8,9,10) \tag{22}$$

The corresponding indicators of each time period are input. By solving the optimization model, the value of the decision variable can be obtained, and the output, profit and cost of the total and sub-periods in each period are obtained.

2.5.3 Calculation Of Each Part Of The Index

The amount of cycling required by the user and the amount of bicycle that can be used after delivery are used separately[5].

$R(k)$ and $C(k)$, then:

$$R(k)=r(k)Q(k)(1+r_t)^{-(t-1)} \quad C(k)=c(k)Q(k)(1+r_t)^{-(t-1)} \quad (k = 1,2,3,4) \tag{23}$$

Decision variables are used before and after the change with $Q(k)$, $R(k)$, $C(k)$ and $I(k)$, then:

$$Q(k) = Q[k, x(k)] \tag{24}$$

$$R(k) = r(k)Q[k, x(k)](1 + r_t)^{-(t-1)} \tag{25}$$

$$C(k) = c(k)Q[k, x(k)] \tag{26}$$

$$I(k) = i(k)x(k) \quad (k = 5,6,7,8,9,10) \tag{27}$$

From the above analysis, the two optimal dispatching vehicles are obtained, as shown in Tab.3, the number of cyclists to be mobilized for each area[6]:

Table 3 Traffic is required for each area

area	1	2	3	4	5	6	7	8	9	10
Solution 1	15	3	5	1	17	18	10	5	13	13
Solution 2	10	5	3	2	15	16	11	7	14	17

After the transfer, the fuzzy neutralization evaluation model[7] based on the entropy weight method is used to obtain the results of the cycling degree of each region as shown in Tab.4:

Table 4 After the scheduling to meet the degree of the region

area	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
result	D	E	E	C	C	E	B	E	D	D

According to the degree of satisfaction of the post-dispatching area in Tab 4., it can be seen that after the non-linearly constrained cycling optimization model, the cycling of each area is 80% above the D level, and only a few difference[8].

Therefore, it can be concluded that the cycling optimization model based on nonlinear constraints can better deal with the problem of crane delivery and achieve a better delivery effect.

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The "Internet plus" Era of The Sharing of Bicycles

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Abstract: Quietly born shared bicycles, occupies an important position in people's daily lives, also led to extensive discussion of the community. This paper studies its distribution and customer satisfaction. First, the study of the distribution of shared bicycles, the optimal scheduling model based on simulated annealing genetic algorithm is established. The data is pretreated to obtain the cycling requirements of each region, then by assuming the relative position of the 10 regions, From the transportation cost, the scheduling path, the maximum load of the vehicle three angles to establish the objective function, Finally, through the selection, crossover, mutation and other operations, we get two optimal scheduling paths: 1-8-2-10-4-6-3-9-7-5 and 3-9-7-5-6-4-10-2-8-1.

Keywords: Rough set; genetic algorithm; simulated annealing

1. INTRODUCTION

Shared cycling refers to a time-sharing leasing model for bicycle sharing services such as campus, subway station, bus stop, residential area, business district and public service area. Sharing a bicycle is a new type of shared economy that has attracted more and more attention. Many bicycle companies have bike GPS positioning, to achieve a dynamic monitoring of vehicle data, riding the distribution of data, and then make all-weather supply and demand forecast for the vehicle, vehicle delivery, scheduling and operation and maintenance to provide guidance.

2. OPTIMAL SCHEDULING MODEL BASED ON GENETIC ALGORITHM

2.1 Model Preparation

Genetic algorithm [1-2] the basic idea is: from a set of feasible solutions to solve the problem, in accordance with the survival of the fittest and survival of the fittest principle, one by one evolution to produce a better and better group of feasible solutions, in each generation, according to the merits of the feasible solution to select a part of the excellent copy to the next generation, and cross the operation, resulting in a new set of solutions. The optimal individual in the whole process as the final solution to the problem.

2.2 The Establishment Of The Model

Have a maximum load of q for the transport vehicle. From the designated parking lot, responsible for the regional points of the bicycle demand scheduling service, after the completion of the task back to a parking lot, the distance between the various regions and their respective needs are known. Let $G=\{1,2,3\cdots n\}$ be a collection of all regions, n for the number of regional points, the parking lot is near area 6 and 30: $V=\{1,2,3\cdots m\}$, m for the number of vehicles to be transported. C for the fixed cost of transport vehicles, Q_1 For the maximum load of the vehicle; if vehicle i is used, Then the binary variable u_i is l, otherwise it is 0.Area i requires the requested amount of l_i, before the service lease point, the current load of the service vehicle j is $r_{ij}(1\le i\le m,1\le j\le n)$.

Table 1. Bicycle Scheduling Requirements Table

Area	1	2	3	4	5	6	7	8	9	10
Demand	14	4	5	2	16	18	10	6	15	15

For two different regions i and j, a_{ij} represents the shortest distance between the two. If the vehicle k is j after service i, then x is 1, otherwise it is 0. The objective function of the model, transportation cost, includes the fixed cost and running cost of the vehicle. The mathematical model of transport costs (denoted as Z) is as follows:

$$\min Z=C\sum_{i=1}^{k}u_i+\sum_{k=1}^{m}\sum_{i=1}^{n}\sum_{j=1,j\neq i}^{n}d_{ij}x_{i,j}^{k} \tag{1}$$

$$\sum_{i=1}^{m}u_i\le m \tag{2}$$

$$\sum_{j=1}^{n}x_{i,j}^{k}=\sum_{j=1}^{n}x_{j,i}^{k}\le 1,\quad k\in\{1,2,3\cdots m\} \tag{3}$$

$$\sum_{k=1}^{m}\sum_{j=1,i\neq j}^{n}x_{i,j}^{k}=1,i\in\{1,2,3\cdots n\} \tag{4}$$

$$\sum_{k=1}^{m}\sum_{i=1,i\neq j}^{n}x_{i,j}^{k}=1,j\in\{1,2,3\cdots n\} \tag{5}$$

$$0\le l_i+r_{ij}\le Q_j,i\in\{1,2,3\cdots n\}\text{且}i\neq 15,j\in\{1,2,3\cdots m\} \tag{6}$$

Table 2 Function Expression

Function type	Significance

Formula(1)	A objective function that represents minimizing transportation costs
Formula(2)	Set out the number of vehicles coming out of the parking lot
Formula(3)	The starting and ending points for each path must be a parking lot
Formula(4)	Provides that each area is served once and only once
Formula(5)	
Formula(6)	It is stipulated that each service can be completed and cannot exceed the maximum load of the vehicle

2.3 Improvement Of Genetic Algorithm And Solution Of Cycling Scheduling Optimization

In the intelligent optimization algorithm, GA(GeneticAlgorithm) with the advantages of fast convergence, but also the local search ability is poor and easy to premature convergence weaknesses. in contrast, SA(Simulated Annealing) can be trapped by the probability of sudden jump into the local minimum and eventually tend to global optimal, but its convergence speed is relatively slow. Based on the strong complementarity between GA and SA, the combination of SA and GA can enhance the global search ability of the algorithm and improve the convergence efficiency. In this paper, an improved genetic simulated annealing algorithm is used to solve the problem of shared cycling [3].

2.4 Fitness Function

Since the minimum transportation cost is required, it is a minimum problem, so the original target value is converted to the fitness value when designing the fitness function [8] to ensure that the excellent individual has a large fitness value. The target value can be converted to the fitness value by the scale transformation of the following equation:

$$Fitness(I)=\frac{D_{\max}-D_i+\alpha}{D_{\max}-D_{\min}+\alpha} \tag{7}$$

Where I is the i-th chromosome of the current population, Fitness (I) is the fitness function value, $D_{\max}$ is the maximum target value of the current population, $D_{\min}$ is the minimum target value of the current population, D_i is the target value to be converted, positive real number in the interval $(0,1)$. Use α to prevent the above formula from being divisible, and to adjust the selection behavior from the fitness value selection to the pure random number selection. If the gap between the chromosomes is greater. Then the fitness ratio is chosen; if the interval is relatively small, the selection tends to be randomly selected in competing chromosomes

2.5 Select The Crossover And Mutation Operation

Use the roulette operation to select the fitness value. First generate the $\alpha(0\le\alpha\le1)$ random number, and then choose the following formula:

$$\sum_{j=1}^{n}\frac{f(x^{j-1})}{\sum_{n=1}^{pop-size}f(x^{j-1})}\le\alpha\le\sum_{j=1}^{n}\frac{f(x^{j})}{\sum_{n=1}^{pop-size}f(x^{j})} \tag{8}$$

Where x^j is the first j individual in the population, $f(x^j)$ is the fitness value of the first individual, the number of regional points for the bicycle, and $pop-size$ is the population size. Through this operation, the parent group needs to be selected. Using the single point crossover [4] and the uniform variation [5] operator, the crossover and mutation probabilities are expressed by adaptive p_c and p_m, and the expression is as follows:

$$p_c=\begin{cases}k_2, f^{'}\le f_{avg}\\ \dfrac{k_1(f_{\max}-f^{'})}{f_{\max}-f_{avg}}, f^{'}\ge f_{avg}\end{cases} \tag{9}$$

$$p_m=\begin{cases}k_4, f\le f_{avg}\\ \dfrac{k_3(f_{\max}-f)}{f_{\max}-f_{avg}}, f\ge f_{avg}\end{cases} \tag{10}$$

Where $f_{\max}$ is the largest fitness value in the population, f_{avg} is the average fitness value for each group, $f^{'}$ is the larger fitness value for the two individuals to be crossed, f is the fitness value of the individual to be mutated, and $0<k_1,k_2,k_3,k_4\le1$.

2.6 Optimal Solution

Assuming that the relative positions of the ten regions are random, as shown in Fig 1, we apply the genetic algorithm to this model.

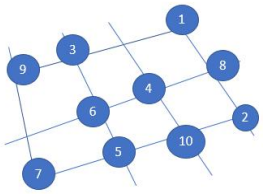

Figure 1 Relative position roadmap

Assuming that any transport vehicle from the parking lot to the various regional points to collect redundant bicycles and assigned to the lack of vehicle area points, and finally return to any one of the parking lot. Therefore, there are two cases.

Table 3 Driving Directions

Transport route	The initial journey	Optimized route	Optimized driving distance
1-4-8-2-10-5-6-3-9-7	51km	1-8-2-10-4-6-3-9-7-5	27km

7-9-3-6-5-10-2-8-1-4	48km	3-9-7-5-6-4-10-2-8-1	25km

3. RESULTS AND DISCUSSION

Optimized route not only saves time and money, but also through the scheduling, to ensure that users enough cycling demand.

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Research on the Development of Mobile Research

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Abstract: In recent years, the number of graduate students studying and studying has increased dramatically. In the immediate development of the Internet, mobile research products are quietly rising. In this paper, the price model based on multiple linear regression analysis and the potential market share model based on Markov chain are established. The factors such as product concern and other factors are used as model to analyze the data distribution of China Mobile product price distribution and search user scale respectively. Through the column chart to compare, and then analyze the characteristics of these variables to find the regression coefficient, the mobile side of the product research reasonable price range. And then use the Markov chain matrix analysis to obtain the market share of the formula: $S = SP$ and $\sum_{i=1}^{n} P_k = 1$, and draw the potential market share.

Keywords: multiple linear regression; regression analysis; Markov chain

1. INTRODUCTION

Research and research boom intensified, PubMed teaching and training of the market has also undergone tremendous changes. In the mobile Internet era of the coming trend, many college entrance examination teaching activities transferred to the mobile Internet and other mobile Internet platform, there have been such as teaching app, mobile phone exam questions, the word book, the wrong title and relying on the existing mobile video platform, such as live Kind of form. Depth understanding of the mobile side of Kaoyan product market share and development trends, has become the intersection of social concern. It is estimated that the reasonable price range of mobile research products will predict the potential market share of Kaoyan products. To understand the price of various types of mobile research products and the number of buyers, and the establishment of different prices under the impact of the purchase of mobile research products to buy the number of evaluation system, it is estimated that the mobile side of the reasonable price range of Kaoyan products; and on the basis of a problem The evaluation of the problem of two to predict the potential market research products potential market share.

2.BASED ON THE MULTIPLE LINEAR REGRESSION ANALYSIS OF THE MOBILE SIDE OF THE PRODUCT RESEARCH ON THE ESTABLISHMENT OF HALF OF THE MODEL, DOUBLE LOGARITHMIC MODEL

2.1 Model Preparation

In the model, the mobile side of the price of research products by the mobile network product type, memory, price and other indicators of the impact, so the above factors as an impact The basis of the model [1].

Linear model

$$Y_K = \beta_0 + \sum_{i=1}^{F} \beta_i X_{ki} + \varepsilon_k, k = 1,2,\cdots, N \quad (1)$$

Semi - logarithmic model

$$Ln Y_k = \beta_0 + \sum_{i=1}^{F} \beta_i X_{ki} + \varepsilon_k, k = 1,2,.....N \quad (2)$$

Double logarithmic model

$$Ln Y_k = \beta_0 + \sum_{i=1}^{F} \beta_i Ln X_{ki} + \varepsilon_k, k = 1,2,.....N \quad (3)$$

In the three models, y is the price of the mobile end of the product, x is the first characteristic of the first sample product, x is the constant term, x is the error term, x is the characteristic variable coefficient, and the xth characteristic pair The effect of price. [2]

2.2 The Evaluation Of Model

The system SPSS is used to solve the product price, and the regression equation is used to eliminate the non - significant characteristic variables, and the other two models are obtained. Finally, a semi-logarithmic regression model is obtained from the table: [3]

$$Ln = 5.938 + 0.178X_1 + 0.006X_2 + 0.003X_3 + 0.014X_4 - 0.068C_3 e^{i\theta} \quad (4)$$

Finally, the double logarithmic regression model is derived from the table: [4-5]

$$Ln = -0.213 + 0.654 LnX_1 + 0.321 LnX_2 + 0.435 LnX_4 + 0.383 LnX_5 + 0.054 C_2 - 0.737 C_3 \quad (5)$$

Table 1 Regression parameters for semi-logarithmic model [6]

Regression results of semi - logarithmic model				
The characteristic variables of the model	Characteristic variable regression coefficient	T value	P value	VIF
Constant	5.938	42.178	0.001	
X1	0.178	2.89	0.004	2.97
X2	0.006	4.45	0.001	1.314

X3	0.003	3.712	0.001	1.318
X4	0.014	1.733	0.084	1.065
C3	-0.068	2.132	0.034	1.01
F value = 52.795 P (F value) = 0.000 R (correlation coefficient) = 0.741 R * R (judgment coefficient) = 0.549 residual square sum = 30.678				

Table 2 Regression parameters for the double logarithmic model

Regression results of double logarithmic model				
The characteristic variables of the model	Characteristic variable regression coefficient	T value	P value	VIF
Constant	-2.13	-0.204	0.839	
LnX1	0.654	2.869	0.004	2.768
LnX2	0.321	4.046	0	1.453
LnX3	0.435	5.847	0	2.213
LnX4	0.383	4.835	0	1.346
C2	0.054	2.042	0.042	1.055
C3	-0.787	-2.337	0.02	1.011

According to the table and table and the resulting semi-logarithmic model, the double logarithmic model we calculated the mobile side of the product price range of 728 ~ 1338 yuan.

According to the statistics, the market share of the product supply and demand, the product of the memory, the type of product and so on according to the random variable market share data, zero to positive infinite when the division, calculated transfer P_{ij} .Through $P_{ij} = P(X_1 = j \mid X_0 = i)$,you can get $P = (P_{ij,i,j \in E})$ and then calculate $P^{(m)} = (P_{ij}^{(m)}, i, j \in E)$.

Which can be used to build the mobile market research market share market forecast model, that is, m-order Markov chain transfer matrix. [7]

$$P^{(m)} = \begin{pmatrix} p_{11} & p_{12} & \cdot\cdot & p_{1N} \\ p_{21} & p_{22} & \cdot\cdot & p_{2N} \\ \cdot & \cdot & \cdot & p_{3N} \\ p_{N1} & p_{N2} & \cdot & p_{NN} \end{pmatrix} = P^{m} \quad (6)$$

We get the transfer probability of m-order, we can get the transfer matrix of market share after m cycles. Assume that the initial market share is $S^{(m)} = (P_1^{(0)}, P_2^{(0)}, \ldots\ldots P_N^{(0)})$, There are m cycles after the market share of $S^{(m)} = S^{(0)}, P^m = S^{(m-1)} * P$

That is

$$S^{(m)} = S^{(m-1)} P = S^{(0)} P^{m} = (P_1^{(0)}, P_2^{(0)}, \ldots\ldots P_n^{(0)}) \begin{pmatrix} P_{11} & P_{12} & \cdot\cdot & P_{1n} \\ P_{21} & P_{22} & \cdot\cdot & P_{2n} \\ \cdot & \cdot & \cdot & P \\ P_{n1} & P_{n2} & \cdot & P_{nn} \end{pmatrix}^{m} \quad (7)$$

If the formula to continue to gradually seek market share, will find that when m to a certain extent, there will not be much change, that is, a stable market share, set its stability value: $S = (P_1, P_2, \ldots\ldots P_n)$,and satisfied $P_1 + P_2 + \ldots\ldots P_n = 1$

If the market flow of customers tends to stabilize for a long time, then after a period of time the market share will be a stable balance, that is, the flow of customers will not affect the market share, and this share has nothing to do with the initial distribution. In the practical sense, we can approximate the final market share, the formula $S = SP$ $\sum_{i=1}^{n} P_k = 1$. Replace the table, $\hat{\lambda} =$ 36.8%.

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Experimental Study on Fractal Characteristics of Particle Crushing of Coarse Grained Soil

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Abstract: Through the compaction test of several coarse graded soils with different gradation and water content, the relationship between the fractal and the coarse grain content and the water content of the coarse grain soil is explored, and the safety and stability of the relevant coarse grained soil are guided effect. Based on the fractal theory, the fractal dimension of coarse grained soil and the crushing degree of coarse grained soil were studied by the influence of coarse grain content and coarse grain soil water content on crushing rate. The fractal dimension after crushing Between the links. (1)Under the same gradation condition, the fractal dimension of the coarse grained soil increases with the increase of its water content. When the coarse grain content is P5> 50%, the fractal dimension increases (2) It can be concluded that the fractal dimension and crushing rate of coarse-grained soil have a good linear relationship, and the fractal dimension of coarse-grained soil can also be used to characterize the crushing degree of coarse-grained soil. (3) The coarse grain content and water content of coarse-grained soil can affect the grain breaking rate, and the coarse grain content has a greater effect on the particle breaking rate.

Keywords: Coarse-grained soil; Water content; Classification characteristics; Particle crushing

1. INTRODUCTION

Coarse soil is mainly used in dam and mine and other construction projects. Coarse grained soil is between the point of contact, in the compaction and shear process, even if the pressure is not great, coarse grained soil will easily break, and under high stress, the degree of fragmentation will be greater, More obvious [1]. Coarse grained soil due to changes in gradation, gradation changes will affect its mechanical properties. In order to improve the mechanical parameters of coarse soil, in the process of filling and accumulation often need to compact, to ensure the safety and stability of related projects. In order to carry out effective guidance on the relevant engineering, this paper makes a corresponding study on the law of coarse grain soil crushing.

In Marsal proposed the rate of particle breakage Bg [2] and Hardin proposed by the crushing and crushing ratio obtained by the relative particle crushing rate Br[3]. Some domestic scholars for the coarse-grained soil particles to do a lot of experimental research and analysis [4-6]. These are the phenomena of particle crushing, particle crushing factors and the effect of particle crushing on the strength of materials and the effect of militancy. Based on the previous research, this paper designs a multi-group compaction test with different water content and coarse grading content in different grading materials, and analyzes the fractal distribution characteristics of particles in different graded coarse grains and the relationship between the crushing rate Bg, and the relationship between the fractal and the coarse grain content and the water content of the coarse soil. With a view to the relevant coarse grained soil safety and stability of the project have a certain guiding role.

2. ACQUISITION OF EXPERIMENTAL

In this study, the material used in the sandstone of the sub - rock - mica quartz schist coarse - grained soil, composed of mica, quartz, and a small amount of feldspar. As the grading of the dumping materials in the dump site is not uniform, the maximum particle size is above 400 ~ 500mm, and the material cannot be directly tested in the laboratory. The equivalent size is used instead of the large diameter obtained from the dump. And the particles having a particle size of more than 5 mm are specified as coarse particles; fine particles smaller than 5 mm and particle diameter content are represented by P5. The grading design is designed according to the coarse grain content of 30%, 50%, 70%, 90% [7, 8]. The coarse grained soils with different gradations are shown in Tab.1.

Table 1 Each size fraction content in different gradations before compaction test

Coarse fraction P5/%	The content of each particle size (mm) of each group/%					
	60~40	40~20	20~10	10~5	5~2	< 2
30	8.85	10.61	6.56	3.98	20.58	49.42
50	14.72	17.7	10.93	6.65	14.7	35.3
70	20.64	24.75	15.32	9.29	8.82	21.18
90	26.52	31.83	19.71	11.95	2.94	7.06

The test samples were air-dried and then the air-dried materials were designed to be divided into five moisture content grades of 2%, 4%, 6%, 8% and 10% respectively. Followed by boring materials for 24 hours, and then compaction test. Divided into 5 layers of compaction, 151 times per layer hit, the rated

power is 600KJ / m3 [8].

3. EXPERIMENTAL

The currently used fractal model is a phenomenon, image, or physical process with self-similarity. French mathematician Mandelbrot proposed fractal theory, on the basis of the establishment of two-dimensional space particle size fractal dimension model. In 1992, Tyler et al. Proposed a standardized equation of the relationship between mass and pore size, and assumed that the soil grade had the same density. Because the soil volume is general, the volume distribution model of fractal dimension of soil particle size distribution is established in order to avoid the inaccuracy of different soil assumptions.

Assuming that the soil is composed of particles of different sizes of self-similarity, the area A of the particles in the two - dimensional plane is larger than a certain characteristic scale R.

$$A\ (r > R) = C_a\left[1-(\tfrac{R}{\lambda_a})^{3-D}\right] \tag{1}$$

In the formula: r is the measurement scale; C_a、λ_a are constant and related to particle size and shape.

Formula(1) can be generalized to three-dimensional space, then larger than a certain particle size Ri (Ri> Ri + 1, i = 1, 2, 3 ..., the particle size decreases with the subscript decreases) coarse grain soil particles The volume V is:

$$V\ (r > R) = C_V\left[1-(\tfrac{R}{\lambda_V})^{3-D}\right] \tag{2}$$

In the formula: C_V、λ_V are constant and related to particle size and shape too.

According to (2) the total volume of particles can be expressed as:

$$V_r(r > R) = C_V\left[1-(\tfrac{0}{\lambda_V})^{3-D}\right] = C_V \tag{3}$$

By the formula (2), (3) we can get

$$\frac{V\ (r > R)}{V_r} = 1-(\tfrac{R}{\lambda_V})^{3-D} \tag{4}$$

When R = RL there will be $\frac{V\ (r > R)}{V_r} = 0,\ V\ (r > R) = 0$, at this time $\lambda_V = R$.

$$\frac{V\ (r < R)}{V_T} = \left(\tfrac{R}{R_L}\right)^{3-D} \tag{5}$$

After taking the logarithm at both ends, the logarithm curve of the different particle size and the corresponding cumulative volume distribution is fitted by the least squares method, and the slope formula k = 3-D of the point can be obtained.

Although the formula (5) is the same as the mass fractal dimension, the difference is that the mass is replaced by the volume, and the volume of the coarse-grained soil is general. The fractal dimension is not due to the density imbalance Of the calculation of the impact, do not need to assume the density of soil, so it is more reasonable.

The fractal dimension D of the coarse grained soils with different gradients before the test is shown in Tab.2, and the fractal dimension of coarse grained soil decreases with the increase of coarse grain content.

Table 2 Granularity fractal dimension of coarse-grained soils with different gradations before compaction

Coarse fraction P5/%	30	50	70	90
Fractal dimension D	2.8161	2.7087	2.5436	2.1741

4. RESULTS AND DISCUSSION

4.1 PARTICLE BREAKAGE CHARACTERISTICS

Geophysite particles in the external load under the action of structural rupture or damage, split the size of particles ranging from particle size of the phenomenon known as the particles broken Guyon proposed particles broken into broken, broken, grinding three types.

Because in the compaction process, coarse particles are often squeezed with each other, rupture, can be divided into a number of particles with uneven particle size, combined with their own structural defects, part of the composition in the extrusion process prone to fall off, large particles gradually reduced, So in the role of particle compaction often show broken and broken two types, grinding prone to coarse particles of particles in the shear surface.

4.2 PERCENTAGE OF PARTICLE BREAKAGE

The number of common particles is mostly quantified by the different size of the sample before and after the experiment. Marsal defines the rate of breakage Bg as a measure of the degree of fragmentation of the test particles, where Bg is the difference between the positive and the mass of the particle size before and after the test.

$$B_g = \sum\left|W_{ki} - W_{kf}\right| \tag{10}$$

W_{ki} :Mass fraction of grain group on grading curve before test;

W_{kf} :Mass fraction of the particle group on the grading curve after the test.

For different gradation and moisture content of coarse grained soil compaction, gradation change table as shown in Tab.3.

The relationship between the crushing rate of coarse grained soil, the water content of coarse grained soil and the coarse grain content in gradation is shown in Fig.1. Fig.1 shows that in the same grading conditions, the particle breaking rate increases with the increase of water content, the water content is equal, the crushing rate increases with the coarse grain content in the gradation, obviously when the coarse grain content P5> 50 %, Particle breaking rate increased significantly.

Table 3 Particle breakage analytical results of coarse-grained soils after compaction test

Coarse fraction P5/%	rate of water content w/%	The content of each particle size (mm) of each group/%						Fractal dimension D	Dimension difference	percentage of damage Bg /%
		60~40	40~20	20~10	10~5	5~2	< 2			
90	10.000	8.517	30.983	23.850	15.933	6.600	14.117	2.382	0.208	37.690
	8.000	9.500	30.083	23.867	19.363	3.873	13.314	2.349	0.175	37.524
	6.000	12.050	30.150	23.800	16.467	5.950	11.583	2.324	0.146	32.290
	4.000	12.983	30.033	23.683	16.633	5.983	10.683	2.301	0.127	30.657
	2.000	14.967	29.383	23.917	16.283	5.500	9.950	2.279	0.105	27.990
70	10.000	8.767	23.500	18.600	11.027	10.747	27.359	2.606	0.062	26.246
	8.000	9.500	24.067	18.450	12.370	8.809	27.519	2.601	0.057	24.383
	6.000	10.717	22.950	18.200	12.160	9.163	26.810	2.598	0.055	23.446
	4.000	13.933	21.167	17.533	11.383	10.233	25.750	2.598	0.051	18.580
	2.000	15.650	21.267	16.450	11.417	10.400	24.817	2.588	0.044	15.613
50	10.000	7.350	15.517	12.333	8.900	15.433	40.467	2.739	0.030	18.773
	8.000	7.850	17.100	11.833	8.850	14.867	39.500	2.731	0.023	14.940
	6.000	8.717	17.383	11.867	8.883	14.200	38.950	2.727	0.018	13.640
	4.000	10.100	17.083	11.350	8.550	14.983	37.933	2.723	0.014	10.473
	2.000	10.933	17.000	11.683	8.367	14.777	37.240	2.718	0.009	8.973
30	10.000	7.033	8.333	7.000	4.467	20.500	52.667	2.830	0.014	8.013
	8.000	7.417	8.767	7.100	4.250	20.383	52.750	2.827	0.011	7.280
	6.000	8.067	9.150	7.400	4.417	19.550	51.417	2.822	0.006	6.547
	4.000	8.083	10.133	7.167	4.183	19.783	50.650	2.818	0.002	4.080
	2.000	8.167	10.333	7.100	4.233	19.900	50.267	2.817	0.000	3.280

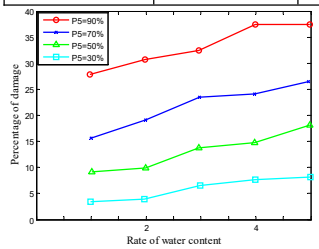
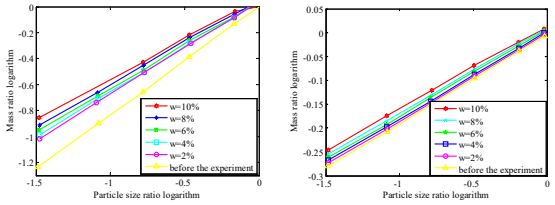


Figure.1 Relationships between broken rates and moisture contents

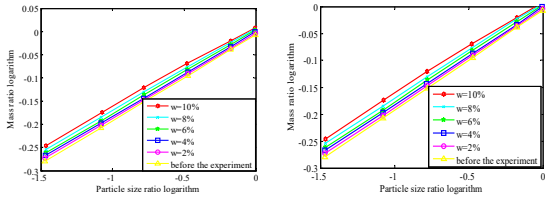
4.3 FRACTAL CHARACTERISTICS AFTER FRAGMENTATION

The fractal dimension of the particle size is the abscissa with the logarithm of the particle diameter ratio and the logarithm of the mass ratio is the abscissa. There is a good linear correlation between the observed data of the image data, and the correlation coefficient is in the range of 0.93 ~ 0.99. The fitting of the experimental data shows that the particle size distribution after crushing of coarse grained soil has fractal characteristics, and its fractal dimension D is given in Tab.3.

Figure 2 fractal distribution of grain size before and after compaction of coarse-grained soil



a Coarse grain quality 90% b Coarse grain quality 70%



c Coarse grain quality 50% d Coarse grain quality 30%

The fractal dimension is used as a quantification index of the fractal characteristics of the particles, and the size of the grain size difference before and after the compaction test can characterize the degree of crushing of coarse grained soil. In the same gradation condition, the relationship between the fractal dimension D and the particle breaking rate after the different water content is obtained is shown in Fig.3. It is not difficult to find a good linear relationship between the fractal dimension D and the crushing rate after crushing. And the fitting degree is in the range of 0.91 ~ 0.99. From this point of view, there is some kind of intrinsic relationship between the objective fractal dimension and the breaking rate.

The relationship between the fractal dimension and the water content of the coarse-grained soil after the compaction test is shown in Fig.4. When the coarse grain content is the same, the fractal dimension of the coarse grained soil increases with the increase of the water content. When the moisture content is gradually increased, the friction between the particles decreases, and the friction resistance decreases. Under the action of the actual power, the contact pressure increases with the particles, the fractal dimension becomes larger, but the increasing trend is larger Small case is not obvious. The fractal dimension of the fractal dimension is larger than that

before the fractal dimension. When the difference is small, the fragmentation rate is small and the fractal dimension difference is large. So the difference between the size of the fractal dimension and the crushing rate can characterize the degree of crushing of coarse-grained soil particles. The results showed that the fractal dimension of coarse grained soil increased with the increase of water content of 0.35% and 0.53%, respectively, when the content of P5 = 50% was analyzed. %, 0.67%, 0.83%, 1.10%. The results show that the fractal dimension increases with the increase of the coarse grain content by 0.06%, 0.22%, 0.67%, 2.14% and 6.88% respectively. The results show that the fractal dimension Is coarse grain content. During the experiment, it was found that the particles with large particle size were broken when the actual strength was equal, the samples with little particle size were not broken, and the grain size gradation gradually stabilized.

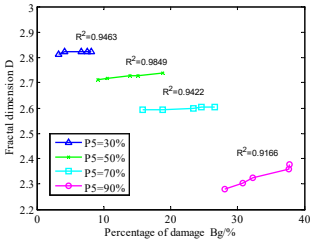


Figure 3 Fitting relationships between broken

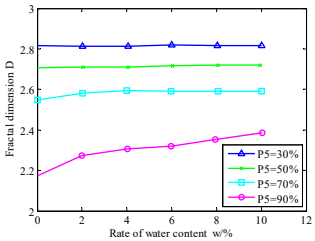


Figure 4 Relationships between granularity

5. CONCLUSIONS

When the coarse grain content P5> 50%, the grain breaking rate Bg increased with the increase of water content and the increasing trend was significant. Before and after the compaction test, the coarse grained soil. The difference between the fractal dimension difference and the particle breakage rate can be used to objectively characterize the degree of crushing of the coarse-grained soil particles. The coarse grain content and water content, Coarse grain content relative to the water content, the coarse grain content on the impact of the rate of more significant.

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Research On Personal Credit Evaluation Model Based On Credit Data

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Abstract: Based on the stepwise regression method, the Logistic model is constructed and the multiple collinearity test of the training set data is carried out. Finally, by calculating the tolerance degree of the variable T and the variance expansion factor VIF, the correct rate of training lumps is 75.4%. The remaining 20% samples were selected as the test set to test the results of the model, and the correctness of the test set was 80.5%. For the above model, based on the correct classification rate of the training set and the test set, the logistic evaluation model based on the stepwise regression method is constructed for all the samples. The total classification accuracy of all the samples is 76.3%, which is between the training set and test the overall classification of the correct rate between the description of the model to build a more reasonable, there is no error cannot be ignored.
Keywords: personal credit risk assessment; Logistic regression model; factor analysis; cluster analysis

1. INTRODUCTION

The main risk of a bank's existence is credit risk, that is, the risk that the counterparty cannot fully perform the contract. If the bank cannot identify the lost assets in time, increase the reserve for bad debts, and stop the interest income under the appropriate conditions to confirm, the banks will face serious risk problems. Therefore, it is very necessary to establish a perfect and automated personal credit evaluation system and to scientifically measure the personal credit risk, so as to realize the maximization of bank credit income.

1.1 data processing

Build a personal credit evaluation index system. Personal credit assessment indicators are divided into the following three categories: personal indicators, economic indicators and credit indicators. As more and more countries are aware that a small number of indicators will cause credit discrimination, see this approach, the original data in the "gender and marital status" this indicator will not enter the evaluation model of this article. The remaining 19 indicators at different levels to sort out, and ultimately determine the index system and variable definitions.

Screening and sorting the sample data. First, 1000 sample points will be classified, 700 high-quality customers and 300 poor customer separation, and then the data were randomly selected. After deleting the last category variable, only 20 index variables in the original data are left and the rational model is reestablished to solve the credit level.

1.2 personal credit evaluation model based on logistic regression

Logistic regression [1] is a multivariate analysis method that studies the relationship between the causal variables for the classification or multiple classification observations and the influencing factors (independent variables), which is a probability nonlinear regression [2]. Logistic regression is a model of accuracy, applicability and robustness in many statistical methods in personal credit assessment.

Suppose there are N cases of the overall composition, Y1, Y2 ... Y3. From which randomly selected n cases as a sample, the observations are marked as y1, y2 ... y3. Let Pi = P (yi = 1 | xi) obtain the conditional probability of the result yi = 1 for a given xi condition yi=0: the conditional probability obtained under the same condition isP (yi = 1 | xi)=1-Pi. The probability that an observation can be obtained is:

$$P(\mathrm{y}_i) = p_i^{y_i}(1-p_i)^{I-y_i} \tag{1}$$

Since the observations are independent of each other, their joint distribution can be expressed as the product of a marginal distribution:

$$L(\theta) = \prod_{i=1}^{\pi} p_i^{y_i}(1-p_i)^{I-y_i} \tag{2}$$

The above equation also becomes an observed likelihood function [3].

$$\frac{\partial \ln[L(\theta)]}{\partial \beta_0} = \sum_{i=1}^{n}[\mathrm{y}_i - \frac{e^{\mathrm{b}_0+\mathrm{b}_1\mathrm{x}_{i1}+\mathrm{L}+\mathrm{b}_m\mathrm{x}_{im}}}{1+e^{\mathrm{b}_0+\mathrm{b}_1\mathrm{x}_{i1}+\mathrm{L}+\mathrm{b}_m\mathrm{x}_{im}}}] = 0 \tag{3}$$

$$\frac{\partial \ln[L(\theta)]}{\partial \beta_i} = \sum_{i=1}^{n}[\mathrm{y}_i - \frac{e^{\mathrm{b}_0+\mathrm{b}_1\mathrm{x}_{i1}+\mathrm{L}+\mathrm{b}_m\mathrm{x}_{im}}}{1+e^{\mathrm{b}_0+\mathrm{b}_1\mathrm{x}_{i1}+\mathrm{L}+\mathrm{b}_m\mathrm{x}_{im}}}]x_{ij} = 0 \tag{4}$$

The above (5) (6) is a likelihood equation, and if there is an independent variable in the model, then there is a simultaneous equation to estimate the value, so that we can get the logistic regression model of the model expression.

1.3 study on the rating of bank customer

1.3.1 factor analysis

Factor analysis is one of the most important statistical methods in multivariate statistics. At present, the most popular factor analysis model is orthogonal

factor model [4]. Let X=(X1, ..., XP) be a P-dimensional random vector whose covariance matrix is Cov(X)=∑, X linearly dependent on a few possible unobservable random variables F1, F2, ..., Fm(m<p) and p additional random variablesε1, ε2, ..., εp.

The model is assumed to be:

$$X = \mu + LF + \varepsilon. \tag{5}$$

Where $\mu = (\mu_1, \cdots \mu_p)^{'}$ is the constant vector, $F = (\mathrm{F}_1, \cdots, \mathrm{F}_m)^{'}, F_1, F_2, \cdots, F_m$ is the so-called common factor; $L = (\mathrm{l}_{ij})_{p \times m}$ is the load array of factors, $\varepsilon = (\varepsilon_1, \cdots, \varepsilon_p)^{'}$, ε_i is the error F, assumed

$$E(\mathrm{F}) = 0, \mathrm{Cov}(\mathrm{F}) = \mathrm{I}_m \tag{6}$$

$$E(\varepsilon) = 0, \mathrm{Cov}(\varepsilon, \mathrm{F}) = 0, \tag{7}$$

$$Cov(\varepsilon) = \psi = \begin{pmatrix} \psi_1 & & & \\ & \psi_2 & & \\ & & \ddots & \\ & & & \psi_p \end{pmatrix} \tag{8}$$

The model that satisfies the above three formulas is the orthogonal factor model.

1.3.2 cluster analysis

Clustering analysis is a process of dividing a set of physical or abstract objects into clusters of multiple objects of similar objects. A set of data objects is called a cluster, and there is a high degree of similarity between the data objects in the same cluster, and the degree of similarity between objects in different clusters is low.

The data set $D = \{\mathrm{x}_i \mid \mathrm{i} = 1, 2, 3, ..., \mathrm{n}\}$ represents the data set of the number of objects whose data is n, and the formula is a formal representation of the clustering result, where $C = \{\mathrm{C}_i \mid \mathrm{i} = 1, 2, 3, ..., \mathrm{k}, \mathrm{k} < \mathrm{n}\}$ represents the set of k groups of clusters after clustering:

2. THE SOLUTION OF THE MODEL

2.1 multiple collinearity test

In the case of using the logistic model, if the multicollinearity problem occurs between the explanatory variables [5], the singularity matrix is generated, the variance of the estimated values of the parameters becomes larger, the estimator is not valid, and the important index variables may be excluded Model, the final interpretation of the model and the accuracy of prediction are reduced. Therefore, this paper in the establishment of the model before the 19 explanatory variables for multiple collinearity diagnosis.

Table 1 Explain the collinearity of variables

Variable	T	VIF	Variable	T	VIF	Variable	T	VIF
A1	-7.928	1.132	A8	3.013	1.304	A16	0.979	1.343
A2	2.311	1.877	A10	-0.923	1.083	A17	-0.036	1.281
A3	-3.572	1.404	A11	0.785	1.182	A18	1.2	1.071
A4	-1.174	1.093	A12	1.742	1.42	A19	-1.31	1.246
A5	2.114	2.206	A13	-0.725	1.298	A20	-2.087	1.086
A6	-4.086	1.104	A14	-2.135	1.075			
A7	-2.251	1.189	A15	-1.781	1.321			

This paper examines the effect of multicollinearity on the model by calculating the tolerance T and variance expansion factor VIF for each variable. Tolerance and variance expansion factor are defined as follows:

$$T = 1 - R_{x_i}^2 \quad VIF - 1/T = 1/(1 - R_{x_i}^2)$$

Where $R_{x_i}^2$ is the coefficient of determination between x_i and other independent variables as the dependent variable. $R_{x_i}^2$ the higher, the lower the tolerance. $R_{x_i}^2 = 0$, $T = 1$, there is no multiple collinearity [6]. Since the tolerance of the 19 variables is much greater than 0.20, it is considered that there is almost no collinearity in the sample data.

2.1.2BUILD AND SOLVE

The stepwise regression method [7] is based on the correlation between the index variables and the dependent variable to determine whether the index variable is included in the model or discarded, with the aim of obtaining a least explanatory variable but maximizing the interpretation of the dependent variable variability Logistic regression model, this paper uses stepwise regression to construct Logistic model.

The filtered 800 sample points are imported into the SPSS for stepwise regression. The regression results are as follows:

The posterior approach principle is to put all the index variables into the regression model first, and then in each step, the partial regression coefficient is not statistically significant (this is set to 0.05). A1, A2, A3, A5, A6, A7, A8, A14, A20 are the independent variables selected for the final regression model after 10 iterations.

Table 2 Training set Logistic regression results

Classa	B	Standard error	Wald	df	Significance	Exp(B)	Exp (B) 95% confidence interval

								Lower limit	Upper limit
1.0	intercept	-3.696	1.188	9.674	1	.002			
	A1	.558	.077	52.939	1	.000	1.747	1.503	2.030
	A2	-.021	.010	4.654	1	.031	.979	.961	.998
	A3	.325	.096	11.388	1	.001	1.384	1.146	1.672
	A5	.000	.000	4.763	1	.029	1.000	1.000	1.000
	A6	.277	.066	17.600	1	.000	1.319	1.159	1.501
	A7	.173	.078	4.940	1	.026	1.189	1.021	1.385
	A8	-.283	.092	9.352	1	.002	.754	.629	.903
	A14	.296	.124	5.742	1	.017	1.344	1.055	1.713
	A20	1.656	.784	4.460	1	.035	5.240	1.126	24.372

SPSS gives the Wald statistic used to test the significance of the regression coefficients:

$$W = (\hat{\beta}_1 / \mathrm{SE}_{\hat{\beta}_i})^2 \tag{9}$$

Where $SE_{\hat{\beta}_i}$ is the standard error of $\hat{\beta}_i$. From the Wald values of each variable, the independent variables entering the model are statistically significant.Then the logistic regression equation is:

$$\frac{p}{1-p} = \exp(-3.696 + 0.558x_1 - 0.021x_2 + 0.325x_3 + 0.277x_6 + 0.173x_7 - 0.283x_8 + 0.296x_{14} + 1.656x_{20}) \tag{10}$$

The remaining 200 sample points are imported into the SPSS for stepwise regression. The logistic regression equation is:

$$\frac{p}{1-p} = \exp(-3.209 + 0.722x_1 - 0.046x_2 + 0.644x_3 + 0.079x_6 + 0.259x_7 - 0.253x_8 + 0.406x_{14} + 0.723x_{20}) \tag{11}$$

The unfiltered 1000 sample points are imported into SPSS for stepwise regression. The logistic regression equation is:

$$\frac{p}{1-p} = \exp(-2.954 + 0.586x_1 - 0.026x_2 + 0.352x_3 + 0.226x_6 + 0.180x_7 - 0.250x_8 + 0.287x_{14} + 1.324x_{20}) \tag{12}$$

Which is the probability of bad credit.

Table 3 Training set correct rate

Observed values	Predictive value		
	1.0	2.0	Correct rate
1.0	495	65	88.4%
2.0	132	108	45.0%
	78.4%	21.6%	75.4%

Table 4 Test set correct rate

Observed values	Predictive value		
	1.0	2.0	Correct rate
1.0	129	11	92.1%
2.0	28	32	53.3%
	78.5%	21.5%	80.5%

Table 5 The correct rate for all sample points

Observed values	Predictive value		
	1.0	2.0	Correct rate
1.0	129	11	92.1%
2.0	28	32	53.3%
	78.5%	21.5%	80.5%

As shown in Tab.3, under the training set, the correct rate of high-quality customers is 88.4%, the correct rate of bad customers is 45.0%; Overall, the corresponding classification of the correct rate of 75.4%. As shown in Tab.4, under the training set, the correct rate of high-quality customers is 92.1%, the correct rate of bad customers is 53.3%; Overall, the corresponding classification of the correct rate of 80.5% and training corresponding to 75.4% The correct rate is close. As shown in Tab.5, the correct rate of high-quality customers is 89.3% and 46.0% for all customers. Overall, the corresponding classification rate is 76.3%, which is between 75.4% of the training set % And 80.5% of the test set, the error is small, we can see that this model is established reasonable.

2.2 research on the ranking of bank clients based on factor analysis and cluster aanalysis

2.2.1 factor analysis for data validation

Through the analysis of SPSS software, we can see that the observed value of Bartlett test statistic is 2455.063, the corresponding probability P value is close to 0, the original variable is suitable for factor analysis, and KMO value is 0.584, according to KMO and Bartlett test results given Of the commonly used metrics can be derived from the original indicators for factor analysis, the effect is better.

2.2.2 extract the principal component

According to the general principle of determining the number of principal factors, the eigenvalues with eigenvalues greater than 1 are selected or the number of feature numbers with the cumulative variance contribution rate greater than 0.80 is chosen as the main factor. Tab.6 can be seen in the selection of the first 8 more appropriate.

Table 6 Common factor variance

Element	Initial eigenvalue			Extract sum of squares load			Cyclic sum sum loading		
	Statistics	variable %	accumulation %	Statistics	variable %	accumulation %	Statistics	variable %	accumulation %

1	2.543	12.717	12.717	2.543	12.717	12.717	2.144	10.722	10.722
2	1.960	9.800	22.517	1.960	9.800	22.517	1.542	7.712	18.435
3	1.403	7.017	29.534	1.403	7.017	29.534	1.511	7.554	25.989
4	1.310	6.549	36.083	1.310	6.549	36.083	1.450	7.248	33.237
5	1.209	6.047	42.131	1.209	6.047	42.131	1.340	6.699	39.936
6	1.167	5.837	47.968	1.167	5.837	47.968	1.305	6.526	46.462
7	1.113	5.565	53.532	1.113	5.565	53.532	1.276	6.378	52.840
8	1.091	5.457	58.990	1.091	5.457	58.990	1.230	6.150	58.990

2.2.3 factor score and sample score

According to the original variable factor score coefficient and the normalized value can calculate the common factor score, you can write the common factor of the original indicators of the linear score function.

$$F_1 = -0.007A_1 + 0.310A_2 + 0.037A_3 + 0.001A_4 + 0.347A_5 + 0.034A_6 + 0.044A_7 + 0.006A_8 + 0.067A_9 + 0.115A_{10} + 0.008A_{11} + 0.121A_{12} - 0.087A_{13} + 0.076A_{14} - 0.054A_{15} + 0.008A_{16} + 0.365A_{17} - 0.135A_{18} + 0.310A_{19} + 0.014A_{20} \quad (13)$$

$$F_8 = 0.018A_1 + 0.191A_2 - 0.162A_3 + 0.626A_4 + 0.058A_5 + 0.033A_6 + 0.070A_7 + 0.039A_8 + 0.064A_9 + 0.062A_{10} - 0.042A_{11} - 0.072A_{12} - 0.009A_{13} - 0.474A_{14} - 0.028A_{15} + 0.148A_{16} - 0.214A_{17} + 0.122A_{18} - 0.080A_{19} - 0.204A_{20} \quad (14)$$

And can get the sample of the comprehensive score function, that is, credit index system:

$$F = 0.182F_1 + 0.131F_2 + 0.128F_3 + 0.123F_4 + 0.114F_5 + 0.111F_6 + 0.108F_7 + 0.104F_8 \quad (15)$$

2.2.4 cluster analysis

Forty groups of data were randomly selected from 1000 samples for analysis.

Table 7 Summary of observation processing

Observed values					
Valid values		Missing value		Statistics value	
N	Percentage	N	Percentage	N	Percentage
40	100.0	0	.0	40	100.0

The table shows that the data into the analysis of a total of 40 groups, the data loss rate of 0%, so the sample is more effective. The results are compared with their original credit rating, and the degree of coincidence is high.

3. CONCLUSIONS

In this paper, a Logistic model based on stepwise regression is given and verified by regression analysis to determine the correct rate of bank customer personal credit risk assessment of 76.3%, and through the sample data in all the indicators of the factor analysis of the main factor, Select some samples for cluster analysis, the individual user's credit rating. Finally, through comparison, it proves that the two have a high degree of consistency, indicating that this model can effectively solve the problem of bank personal credit evaluation.

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Research on Job Shop Scheduling Problem Based on Hybrid Discrete Particle Swarm Optimization

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Abstract: The scheduling problem of manufacturing workshop is the core of manufacturing system, operation technology and management technology. The effective research and application of dispatching method and optimization technology has become the foundation and key of advanced manufacturing technology practice. For job shop scheduling problem, we establish a model predictive control model based on hybrid particle swarm optimization algorithm. This model ends the local search algorithm to enhance the search precision of the DPSO algorithm in the local range; In addition, by adding additional information reference points, the simulation optimization algorithm is applied to the information preferred position of the particles, and the optimization is achieved to improve the global optimization ability of the algorithm. For examples, the problem about six pieces of work and six machines. Each machine has six processes to be processed. This algorithm is used to solve this problem 10 times, the number of iterations of the algorithm is 200 times, and then obtain the average of each generation curve. The optimal solution of shop floor scheduling is obtained by mixing discrete particle swarm optimization algorithm and expressed by Gantt chart. Then, the time complexity of this algorithm is $TM \times [O(P \times 6l) + O(P \times l) + O(P) + O(P \times l) + O(P)] \approx TM \times [9 \times O(P \times l) + 3 \times G \times O(P)] \approx TM \times G \times O(P \times l)$ and he spatial complexity is 1804 bytes. Our approach is more advantageous in both respects than in other ways.

Keywords: Hybrid particle swarm optimization; workshop scheduling problem; space - time complexity

1. INTRODUCTION

Product upgrading and fierce competition in the market makes the factory's pipeline production is facing unprecedented pressure. Pipeline production with a fixed mode of production, in the event of unexpected circumstances such as emergency insertion and scraping materials, etc., the production line will be completely disrupted, companies will face plans black hole [1-4]. Resulting in production capacity cannot meet the processing needs, there processing "static wait", delayed delivery time caused by credit crisis. At this point, to grasp the law of product production activities, reasonable scheduling is particularly important.

We have established a predictive control model to solve the production line encountered in a variety of problems, including scrap feeding, emergency insertion and so on. So that in the processing and production process will not be due to different processing processes, processing time and the emergence of the machine "static wait" problem. The model is to be established so that products with different processing processes are in the best way to do so that there will not be a tight machine, another machine is idle, and there will not be a "traffic jam" or "crash" "The ultimate goal is to produce the most products in the shortest possible time to best meet the needs of customers and improve the utilization of equipment.

Finally, this paper chooses a processing plant processing example, apply the model to carry on the reasonable schedule, obtains the waiting time, the processing time and the processing route three performance indexes. This example calculates the running speed and the memory size of the algorithm. Then the algorithm is used to deal with the problem, and the comparison between the execution time of the algorithm and the storage space is needed. The algorithm is compared and the advantages and disadvantages of the algorithm are obtained.

2. EXPERIMENTAL

2. 1 study area

Product upgrading and fierce competition in the market makes the factory's pipeline production is facing unprecedented pressure. Pipeline production with a fixed mode of production, in the event of unexpected circumstances such as emergency insertion and scraping materials, etc., the production line will be completely disrupted, companies will face plans black hole [5]. Resulting in production capacity cannot meet the processing needs, there processing "static wait", delayed delivery time caused by credit crisis. At this point, to grasp the law of product production activities, reasonable scheduling is particularly important. Manufacturing plant scheduling problems are the core of manufacturing systems, optimization techniques, operational

technologies and management techniques, [1]. The effective research and application of scheduling method and optimization technology has become the foundation and key of advanced manufacturing technology practice.

2. 2 method

2. 2. 1 method preparation

2. 2. 1. 1 indicators

For the scheduling problem of flow shop, the main optimization indexes are: based on the completion time of the workpiece, such as maximizing the completion time and the total running time; Based on the delivery time of the workpiece, such as the maximum delay time, total delay time, the number of work pieces; Based on inventory index, maximum machine idle time; Based on the multi-objective comprehensive performance index, such as early/delay penalty, the index is a performance indicator that meets the production schedule. Maximum completion time for all artifacts in processing machines, the total completion time, namely from the first part is on the first machine processing to a workpiece finally at the end of the last machine processing and the total time. Total flow time is the sum of the total time of all workpiece processing. Delay time for the processing of the workpiece in the machine delay time, namely the completion time of the workpiece in the machine and workpiece due to time difference between, drag the workpiece number is greater than the work-piece due time to the accumulation of Numbers, the largest delay time to the maximum extent permitted by the workpiece, the completion time and the workpiece in the machine, due to time difference between workpiece delay time is the total delay time of cumulant. The idle time of the machine is the free time before the machine begins to process, the free time from the completion of the machine to the last piece of work, and the total amount of idle time between each process. The penalty performance based on the advance/delay penalty is the sum of the penalty expenses incurred due to the completion of early completion and the completion of the delay time. In the process of solving the scheduling problem in the flow workshop, the joint optimization is usually carried out according to several performance indexes, but it is more difficult to solve the scheduling problem.

2. 2. 2 mathematical model

$$F_1 = \min C_{\max} = \min\left\{\max_{p=1}^{N_n}\{C_p\}\right\}; \tag{1}$$

$$S_{p(q+1)} \geq s_{pq} + t_{pqh} \times \sigma_{pqh}, \text{ and } p \in J; h \in M_{pq}; q = 1,2,\cdots,N_p - 1; \tag{2}$$

$$S_{p'q'} + (1-\zeta_{pqh-p'q'h})U \geq S_{pq} + t_{pqh}, \text{ and } p, p' \in J; h \in M_{pq}; q, q' = 1,2,\cdots,N_p; \tag{3}$$

$$\sum_{h=1}^{M_{pq}} \sigma_{pqh} = 1, \text{ and } p, p' \in J; h \in M_{pq}; q, q' = 1,2,\cdots,N_p - 1; \tag{4}$$

$$\sum_{h=1}^{M_{pq}} \sigma_{pqh} = 1, \text{ and } p \in J; q = 1,2,\cdots N_p; \tag{5}$$

$$C_p \leq C_{\max}, \text{ and } p \in J; \tag{6}$$

$$\sum_{p=1}^{N_q}\sum_{q=1}^{N_p} t_{pgh} \times \sigma_{pgh} \leq Z_h, \text{ and } p \in J; h \in M_{pq}; \tag{7}$$

$$S_{pq}, t_{pqh} \geq 0, \text{ and } p \in J; q = 1,2,\cdots N_p; h = 1,2,\cdots,N_m; \tag{8}$$

$$\sigma_{pqh}, \varsigma_{pqh-p'q'h} \in \{0,1\}, \text{ and } p, p' \in J; h \in M_{pq}; q, q' = 1,2,\cdots,N_p; \tag{9}$$

Equation (1) indicates that the objective function is the maximum completion time. Equation (2) indicates that the process of each workpiece must be processed in the order given in advance. (3) and (4) show that a process can only be started when the selected machine is idle and the previous process of the workpiece has been completed. Equation (5) indicates that each machining process can only be selected from a set of candidate machines. Equation (6) indicates that the maximum completion time is greater than or equal to the single workpiece completion time. Equation (7) represents the load constraint of each machine. Equation (8) indicates that the starting time of each process and the processing time on each machine are equal to or greater than 0. Equation (9) indicates that the value of the decision variable sum is 0 and 1.

2. 2. 2. 1 particalcoding scheme

The design and application of the optimization of particle swarm optimization, the first need to solve the problem for the particle coding problem. Coding refers to the expression of the particle position, by encoding the particles and the corresponding solution space. Traditional job shop scheduling problems are mostly based on the process of coding, after obtaining a feasible solution, by decoding a corresponding process to sort. Combining process-based coding and machine-based coding with two-dimensional coding, this paper uses two-dimensional vector representation of the particle as a coding scheme. The two L-dimensional vectors are used to represent the position of the particles; L is the total number of processes. $l = \sum_{p=1}^{n} n_p$;OS vector is based on the process of coding, the vector of the various elements for the workpiece number,

respectively, represents a process, where the qth occurrence of p said the workpiece p of the first q process that remember O_{pq} and each p appear n times. $p \in \{1,2,\cdots,n\}$, $q \in \{1,2,\cdots,n_p\}$. The MA vector is based on machine coding, and each element in the vector is represented as a process machine. H means the processing machine is M_h , $h \in \{1,2,\cdots,m\}$.

2. 2. 2. 2 population initialization

The initial population is the search starting point of the evolutionary algorithm, and a good initial population can improve the algorithm to solve the quality. In this paper, the two-dimensional identity of the particles were initialized. For the MA vector, the initial population location method proposed by Kacem is used to initialize the machine according to the machine load. The machine operation process is: (1) select the machine with the shortest processing time for each process; (2)Update the machine load, add the shortest processing time to the other items in the same column in the schedule. For OS vectors, a randomly initialized generation is used to extend the search range of the solution.

3. RESULTS AND DISCUSSION

3. 1 SIMULATION

It is the key to establish the model of shop scheduling problem. In solving the problem of shop scheduling problem, the Gantt chart of the input and dispatching result of the equipment set and the workpiece task set is taken as the output of the model, [2] The input of the problem is determined by the decision set and the optimization, so as to get the output of the problem. The decision and optimization here is the optimization algorithm of solving the problem.

3. 2 EXPERIMENT

In order to verify the effectiveness of the hybrid particle, [3] swarm optimization algorithm, the workshop scheduling example is used to simulate and verify. The study of the six parts, six machines, each workpiece has six to be processed process, the workshop scheduling data as shown in the tab below.

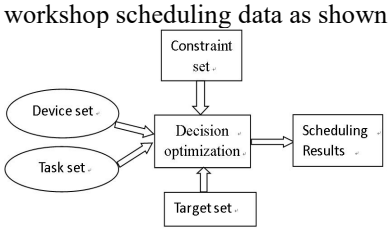

Figure 1. The shop scheduling problem is input with output.

Table 1 Workshop scheduling date.

Workpiece number	Machine number / processing time					
1	3/1	1/3	2/6	4/7	6/3	5/6
2	2/8	3/5	5/10	6/10	1/10	4/4
3	3/5	4/4	6/8	1/9	2/1	5/7
4	2/5	1/5	3/5	4/3	5/8	6/9
5	3/9	2/3	5/5	6/4	1/3	4/1
6	2/3	4/3	6/9	1/10	5/4	3/1

The optimal solution for this problem is 55, and the optimal solution of this problem is shown in the following fig. The scheduling time is used as the abscissa, the number of the machine is the ordinate, The number of the workpiece indicates the number of the workpiece, the number of times from the left to the right indicates the process of machining the workpiece. The abscissa of the beginning of a rectangle indicates the start time of the process on the machine. The position of the right end of the rectangle indicates that the step Processing time is complete.

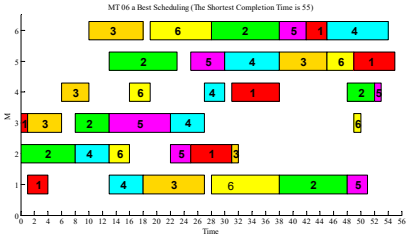

Figure 2 shop scheduling output gantt chart.

The algorithm is used to solve this problem 10 times, the number of iterations of the algorithm is 200 times, and then obtain the average of each generation of the resulting curve as shown below. The abscissa of the graph represents the iteration number of the algorithm, and the ordinate represents the average of the 10 optimal solutions. It can be seen from the fig that the convergence speed of GSPSO algorithm is faster.

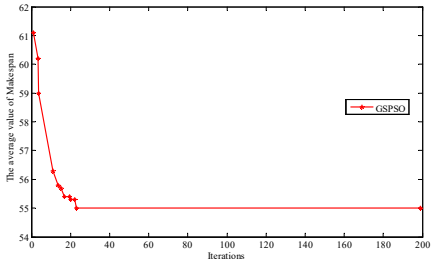

Figure 3 Algurithm convergence.

3. 3 THE COMPLEXITY

The size of the population is p. Particle length is L. The number of iterations is TM. Each iteration contains a particle location update and a local neighborhood search. Mixed discrete particles in the particle location update in the worst need to adjust the OS vector twice, the MA vector four adjustments, the worst time complexity of time is $O(P \times 6l)$. The time complexity, [4-5] of calculating the particle target value and preserving the optimal individual is $O(P \times l) + O(P)$. The worst-case complexity of the neighborhood search process is $O(P \times l) + O(P)$. The time complexity of calculating the particle target value and preserving the optimal individual is

$O(P \times l) + O(P)$. The time complexity of the mixed discrete particle group is

$$TM \times [O(P \times 6l) + O(P \times l) + O(P) + O(P \times l) + O(P)]$$
$$\approx TM \times [9 \times O(P \times l) + 3 \times G \times O(P)] \approx TM \times G \times O(P \times l)$$

Similar to time complexity, spatial complexity is a measure of the storage space required for an algorithm to be executed in a computer. $S(n) = O(f(n))$, N is the size of the problem. $f(n)$ is the statement occupying the function of the storage space about n. The spatial complexity of the algorithm is 1804 bytes.

4. CONCLUSIONS

The optimal solution of the shop scheduling is expressed by the Gantt chart. This paper gets the process of processing a part of a machine at each time. Gantt chart is very clear to express the optimal shop scheduling. The model minimizes the time it takes to produce and increased machine utilization. The time complexity of the algorithm is

$$TM \times [O(P \times 6l) + O(P \times l) + O(P) + O(P \times l) + O(P)]$$
$$\approx TM \times [9 \times O(P \times l) + 3 \times G \times O(P)] \approx TM \times G \times O(P \times l)$$

The spatial complexity of the algorithm is 1804 bytes. The operation of this article is faster and space takes up less memory. This paper has a better effect in solving the shop scheduling problem.

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Prediction of Silicon Content in Blast Furnace Ironmaking Based on Neural Network

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Abstract: In the whole process of blast furnace control, in which the furnace temperature control is particularly important, furnace temperature control is the core technology of blast furnace control. According to the actual situation - the four volumes of each group can only affect the [Si] content of the next group, the BP neural network prediction model is established. The most training set of 80% data is selected and tested with the remaining 20% data. Based on neural network powerful non-linear processing power, data fusion capabilities and data prediction capabilities. The amount of hot air, the amount of pulverized coal injected and the time series as the input layer, the establishment of silicon prediction of BP neural network can be [Si] dynamic prediction. And the neural network has the advantages of high fit, can simulate the internal process is very complex nonlinear problems. Through the rational use of SPSS software, a detailed and complete description of the model of the establishment process and methods. Thus realizing the prediction of silicon content and realizing one-step prediction and two-step prediction.
Keywords: BP neural network; Iron content of molten iron

1. INTRODUCTION

Iron and steel smelting is one of the pillar industries of national economy, quality and cheap energy-saving environmental protection is the inevitable requirement of development, blast furnace process is a high-dimensional large data time series, many factors, but the final production indicators are with the smelting process A controlled intermediate index, furnace temperature, that is, the amount of silicon content of molten iron [Si] (percentage of silicon content of molten iron) is closely related to accurately predict the [Si] time series prediction of the current blast furnace operating parameters of the control direction. Therefore, the accurate prediction control modeling of [Si] becomes the key technology of smelting process optimization and forecast control. The quality of molten iron is also affected by a variety of factors. Blast furnace metallurgy production is the most important part of the process of iron and steel smelting, blast furnace smelting is the iron ore powder to reduce the generation of iron into a discrete, continuous smelting, discrete output of the very complex production process. Fig. 1Metallurgical workers have put forward a variety of blast furnace hot metal silicon content forecasting model to determine the level of molten iron within the blast furnace level, in order to understand and grasp the furnace conditions in advance, so that blast furnace stability, high yield. Neural network technology has also been applied in the field of metallurgy. In this paper, the neural network technology combined with the statistical method is applied to the prediction of iron and silicon content in blast furnace. The mechanism of the smelting process is improved by the algebraic equation Group and partial differential equations of the complex mathematical model, the model equation is as follows: A+B = F+G+△Q∩(ST∩P∩D)Solving the optimal solution of the above hybrid equations by mechanism is a still unsolved mathematical problem. Therefore, it is a feasible way to solve the process by means of large data mining technology. Since the relationship between [Si] - [S] -FL-PML and [Si] is not known in this question, it is not clear that the mathematical equation of this mapping cannot be given. Considering the ability of the BP neural network to learn and store the mapping relationships of a large number of input-output patterns, it is not necessary to reveal the specific mathematical equations in which the mapping relationships are described in advance. In this paper, we use BP neural network model, through the middle of the black box operation, to give a given input part, automatically output the desired output part [1-5]. The neural network algorithm has a wide range of applications in prediction, and it is predicted that the model is trained by the hierarchical screening to find the prediction results, and the accuracy of the two-step prediction and the two-step prediction is analyzed. Controlling the classification accuracy by sample size is another very important factor in addition to sample quality, algorithm parameters, and data filtering [4-7].

2. ESTABLISHMENT AND SOLUTION OF BP NEURAL NETWORK MODEL STRUCTURE

2.1 determination of model structure (see Figure 1).
2.2 the weight of each layer adjustment (see Figure 2)
2.3 model establishment and solution

The convergence factor: ξ = 0.000 001; Error convergence factor: β = 0.1 According to the material in the blast furnace smelting process, the amount of

neurons in the molten steel composition is as follows: 11; step length: η = 0.5;, We have reason to believe that the silicon content of molten iron and the amount of air and the amount of coal has a great correlation with the time series and the content of sulfur in molten iron has a very small correlation, so the molten iron in the silicon content as the dependent variable, And the amount of pulverized coal injected as an independent variable can be influenced by man-made control. The influence of time series and sulfur content in molten iron as a covariate and silicon content in molten iron is very small and is not controlled by human factors Using the neural network analysis in SPSS statistical analysis software, the corresponding independent variables, dependent variables and covariates were selected to randomly select the learning samples, and the neural network model was established. The top 400 of the data was selected as the training model, Step prediction model, after training, the predicted value of silicon in molten iron is 0.5 and the actual value is 0.5, the difference is zero. Two steps to predict the molten iron in the silicon content of 0.41 and the actual value of 0.42, a difference of 0.01.

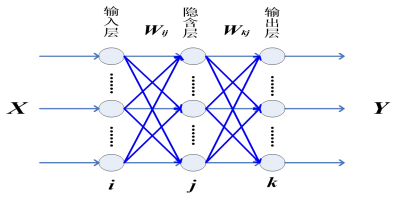

Figure 1 Schematic diagram

It can be seen that in the prediction process, the one-step prediction is more accurate than the two-step prediction, indicating that the silicon content in each furnace molten iron during the blast furnace smelting is closer to that of the previous furnace, the relationship between the two furnace is more alienated, so that the silicon content of molten iron, although with the time series, but the correlation is not, with the previous moment more closely. Using the random number generator to select several samples to verify the success rate of the model prediction, the numerical prediction success rate prediction data and the actual data is exactly the same 21.11%. According to the data, the prediction of the rise or fall of the blast furnace temperature, that is, the prediction of the silicon content in the molten iron is related to the control direction of the current blast furnace operating parameters, that is, the change of the silicon content in the molten iron is the blast furnace temperature change, The actual data in the molten iron in the silicon content before and after the difference is predicted to the molten iron before and after the silicon content is also poor, the difference is greater than or equal to 0 as 1, less than 0 is 0, and then the actual difference is poor with the forecast Of the same as 1 or the same as 0, recorded as 1, that the direction of the same lift, otherwise recorded as 0, is inconsistent. The feasibility of dynamic predictive control is discussed.

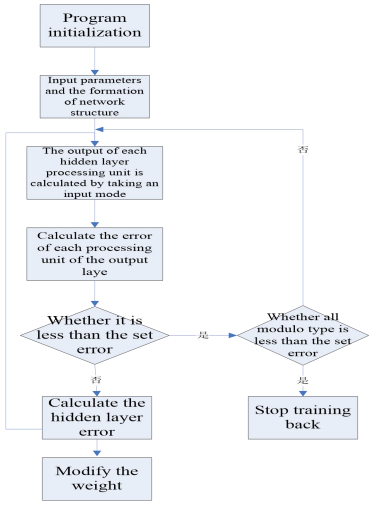

Figure 2 weight of each layer adjustment

The success rate of numerical prediction based on the BP neural network predicted by silicon content is not very high, mainly because there is no specific relationship equation or feasible interval between furnace temperature and silicon content in molten iron. But the predicted power of the furnace temperature is very high, which proves that the dynamic predictive control has a certain degree of feasibility, the specific model summary table (see Table 1).

Table 1 Model Summary Table

Training squares and errors	Training squares and errors	Training squares and errors
Relative error .055	Relative error .055	Relative error .055
The maximum number of schedules that have been used to abort the rule that has been exceeded	The maximum number of schedules that have been used to abort the rule that has been exceeded	The maximum number of schedules that have been used to abort the rule that has been exceeded
(100)	(100)	(100)
Training time 0: 00: 36.801	Training time 0: 00: 36.801	Training time 0: 00: 36.801

Using the neural network model to predict the silicon content of molten iron, the predicted value and the actual value of the scatter Fig.3, can be clearly observed for the silicon content of the predicted value is relatively concentrated, and there is significant Linear development trend.

The judgment of the direction of the furnace temperature can be judged intuitively from the silicon content in the actual molten iron and the predicted line of the silicon content in the molten iron (see Fig. 3). The success rate of the furnace temperature rises and fall is 88.75%It can be observed that there are many overlapping areas for the real silicon content and the predicted silicon content curve, and the

access part occupies a minority to confirm the accuracy of the prediction.

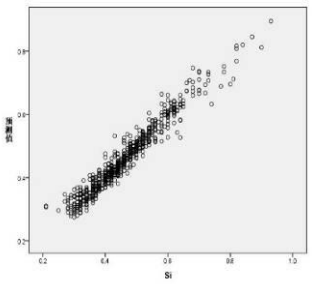

Figure 3 predicted value and the actual value

2.4 Forecast results and analysis

This model has predicted the silicon content, the numerical success rate is 21.11%, the success rate of furnace temperature prediction is 88.75%, with high accuracy. Which numerical accuracy is unsatisfactory, because the numerical accuracy to the decimal point after the two, so that the true value and the forecast is completely consistent with the slight difficulty, so only reached 21.11%. We predict the calculated silicon content of the 401st furnace with a value of 0.5, exactly the same as the true value. The second step predicts the silicon content of the 402nd furnace, with a value of 0.45 and a difference of 0.01 from the exact value. Therefore, we consider this model to be qualified The

One-step prediction, the success rate of two-step prediction of numerical success rate and furnace temperature rise and fall direction are shown in Table 2.

Table 2 Fall Direction

	Numerical success rate (α = 0.05)	Temperature rise and fall direction prediction success rate
One step prediction	83.50%	72.36%
Two - step prediction	52.26%	31.60%

It can be seen from the above table that the accuracy of the one-step prediction is significantly higher than the accuracy of the two-step prediction, both in the numerical success rate and in the furnace temperature rise and fall. It can be explained that the content of [Si] - [S] -FL-PML content has a very close relationship, one-step prediction of the error will lead to two-step prediction to produce greater error. Therefore, the proposed model is mainly used for one-step prediction.

3. CONCLUSION

Neural networks have important applications in the prediction, even if the operation process is somewhat complicated, but it can be seen that the neural network prediction is indeed very high. Selecting more data as a training set can improve its fitting accuracy and set more hidden neurons to simulate more complex nonlinear problems. In the model of silicon content prediction of molten iron, the neural network technology is introduced to forecast the silicon content of molten iron in 60 stainless steel without the use of blast furnace gas continuous analysis system to provide timely furnace gas composition and the fluctuation range of silicon content of molten iron. When the allowable error is (± 0.1)%, the predicted hit rate is 85%, and good results are obtained, which provides an example for the application of neural network in blast furnace. In addition, the model does not need to consider the blast furnace reaction mechanism and process, do not need too much blast furnace operation experts experience, as long as the required data into the database, using the neural network to self-study data, you can better grasp its internal Rules, methods are simple and easy, there are other predictive methods unparalleled superiority, with broad prospects for development.

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Shared Cycle Scheduling Optimization Problem Based on Dynamic Programming

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Abstract: Due to geographical and time factors such as the impact of cycling resources and the actual demand between the demand does not match, so we do the following work:1) Based on the method of probability statistics, the neural network forecasting model is established on the basis of the original data, and the distribution model of the bicycle is established by comparing the distribution of the bicycles in the case of "the same time" and "the same place" Time - space distribution problem.2) Using factor analysis method, three indexes such as vehicle difficulty degree, shared bicycle demand, shared bicycle inflow / outflow rate are constructed, and the supply and demand index function is constructed. Using the moving weighted average method, the matching degree of supply and demand is poor of the area to rational distribution of 100 bicycles.
Keywords: Factor analysis method; dynamic programming; cycling volume; scheduling optimization

1. INTRODUCTION

With the advent of the "Internet age", "shared culture" is increasingly popular with people, as a "shared family" shared bicycle is a concern. The emergence of shared bicycles greatly alleviates the problem of traffic congestion, but also in line with the low-carbon travel lifestyle, but because of the current sharing of the initial implementation of the bicycle there are uneven distribution, supply and demand matching poor reason, we set up a mathematical model to adjust Shared cycling problem. First of all, according to the problem of a statement to establish a chart to observe the shared space distribution of bicycles, For the three problems we find a number of factors affecting the supply and demand matching, the use of factor analysis to screen out a number of representative factors, the establishment of the index equation to obtain supply and demand indicators, and then use the weighted average of 100 bicycles to a reasonable delivery,

2. PROBLEM RESTATEMENT AND ANALYSIS

For the question 1: the establishment of a frequency distribution map, and analysis of the same time at different locations of the number of bicycles and the same location at different times the distribution of bicycles, we select a number of representative locations for summary analysis, a comprehensive analysis of these locations Temporal and spatial distribution. In order to solve the problem three: the use of factor analysis, to explore the impact of supply and demand factors, screening out a few large indicators, and then establish a mathematical model analysis and find the degree of supply and demand matching, and then use the weighted average method, Reasonable allocation of 100 bicycles.

3. MODEL HYPOTHESIS

3.1 assume that shared bicycles can be used normally
3.2 the data given is accurate witjin the allowable range of error
3.3 assume that the population, gdp, and number of shared bicycles in a given city are relatively stable over a short period of time
3.4 the establishment and solution of model

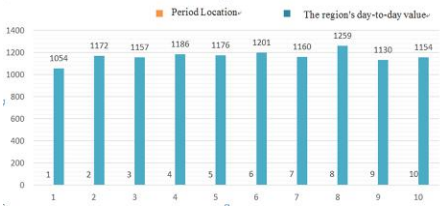

Figure 1 Regional summary of the flow of people within one day

According to the Fig.1, we can see that the flow of people in 10 locations in one day is basically balanced, so we can select three representative locations to analyze the bicycle distribution at different times in the same place. We selected 1, 2, 8 three locations to start the analysis [1].

Table 1 Time period

Time period / area	1	2	3	4	5	6	7	8	9	10
360-390	12	20	20	16	18	28	16	23	21	23
390-420	28	17	32	31	32	26	29	40	28	35
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1020-1050	24	29	27	29	31	17	30	36	28	17
1050-1080	30	31	23	27	28	26	25	24	31	33
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1380-1410	13	6	5	13	16	12	11	15	5	6
1410-1440	5	1	2	3	5	1	2	1	3	1

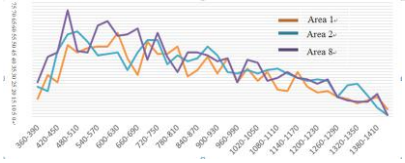

Figure 2 Representative area shared bicycle usage

According to Fig.2, the use of shared bicycles in three regions is analyzed, and almost no one uses shared bicycles in the 12: 30-6: 00 periods. At 6:00 people began to increase the number of shared

bicycles at 7: 30-8: 00-time period is the use of shared cycling peak, at 12: 00-12: 30 use the number of shared bicycles once again small growth, then gradually decline. The time t travels with a single shared bicycle reflects the distance s of a single shared bicycle ride, in the range of error tolerance, the distance s and the time t are proportional function, ie s = kt. (K is constant) The distance between different regions and different regions is different, and the number of times of sharing bicycles is affected. The number of shared bicycles starting from one area to another in one day is counted as one-way ride. The maximum ride time is 16.28 minutes for a thousand shared bike tracker survey samples. Longer riding is not considered for the time being. Analyze the data: Use the arrival time t1 - the departure time t2 to get the riding time t, and calculate the riding times of the different riding time periods to study the impact of the riding time t on the one-way ride in the time period. The ratio of the average of the riding times of each riding time period to the average value of the riding times of all the riding times is calculated as χ_1

$$\chi_i = \alpha_i / (\alpha_1 + \alpha_2 + \alpha_3 + ... + \alpha_n)$$

Figure 3 Bicycle sharing time and number

From Fig.3 you can see the ride time in 7 minutes, people will be more inclined to use a shared bike travel, riding time in 4 to 5 minutes to reach the maximum number of people, that is 4 to 5 minutes, the maximum number of travels in the use of shared bikes, the ride time is 7 minutes or more than 7 minutes, and the number of one-way riding usage fluctuates up and down at 120 times.

Outgoing items are the number of times the bicycles are shared from the area to other areas during the day. The proportion of inflows is the proportion of the inflows of the region and the inflows of all regions, reflecting the development of bicycles in the region. The inflow weight is recorded as γ_i . Constant as $K_i^{'}$

$$K_i^{'} = 0.550 * K_i + 0.100\rho_i \quad (2)$$

$$K_i^{'} = 0.205 * \chi_i + 0.345 * \gamma_i + 0.100\rho_i \quad (3)$$

According to a certain point A, according to a certain period of time to a certain number of users to different locations of the riding time and reach the region of the impact of the period and the proportion of inflow, get the proportion of the arrival area, and then get the distribution. Such as: a period of time there are 1, 000 vehicles riding area 1, while the area 1 to the area 2 of the ride time is roughly 10 to 11 minutes, the regional inflow of the specific gravity of 0.100609494 period impact value of 0.571150097Get $K_2 = 0.09657$, that is, 97 vehicles from the area 1 into the area 2..Peak time to obtain $K_2^{'} = 0.110228$, that is, 110 two shared bicycles from the area 1 into the area Establishment and Solution of ModelFactor analysis [2] the basic idea is to classify the observed variables, the correlation is higher, that is, the more closely linked in the same class, and the correlation between different variables is lower, then each class The variable actually represents a basic structure, the common factor. For the problem studied, each component of the original observation is described by the sum of the linear function of the common factor and the special factor. When determining the number of factors, select the first eigenvalue cumulative contribution rate ≥ 85% of the corresponding sort position, combined with the post-rotation factor load array variables, there is no loss to determine the number of factors m the factor of the score function Z , expression: $Z_i = b_i^{'} x$, where b_i is the i column vector of the factor score coefficient matrix. Comprehensive factor score (evaluation) Formula: $Z_{综}^{m} = \sum (v_i / p) Z_i, v_i / p$ is the contribution rate of the i -th number in the eigenvalue. There are several main indicators (mainly for peak data) that share the degree of supply and demand matching of shared bicycle resources: car ride x1, shared bicycle demand x2, shared bicycle inflow / outflow x3, Three major indicators. $x_1 = (k_1 * a_1, k_2 * a_2, k_3 * a_3 + ... + k_n * a_n)$ Wher e the coefficient $(k_1, k_2, k_3, ...k_n)$ is called, $(a_1, a_2, a_3, ...a_n)$ for the extraction of several representative groups of regions. Difficulty of the car, the value is too high, indicating that the need for more cyclists, the demand for more vehicles, shared bicycle outflow increased, if the inflow of insufficient supply and demand tensions. $x_2 = (k_1^{'} * a_1^{'} + k_2^{'} * a_2^{'} + k_3^{'} * a_3^{'} + ...k_n^{'} * a_n^{'})$ Where the coefficient $(k_1, k_2, k_3, ...k_n)$ is called, $(a_1, a_2, a_3, ...a_n)$ for the extraction of several representative groups of regions. $x_3 = m / M$ Where m is the shared bicycle inflow, and M is the shared bicycle outflow.

We selected several representative regions 2, 4, 5, 7, 8 for analysis:

Table 2 Shared bicycle inflow / outflow

area	Easy to use car	Share cycling demand	Shared bicycle inflow / outflow
2	1.63	1262	0.992379
4	1.61	1300	0.993299
5	0.52	1267	1.010309
7	0.53	1301	1.006944
8	1.81	1379	0.987451

Using Factor Analysis to Extract Common Factors from Variable Groups. Factor analysis based on the

correlation coefficient matrix, the use of principal component analysis to extract the cumulative contribution of 85% of the components. After determining the remainder of the principal components based on the principal component analysis [3], the sum of the squares of the n eigenvectors is determined as the commonality, and the value of the diagonal of the correlation matrix is replaced by this value to form the correlation matrix. On the basis of the correlation coefficient matrix, the coefficients of the factor and the coefficients are further determined by repeatedly finding the eigenvalues and eigenvectors.

Table 3 Three major indicators and Ingredients

area	Easy to use car	Share cycling demand	Shared bicycle inflow / outflow
2	1.63	1262	0.992379
4	1.61	1300	0.993299
5	0.52	1267	1.010309
7	0.53	1301	1.006944
8	1.81	1379	0.987451

Set the car difficulty x_1 , share the demand for cycling x_2 , shared bicycle inflow / outflow x_3 . $F_1 = 0.432x_1 + 0.615x_2 - 0.238x_3$ (4) The formula for ingredient2is: $F_2 = 0.193x_1 - 0.032x_2 - 0.869x_3$ (5)

Table 4 Ingredients Initial eigenvalue variance%

Ingredients	total	Initial eigenvalue variance%	Grand total%	total	Extract square and load variance%	Grand total%
1	1.561	56.233	56.233	1.561	56.233	56.233
2	1.347	41.935	90.463	1.347	41.935	90.463
3	0.322	20.118	98.270			

The final indicator is obtained using the initial eigenvalues in the total variance of the explanations given in Tab.4 $F = 0.235F_1 + 0.465F_2$ (6) (4) and (5) into equation (6) to obtain the general index: $F = 0.168x_1 + 0.522x_2 - 0.317x_3$ (7)It can be seen from equation (7) that the final composite index is positively correlated with vehicle difficulty and shared bicycle demand[2], negatively correlated with shared bicycle inflow / outflow, and when the indicator F is smaller, the shared bicycle supply and demand match The better the degree, the better the match. The data of the above different regions are dimensionless and then substituted into equation (7).

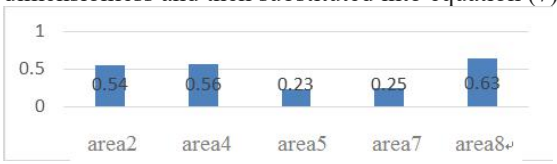

Figure 4 Areas Probability

Fig.4 can be seen from the region 5, 7 supply and demand match is better, from Fig.4 we see2, 4regional supply and demand more tense [3].Weighted average method [3, 4] distribution of vehicles.If you add 100 bicycles, according to the regional supply and demand is different, we give different weights, and then the distribution of bicycles. Area 2, 3, 4, 8 vehicles are more tense, so the need for these areas of the vehicle scheduling. The weight coefficient of the region 2 is k1, the weight coefficient of the region 4 is k2, the weight coefficient of the region 4 is k3, the weight coefficient of the region 8 is k4;

Therefore, the sharing of bicycles for these four regions is: a1, a2, a3, a4; Area 2: a1 = 25; Area 3: a2 = 8; Area 4: a3 = 22; Area 8: a4 = 45; This will be better delivery, more conducive to sharing the balance of supply and demand cycling, and better maintain the traffic operation.

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Study on Prediction of Silicon Content in Blast Furnace Ironmaking

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Abstract: The ELM algorithm is used to predict the silicon content in blast furnace ironmaking. A part of the data is selected as the training set, and the residual data is used to test the silicon content. The results showed that neural network model for dynamic prediction of silicon under the different conditions of silicon content, sulfur content, coal injection, and air volume. Combined with the predicted silicon content in one-step instead of the original position of the silicon content, the other three factors unchanged for the second forecast. The results show that the accuracy of one-step prediction and two-step prediction is basically the same. When using the ELM algorithm theoretically, two-step prediction can be omitted.

Keywords: Blast furnace ironmaking; ELM; Dynamic prediction; Neural Network

1. INTRODUCTION

As one of the pillar industries of the national economy, the iron and steel industry is an important symbol of the level of industrialization of a country, occupying a pivotal position in the national economy. With the rapid development of science and technology and the rapid development of modernization, China's crude steel production increased significantly, making the steel market gradually saturated, the steel industry is facing fierce competition, which means that iron and steel enterprises must reduce costs and improve the utilization of raw materials [1].

Blast furnace ironmaking is a complex and multi-phase multi-field coupling of large hysteresis, nonlinear dynamic system, the key process indicators molten iron quality parameter detection, modeling and control has been the problems in the field of metallurgical engineering and automatic control[2], but the final production index of molten iron is closely related to a control intermediate index of the smelting process-furnace temperature, silicon content of molten iron(the percentage of silicon content of molten iron).How to accurately predict the time series of silicon has been a hot topic.

The feedforward neural [3] network has been widely used in many fields because of its good learning ability. However, the method still has the following problems. Firstly, the training speed is slow, because the gradient descent method needs to iterate several times to achieve the proper weight and thresholds, and therefore, the training process takes a long time, secondly, easy to fall into the local minimum, cannot achieve the global minimum, thirdly, it is sensitive to choose learning rate, because learning rate plays a important role in the performance of neural network, we must choose the appropriate learning rate to get a more ideal network. Thus, this paper chooses the improved algorithm of the feedforward neural network-ELM. The algorithm randomly generates the connection weights between the input layer and the hidden layer and the threshold of the hidden layer neurons, and there is no need to adjust in the training, only need to set the number of hidden layer neurons, you can get the only optimal solution. Compared with the traditional training methods, the method has the advantages of fast learning speed and good generalization performance.

2.THEORETICAL BASIS

2.1 ELM

ELM structure has three layers: input layer, hidden layer, output layer, with the traditional neural network, such as BP neural network[4] structure is more similar, but it can randomly generate connection weights between input layer and implicit layer and the threshold of implicit layer of neurons, the specific structure shown in Fig.1. Application of neural network prediction model, the most important is the choice of data. ELM can randomly select the data, to avoid the choice of due to human factors and the establishment of a more unsatisfactory neural network.

On the basis of previous studies, Huang et al. proposed the following two theorems:

Theorem 1 Give random Q different samples (x_i, t_i), among them,

$$x_i = [x_{i1}, x_{i2}, \ldots, x_{in}]^T \in R^n \quad (1)$$

$$t_i = [t_{i1}, t_{i2}, \ldots, t_{im}] \in R^m \quad (2)$$

an infinitely differentiable activation function for an arbitrary interval[5] g:R→R, for SLFN with Q hidden neurons, in the case of any assignment $W_i \in R^n$ and $b_i \in R$ its hidden layer output matrix H is reversible and has $\|H\beta - T'\| = 0$.

Theorem 2 gives random Q different samples (x_i, t_i), among them, $x_i = [x_{i1}, x_{i2}, \ldots, x_{in}]^T \in R^n, t_i = (t_{i1}, t_{i2}, \ldots, t_{in}) \in R^m$.

given any small error $\varepsilon(\varepsilon > 0)$ and an arbitrary

interval infinitely differentiable activation function g:R $\rightarrow$ R, there is always a SLFN containing $K(K \leq Q)$ hidden neurons, in the case of any assignment $W_i \in R^n$ and $b_i \in R$, has $\left\|H_{N\times M}\beta_{M\times m} - T'\right\| < \varepsilon$.

It can be seen from theorem 1that if the number of neurons in the hidden layer is equal to the number of training sets, then for any w and b[6], SLFN can approximate the training sample with zero error, as:

$$\sum_{j=1}^{Q}\left\|t_j - y_j\right\| = 0 \quad (3)$$

among them,

$$y_j = \left[y_{1j}, y_{2j}, \ldots, y_{mj}\right]^T, j = 1,2,\ldots,Q \quad (4)$$

However, when the number of training samples Q is large, the number of neurons in the hidden layer is usually smaller than Q in order to reduce the computational complexity. From the theorem 2, SLFN training error can be approximated to an arbitrary $\varepsilon > 0$, as:

$$\sum_{j=1}^{Q}\left\|t_j - y_j\right\| < \varepsilon \quad (5)$$

In addition, related studies have shown that not only many non-linear activation functions [7]can be used in ELM, such as S-type functions, sine functions and composite functions, and can also use non-differentiable functions, and even use discontinuous functions as activation functions.

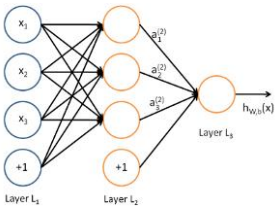

Figure 1 Extreme Learning Machine structure

3.ALGORITHM DESIGN

3.1ELM ALGORITHMDESIGN

ELM can randomly generate w and b before training, and only need to determine the number of hidden neurons and the activation function (infinitely differentiable) of the hidden neurons. Specifically, ELM learning algorithm mainly has the following steps:

(1)Determine the number of neurons in the hidden layer, and randomly set the connection weight[8] w between the input layer and the hidden layer and the bias b of the hidden layer neurons.

(2)Select an infinitely differentiable function as the activation function of the neurons of the hidden layer, and then calculate the hidden layer output matrix H.

(3)Calculate the output layer weights: $\hat{\beta}$: $\hat{\beta} = H^{+}T'$

4.PREDICTIONS AND ANALYSIS OF SILICA CONTENT IN BLAST FURNACE IRONMAKING

4.1 EXPERIMENTAL DATA COLLECTION AND VARIABLE SETTINGS

The 1000 sets of data contained in the question contain four variables, namely, silicon content, sulfur content, coal injection, air volume, the symbol is as follows:

Silicon and sulfur are both the chemical composition in the molten iron, they have a negative correlation between the relationship. At the same time, their changes are a function of the control of the amount of coal and the amount of air flow; however, silicon and sulfur cannot control variables between each other, which are the production of common sense. This is because the chemical composition is tested at the same time. Therefore, when selection data in the one-step to predict silicon content, we eliminates the impact of sulfur content, that is, the next group of silicon content only by the previous group of silicon content, coal injection, air volume[9]. In the second step prediction, the first step of the predicted silicon content instead of the original position of the silicon content, the other two volumes unchanged and the second forecast.

4.2 FORECAST RESULTS AND ANALYSIS

4.2.1 ONE-STEP PREDICTION

First of all, the choice of data, the first attempt, select the 800 sets of data as a training set, 200 sets of data as a test set, the test results are as follows:

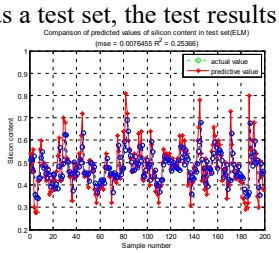

Figure 2 Comparison of prediction results(800/200)

Because the first attempt to get the effect is not ideal, so try to improve. Consider several aspects, firstly, on the number of hidden layers, starting from the smaller number, has been trying to a larger number, and finally determine a range. When the hidden layer of neurons in the number between the 8-12, the effect is better, initially set to 8. Secondly, on the activation function, tried to use sig, sin, hard-lim[10] these three functions respectively, the effect is nearly same, the effect of sin and sig is relatively good, select the sig. Thirdly, considering the problem of sample data selection, because blast furnace ironmaking is a high-dimensional large data time series[11], it cannot be randomly selected, only artificial division of training set and test set, this time selected 500 groups for the training set, 500 groups for the test set, the test results are as follows:

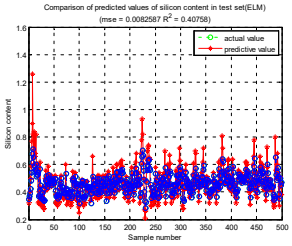

Figure 3 Comparison of prediction results(500/500)

4.2.2 TWO-STEP PREDICTION

Two-step prediction choose the data from the better one-step prediction, 200 groups as a training set, 199 groups as a test set, the test results are as follows:

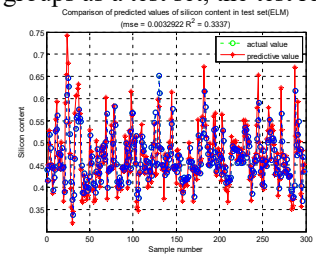

Figure 4 Comparison of two-step prediction results

Experiments show that the accuracy of the two-step prediction and the accuracy of the one-step prediction are basically the same. In the process of actual operation, the two-step prediction can be omitted and the one-step prediction training network can be used to predict the silicon content under different conditions[12]. When the number of hidden layers of the Extreme Learning Machine is reasonably chosen and the amount of data of the training set and the test set is reasonably allocated, the phenomenon of excessive learning can be weakened or eliminated. However, due to the randomness of the Extreme Learning Machine is too strong, it can reduce the predictive accuracy rate when it cannot fully satisfy its randomness[13], or when the sample data is affected by the time series, the prediction accuracy will reduce, and the fluctuation of the trained network is larger, then it is necessary for the same state of the data to repeated training, people take the best. In contrast to BP neural networks trained with 800 sets of data and 200 sets of data, the results are as follows: As a kind of multi-layer feedforward neural network, BP neural network has many advantages, such as simple structure, many adjustable parameters, many training algorithms and good operability, and has been widely used[14]. Compared with ELM, its operability is strong, BP neural network training depends on the artificial set of parameters, if the set parameters appropriate, will soon be able to achieve convergence effect, if the set is not appropriate, it may not achieve to the ideal network[15].

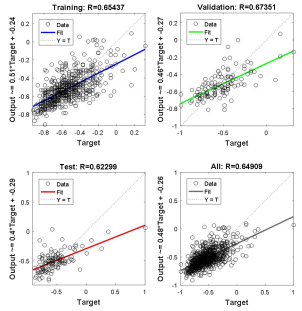

Figure 5 The relationship between the target and the output

5. CONCLUSION

Compared with the two methods, ELM can provide a random network in the shortest possible time, either suitable or inappropriate, depending largely on the choice of data, more suitable for large data without time series, BP neural network[16] after training several times still cannot achieve the ideal effect, you can use ELM; BP neural network give a network in a relatively long period of time, if within the scope of error, given is the ideal network, the core lies in the artificially grasp the balance between lack of learning and over learning, set reasonable parameters, more inclined to try to do BP neural network.

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Optimization of Sulfur in Blast Furnace Ironmaking Based on BP Neural Network

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Abstract: In this paper, a neural network model is established for the optimization problem of sulfur. The factors affecting the sulfur content in molten iron are mainly analyzed from the aspects of slag oxygen content and slag basicity. The sulfur content in molten iron is predicted and optimized by time difference method. The greater the increase of complex alkalinity, the more the sulfur content The lower the content of Cao and Mgo, the lower the content of TiO2, and the higher the content of TiO2, the higher the sulfur content, the lower the sulfur content, the lower the sulfur content, the lower the sulfur content, Based on the use of the model has been established on the silicon content of a reasonable expectation of prediction, the final accuracy is relatively high.

Keywords: BP neural network; sulfur optimization time; difference method

1. INTRODUCTION

Ironmaking process in accordance with the time sequence of the acquisition process parameters is a high-dimensional large data time series, hundreds of factors. The sulfur element from the furnace into the raw materials, the artificial manufacturing of the material (sinter, pellet furnace) as the main iron raw materials, coke into the sulfur content of the total sulfur content of more than a quarter, smelting per ton of charge, the amount of sulfur into the content known as the "sulfur load."

2.THEORETICAL BASIS AND THE ESTABLISHMENT OF THE MODEL

In this paper, the BP neural network model is established and the sulfur content in molten iron is optimized and predicted. The BP network has three layers: the first layer is the input layer, and the sulfur content in the molten iron is many, (Coke load) and slag pH are set as the main research object. The second layer is the implicit layer, which is the nonlinear relationship between the input and output of the neural network. The third layer is the output layer. A single neuron, representing the sulfur content.

Where the total ratio of sulfur in the furnace balance relationship:

$$\omega[S]=\frac{0.1(S_{料}-S_{气})}{1+0.001LsQ_{渣}} \tag{1}$$

Where $\omega[S]$ is the sulfur content of the paste, $S_{料}$ for the sulfur load, $S_{气}$ with the furnace gas escape sulfur, Ls sulfur in the iron between the distribution coefficient, $Q_{渣}$ tons of iron slag volume.

3. SLAG DESULFUNIZATION BASIC REACTION

$$[FeS]+(CaO)=(CaS)+(FeO) \tag{2}$$

$$Ks=\frac{a_{(CaO)}\cdot a_{(FeO)}}{a_{[S]}\cdot a_{(CaO)}}=\frac{\omega(S)}{\omega[S]}\cdot\frac{\gamma_{(FeO)}}{\gamma'_{(s)}}\cdot\frac{\gamma_{(CaS)}}{\gamma_{(Feo)}}\cdot\frac{\omega(FeO)}{\omega(CaO)} \tag{3}$$

$$Ls=\frac{\omega(S)}{\omega[S]}=Ks\cdot\gamma'_{[s]}\cdot\frac{1}{\gamma_{(FeO)}\cdot\omega(FeO)}\cdot\frac{\gamma_{(CaO)}\cdot\omega(CaO)}{\gamma_{(CaS)}} \tag{4}$$

It is known that Ks is a single-valued function of temperature

$$\lg Ks=-\frac{4970}{T}+5.383 \tag{5}$$

So the slag sulfur removal reaction expressed as: $(CaO)+[S]+C=(CaS)+CO$

$$K's=\frac{\gamma_{(CaS)}\cdot\omega(CaS)}{\gamma'_{[s]}\cdot\omega[S]}\cdot\frac{p_{co}}{a_c} \tag{6}$$

Because the Fe in the hearth is saturated with C ,so $a_c=1$,Iron liquid $\gamma'_{(s)}=7$,Substitute (8) to get:

$$\frac{\omega(S)}{\omega[S]}\cdot p_{co}=Ls\cdot p_{co}=4K's\frac{\gamma_{(CaO)}}{\gamma_{(CaS)}}\cdot\omega(CaO) \tag{7}$$

By comparing (6) and (7), when the $\omega[Si]$ in the molten iron is high, the oxygen potential is determined by the reaction of $[Si]$ to SiO_2 , and the $Si-S$ coupling reaction :

$$(CaO)+[S]+\frac{1}{2}[Si]=(CaS)+\frac{1}{2}(SiO_2)$$

As the c in the blast furnace is always excess, the oxygen potential of the slag is determined by the temperature and $\omega[Si]$、$\omega[Mn]$ The higher the temperature, the higher the Ls CC value, the lower the residual oxygen potential, the more favorable the reaction of the slag, low.

Because the ore has a strong ability to absorb sulfur,

so the level of alkalinity affects the sulfur content, the production of acid and alkali oxide by the ratio of the basic definition of slag alkalinity, usually $\frac{CaO}{SiO_2}$、$\frac{CaO+MgO}{SiO_2}$、$\frac{CaO+MgO}{SiO_2+Al_2O_3}$, with the composition of $mole$ scores to make Closer to reality,
which is:

$$B=\frac{N_{CaO}+\frac{1}{2}N_{MgO}}{N_{SiO_2}+\frac{1}{3}N_{Al_2O_3}}$$

The general alkalinity and $Bell$ alkalinity together, in the complex alkalinity, the expression is:

$$\begin{cases} B_{复}=\dfrac{N_{CaO}+N_{MgO}}{N_{SiO_2}+0.81N_{TiO_2}}, N_{MgO}<0.146 \\ B_{复}=\dfrac{N_{CaO}+0.7N_{MgO}}{N_{SiO_2}+0.81N_{TiO_2}}, N_{MgO}>0.146 \end{cases} \quad (8)$$

Or

$$\begin{cases} B_{复}=\dfrac{CaO\%+1.40MgO\%}{SiO_2\%+0.61TiO_2\%}, MgO\%<0.146 \\ B_{复}=\dfrac{CaO\%+MgO\%}{SiO_2\%+0.61TiO_2\%}, MgO\%>0.146 \end{cases} \quad (9)$$

4. CONCIUSION

From the above solution, we can see that when TiO_2 increases, $B_{复}$ decreases, slag desulfurization capacity is reduced, and when CaO、MgO increases, $B_{复}$ increases, so desulfurization capacity increases. MgO is smaller than 8% when the $B_{复}$ ratio is larger than 8%, also shows that MgO less than 8% when the larger impact of the slag desulfurization capacity.

The lower the content of CaO、MgO, the lower the content of TiO_2, the greater the impact on the increase of $B_{复}$, the higher the sulfur content, the lower the sulfur content, the lower the sulfur content, the lower the sulfur content low.

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Evaluation of Internet Shared Bicycle Profit Model Based on DEA and Gray Forecast

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Abstract: In this paper, the degree of "supply and demand matching" of shared bicycle resources is approximated into input-output efficiency, and the data envelopment model is established. By analyzing the matching factors of resource supply and demand for the bicycles in the north and south cities, constructing the input index and the output index, this paper uses each city as a decision unit in the evaluation model to query the relevant data to solve the different time and space efficiency values, to see whether the city supply and demand matching to achieve the optimal state. Create a shared bike service platform and design a sustainable profit strategy. After consulting the literature, it is concluded that the shared bicycle mainly uses the deposit paid by the consumer to obtain the profit. Based on this, the new strategy of raising the deposit is given to the consumer, and the gray forecasting model is used to verify the rationality of the new platform.

Keywords: continuous profit strategy; data envelopment model; shared bicycle; gray prediction model

1. INTRODUCTION

The advent of the motorbike barred the Internet to share the market of bicycles, driving the market for half a year of $ 4 billion in financing. With the advent of the Internet + era, companies have built a shared bike service platform that provides roaming services on the mobile Internet, while these companies have introduced a variety of shared bike subsidy programs.

2. RESEARCH FIED AND THEIRETICAL BASIS

The study is aimed at a study of the more popular shared bikes, which analyzes the supply and demand matching of shared bicycles and the establishment of a new platform to propose new pricing strategies.

Data envelopment by the famous American operations scientists W.W. Cooper and A. Charnels and other scholars in the "relative efficiency evaluation" concept developed on the basis of this is a new system analysis, referred to as DEA [1]. C^2R model is one of the ways in which the efficiency of inputs and outputs is used to assess efficiency [2]. The concept of "envelope" is used to project the input and output of all decision-making units into the hyperplane to find the highest output or Put the least "effective frontier". If the DMU falls on the frontier, it is said that DEA is valid. If the DMU falls within the effective frontier, DEA is invalid [3].In this paper, we use the C^2R model, we assume that the matching degree of supply and demand matching for a given city is evaluated, and each city (DMU) has m input variables and s output variables. The first step is to set up the variables corresponding to the input and output indicators. Considering the quantitative and DEA as the method of evaluating the relative efficiency of the economic system, the matching degree of the shared bicycle supply and demand is evaluated. For the data envelopment evaluation and analysis model, the input indicators of this paper select the urban congestion delay index, early and late evening traffic, road leveling, weather conditions. Output indicators to build an average daily number of vehicles without the use of empty rate, the amount of per square kilometer, the evaluation index system shown in Table 1.

Table 1 Bicycle Matching Degree Evaluation Indicators

	variable	Indicator name
Input indicators	X_1	City congestion extension index
	X_2	Daily traffic
	X_3	Road flatness
	X_4	The number of days that can be traveled
Output indicators	Y_1	Average daily number of times per use
	Y_2	Car empty rate
	Y_3	Per square kilometer

Assume that X_{ij} represents the total amount of the i-th input of the jth city, Y_{ij} is the total amount of the i-th output of the jth city, $x_{ij} > 0, y_{ij} > 0, i = 1,2,\cdots,m, r = 1,2,\cdots,s$ In this way, the input of the jth region is recorded as $X_j = (x_{1j}, x_{2j}, \ldots, x_{mj})^T$, output is recorded as $Y_j = (y_{1j}, y_{2j}, \ldots, y_{pj})^T$. The maximum relative efficiency value of DMU0 is: $X_j = (x_{1j}, x_{2j}, \ldots, x_{mj})$

$$\begin{cases} \min\theta \\ s.t.\sum_{j=1}^{n}\lambda_j X_j + s^- = \theta x_0 \\ \sum_{j=1}^{n}\lambda_j Y_j - s^+ = y_0 \\ \lambda_j \geq 0, j = 1,2,\cdots,n \\ s^+ \geq 0, s^- \geq 0 \end{cases} \quad (1)$$

Where θ is the effective value of the evaluation unit DMU [4]. The bigger the θ, the more reasonable the resource allocation. s^-, s^+ is the slack variable, and the nonzero s^-, s^+ indicates the amount of invalid input and output of the resource, respectively. According to the value of θ, s^-, s^+ the decision-making unit is divided into three categories:

(1) when the $\theta = 1$ and $s^- = s^+ = 0$, the DMU0 for the DEA effective, that is, in this decision-making unit of the economic system, the resources are fully utilized, the input elements to achieve the best combination, and achieved maximum output effect.

(2) when the $\theta = 1$ and at least one $s^- > 0$ or an $s^+ > 0$, then said DMU0 for the DEA weak, that is, in the n decision-making unit of the economic system, if $s^- > 0$ said the i-type resources are not fully utilized the amount of $s^-, s^+ > 0$, that the first j-type output indicators and the maximum output value of the existence of $s_j^+ > 0$ [5].

(3) DMU0 is valid for non-DEA when $\theta < 1$ is satisfied. That is, in the economic system composed of n DMUs, the output can be reduced to the original input θ, ratio by combining to maintain the original output diminished [6] [7].

In the north, we choose the first-tier cities A, second-tier cities B third-tier cities C, in the south to select the first-tier cities D, second-tier cities E third-tier cities F (8), select the working day and non-working days as a time shift, and output indicators, data envelopment model evaluation of each decision-making unit is a city, each unit of the input and output indicators are the same, by querying the work of each city corresponding indicators of the data, get Table 2.

Table 2 Weekly input indicators and output indicators data sheet

	Area	North			South		
	City	A	B	C	D	E	F
Input indicators	City crowded index	2.06	1.99	1.62	1.89	1.67	1.63
	Daily traffic (million people)	1194.69	520.8	459.23	854.19	653.4	216.1
	Road flatness (%)	93	75	72.6	92.8	78.3	75
	Number of travelable days (%)	73.7	66.5	79.8	58.4	63.6	64.1
Output indicators	Average daily number of times per use (times)	6.01	4.7	3.11	5.53	3.1	1.55
	Car idle rate (%)	54	67	79	59	69	88
	Average per square kilometer (vehicle)	18	2	4.5	17	7	5

The relative efficiency values of the cycling supply and demand matching in these six cities were calculated as 0.9971, 1.0000, 0.7912, 1.0000, 0.7912, 1.0000, 0.6760 and 0.7948 respectively by MATLAB programming.

The relative efficiency value of the working day is analyzed, and the matching degree of the supply and demand matching of each city in the non-working day is analyzed. The input index and the output index data are shown in Table 3.

Table 3 Non-working day input indicators and output indicator data

	Area	North			South		
	City	A	B	C	D	E	F
Input indicators	City crowded index	3.01	2.52	2.01	2.86	2.34	2.05
	Daily traffic (million people)	1987.23	780.35	636.23	1357.63	968.25	452.31
	Road flatness (%)	93	75	72.6	92.8	78.3	75
	Number of travelable days (%)	73.7	66.5	79.8	58.4	63.6	64.1
Output indicators	Average daily number of times per use (times)	8.6	6.2	3.9	7.89	5.6	4.8
	Car idle rate (%)	43	58	67	50	61	79
	Average per square kilometer (vehicle)	18	2	4.5	17	7	5

The relative efficiency values of the matching supply and demand matching in the six cities were 1.0000, 0.8780, 0.6922, 1.0000, 0.8674 and 0.8485, respectively, calculated by MATLAB programming.

2.1 RESULTS ANALYSIS

Using the data envelopment analysis model, the data of the index system established by MATLAB software are collated and finally the results shown in Table 4 are obtained.

Table 4 Summary of Indicator System

City Time	A	B	C	D	E	F
Working day	0.9971	1.0000	0.7912	1.0000	0.6760	0.7948
Non-working day	1.0000	0.8780	0.6922	1.0000	0.8674	0.8485

Through the urban efficiency value θ obtained in Table 4, it can be seen that the relative efficiency value of D city is 1, whether it is in the working day or non-working day, so that the city's shared bicycle supply and demand match is reasonable, the optimal state; And C, E, F at any time, its relative efficiency values are less than 1, that is $\theta < 1$, so DEA invalid, indicating that the three cities to share the level of supply and demand matching bicycle unreasonable, need to share the relationship between supply and demand of a reasonable adjustment.

3. GRAY PREDICTION MODEL

After analysis found that the decision to share the sustainable development of bicycle profit is an important factor in the total amount of consumer mortgage money, if the total amount of money the total deposit, the profit will be higher and higher, the introduction of the new Business model, that is, by increasing the deposit, in order to achieve multi-preferential model. So through the survey data query for each shared bicycle different deposit under the circumstances of the net profit. As shown in Table 6.

Table 6. Share the net profit in the case of a different deposit

Deposit (yuan)	99	150	199	250	299
Net profit (billion)	10.08	11.25	13.54	16.84	21.06

Through the existing deposit and the case of net profit data, we have to predict the deposit in the 350 ~ 450 yuan between the case of the company's theory of net profit [9], the establishment of gray prediction model. Using MATLAB to predict the net profit of different deposits, get the results shown in Figure 3, the red line for the real data, blue line for the forecast data. The predicted values were 25.7431, 31.8275 and 39.3501, respectively. The absolute error in this result is 3.5845%.

Through the forecast curve can be drawn from the new platform proposed business model, that is, a small increase in the amount of the deposit can be used as a shared bicycle continued profit business model.

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Prediction of Furnace Temperature Based on Nonlinear Time Series RBF Neural Network Model

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Abstract: In the iron and steel smelting industry in the production process, to achieve the furnace temperature forecast can be more effective control of product quality to a higher level. Based on this, this paper presents a prediction model of RBF neural network based on nonlinear time series, which overcomes the problem that the single neural network is easy to fall into the local minimum and the slow training of the network in the nonlinear time series prediction. Choose more precisely. Firstly, the structure principle of RBF neural network is introduced, and then the dynamic k-means algorithm is applied to the center selection of RBF neural network. Finally, the simulation experiment is carried out. The results of the simulation results on the surface of the algorithm are more practical and effective, can be more accurate prediction of furnace temperature, industrial production to provide a theoretical basis.
Keywords: RBF neural network; k-mean; nonlinear time series; prediction

1. INTRODUCTION

Iron and steel is one of the most important raw materials of modern society, blast furnace ironmaking plays an important role in China's economic development. In the blast furnace production, to maintain a reasonable furnace temperature is one of the necessary conditions for the development of production. Due to the complexity of the blast furnace ironmaking process and the difficulty of measurement, it is difficult to directly measure the furnace temperature. Therefore, the temperature of the furnace is generally reflected by the silicon content (commonly known as chemical heat) Blast furnace hearth thermal state In reality, the method of detecting the silicon content of molten iron mainly includes iron observation and iron quality monitoring. The method of direct observation is inaccurate and there is a certain hysteresis in the inspection of molten iron quality, which can not meet the requirements of real-time and accurate reaction of blast furnace temperature and hot metal quality. The establishment of mathematical model to predict, as the iron content of silicon content of the important means of predictive control.

Neural network as a better predictive effect of intelligent algorithms can be used for a variety of research, scholars have also carried out a lot of research. Bridge Junfei et al. Proposed a dynamic dynamic optimization design method for the structural problem of Radial bassis function (RBF) neural network. Sensitivity analysis (SA) was used to analyze the effect of hidden layer neurons Output weighting on the neural network output, to solve the RBF neural network structure is too large or too small problem [1]. Wei Min et al. Used the gradient descent method and the optimization method to deduce the dynamic optimal learning rate of the RBF neural network and apply it to the network learning algorithm. The RBF neural network with dynamic optimal learning rate is better than the traditional fixed learning rate RBF neural network has a faster convergence rate [2].

The prediction of silicon content in blast furnace hot metal is a time series forecasting problem. The main methods are traditional AR-MAX model and neural network method. The neural network expert system model is used to predict the silicon content of molten iron and has a strong nonlinear mapping ability. At present, BP neural network is used to forecast the silicon content of molten iron in blast furnace. However, due to the modification of the first derivative information of the criterion function in the BP learning algorithm, the convergence rate is relatively slow and may converge to Local minimal point. RBF neural network not only has a strong nonlinear mapping ability, but also has the characteristics of fast convergence and global optimization. In this paper, RBF neural network model is used to predict the silicon content of molten iron. The dynamic K-means algorithm is used to optimize the RBF network center, and a nonlinear time series based on RBF neural network is established Forecasting model. The RBF has the characteristics of adaptive network structure, independent of the initial weight and so on. It can approximate any continuous nonlinear function and can deal with the system. The RBF has the advantages of high nonlinear mapping and parallel processing capability. Inherently difficult to parse the law, the theory proved in the forward network RBF

network is the perfect mapping function of the optimal network, and in practice the use of good results.

2. THEORETICAL KONWLEDGE

RBF neural network is a kind of feedforward neural network with excellent performance. RBF network can approximate arbitrary nonlinear function with arbitrary precision, and has global approximation ability, which solves the local optimal problem of BP network and the topology is compact, Structural parameters can be achieved separation learning, convergence speed. RBF network and fuzzy logic can achieve a good complement, improve the neural network learning generalization ability.

2.1 RBF NEURAL NETWORK ALGORITHM

Neural network is a kind of neural network model proposed by Moody and Darken. It simulates the neural network structure in the human brain and covers the neural network structure of the receiving domain. It has the strong biological background and the ability to approximate any nonlinear function. RBF neural network structure has three layers: the input layer, RBF layer, the output layer, its structure shown in Fig1, where each layer has a completely different role. The input layer is composed of some source points (perceived units), which is the network and the external environment to pick up; the second layer is the only hidden layer in the network, its role is from the input space to the hidden layer of space Linear transformation. The function of the hidden layer (the base function) will respond locally to the input signal, that is, when the input signal is close to the central range of the basis function, the hidden layer node will produce a larger output, The network has local approximation capability. The output layer is linear and provides a response to the active mode (signal) acting on the input layer.

The hidden layer function uses the Gaussian function:

$$G_i(r) = \exp(\frac{-r^2}{2\sigma_i^2}) \tag{1}$$

Let H be the number of hidden layer nodes, X is the input quantity, w_h is the weight value, C_{h} is the RBF center of the h hidden node, the hidden layer output is:

$$Z_h = G(\|V - C_h\|), h = 1, \cdots H \tag{2}$$

The network output is:

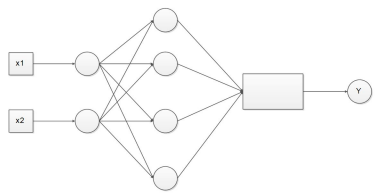

Figure 1 RBF neural network structure

$$Y = \sum_{h=1}^{H} W_h Z_h \tag{3}$$

2.1.1DYNAMIC K-MEANS CLUSTERING ALGORITHM FOR RBF NETWORK CENTER

The role of dynamic K-means clustering algorithm in RBF network center selection is to adjust the clustering center so that the selection of network center is more accurate. Its calculation process can be briefly described as follows:

First, make the number of classes 0 (the first input will force the creation of a category pattern to support the input). Later, each time a new input vector is encountered, the distance between it and any of the assigned class patterns is calculated. If the first P input vector $X^{(p)}$ is specified and the jth cluster center is C_j, the Euclidean distance d can be expressed as:

$$d = \left\|X^{(p)} - C_j\right\| = \left[\sum_{i=1}^{M} (X_i^{(p)} - C_{ji})^2\right]^{\frac{1}{2}} \tag{4}$$

Where M is the dimension of the input vector.

Let the distance between the input vector $X^{(p)}$ and all allocated pattern classes be known and the center closest to the input vector is C_k, where T is the number of known categories.

After determining the center closest to the input vector, k is determined, and d_0 is determined. It is compared with the distance limit ρ, there will be the following two cases:

(1) When $d_0 < \rho$, the input vector $X^{(p)}$ is within the allowable error range when the input k vector belongs to the first category. That is, if S_k is used to represent the set of all the input vectors corresponding to the $X^{(p)} \in S_k$ center, In this case, we can introduce the idea of k-means clustering method, and make the center update by finding the average of all the member vectors. which is:

$$C_k = \frac{1}{N_{S_k} + 1} \sum_{X \in S_k} X \tag{5}$$

Where N_{S_k} represents the number of input vectors to which the Kth cluster center is directed.

(1) At that time $d_0 > \rho$, the input vector $X^{(p)}$ is within the allowable error range and can not be assigned to that category. At this point, should be $X^{(p)}$ as the center, the distribution of a new cluster center, the algorithm flow chart shown in appendix.

(2)The above process uses the method of dynamic clustering to find the center of the network in real time. After determining the network center C_j, the corresponding radius σ_i can be made equal to the average distance between the training samples

belonging to the class,

$$\sigma_i = \frac{1}{T}\sum_{X^{(p)}\in S_j}(X^{(p)}-C_j)^T(X^{(p)}-C_j) \quad (6)$$

2.2.ALGORITHM DESIGN

Step 1. Determine the input and output layers of the RBF neural network according to the actual situation.

Step 2. Use the dynamic k-means mean algorithm to find the RBF network center and width

Step 3. Use the negative gradient algorithm to find the weight

Step 4. Select the training sample and test the sample to establish the test model to establish the flow chart as follows:

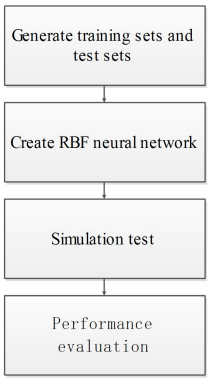

Figure 2 Model build steps

2.3.NONLINEAR TIME SERIES FORECASTING MODEL BASED ON BASED ON RBF NEURAL NETWORKN ONLINEAR

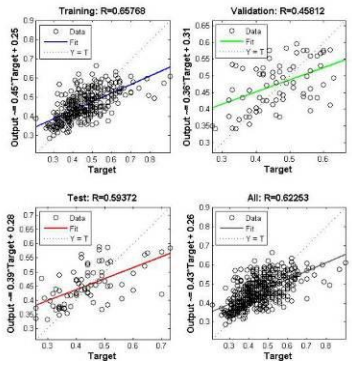

Figure 3 One-step prediction data assessment

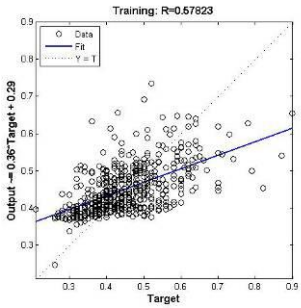

Figure 4 Two-step prediction of training results

Nonlinear time series prediction model based on NAR model:

$$y_t = f(x_{t-1}, x_{t-2,}\cdots x_{t-p}) + e_t \quad (7)$$

Of which $E(e_t \mid x_{t-1},\cdots) = 0$:, and e_t there is a finite variance of σ^2.

The minimum variance is predicted as:

$$\hat{x}_t = \hat{f}(x_{t-1},\cdots,x_{t-p}) \quad (8)$$

The RBF neural network approximation function $\hat{f}$ is used to predict:

$$\hat{x}_t = NN_\Phi(x_{t-1},\cdots x_{t-p}) \quad (9)$$

Similarly, you can get two-step prediction:

$$\hat{x}_{t+1} = NN_\Phi(x_{t-1},\cdots x_{t-p}) \quad (10)$$

The accuracy of the two-step prediction is 0.57823 as shown in Fig. 5. The results of the simulation are shown in Fig. 5, and the prediction result is high.

3. CONCLUSION

3.1. RBF neural network prediction model, which has the characteristics of simple structure and high accuracy of prediction, and obtains satisfactory results in predicting the silicon content.

3.2. Using the dynamic k-means algorithm to find the RBF network center, the selection of the network center is more accurate, and the prediction result is more accurate.

3.3.The RBF neural network does not have the minimal problem of local minimal problem. The growth structure learning algorithm automatically constructs the near-optimal network, which solves the over-fitting problem and improves the generalization ability of the network.

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Study on Prediction Method of Silicon Content in Blast Furnace Smelting Process

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Abstract: As the basic industry of national economy development, blast furnace ironmaking plays an important role in the development of iron and steel industry and energy saving. In the process of production, the change of the silicon content is usually used to reflect the change of furnace temperature indirectly. Therefore, accurate prediction of silicon content is beneficial to control furnace temperature and maintain stable operation of blast furnace. The blast furnace process is a discrete, continuous, continuous smelting, discrete output of complex production process. It is an unsolved mathematical problem to solve the optimal solution of the mixed dynamic equations in the smelting process. Therefore, the time series prediction model is used to predict the silicon content. First eliminate outliers, using the weighted method, the average of the initial set of data is selected as the initial value, Change the weighting coefficients and predict with the matlab program, Select the smallest alpha value with the loop statement [1-4]. A stable model is constructed by moving average processing of the sequence. 40 groups of data were selected for prediction and verification analysis. The results show that the prediction of silicon content in hot metal by using time series model is feasible. The predicted value is basically fitted with the actual value, and the calculation is simple and the prediction accuracy is higher.

Keywords: Time series forecasting model; BP neural network; Temperature prediction; The optimization model of S

1. INTRODUCTION

The process of blast furnace ironmaking involves adding raw fuel such as ore and coke to the top of the blast furnace in order of feeding. he processes of adjusting furnace temperature by continuously blowing hot air and injecting pulverized coal into the lower part of blast furnace. From the top of the raw fuel to slag and molten iron, the smelting cycle is 6-8 hours. The blast furnace once 2 hours after the slag, iron once. And test the chemical composition of the molten iron and slag, Therefore, there is a correlation between the silicon content of the hot metal in the two furnaces, that is, the furnace temperature.

Given that the data is sorted by time series, the neural network model does not have a good applicability that reflects the correlation between the two hot metals. And the time series considers that the most recent N-stage data has an effect on the future value and is weighted to predict future N + 1 data. Therefore, it is decided to use the time series prediction model to establish the dynamic mathematical model of silicon.

And the production time delay of the blast furnace is larger and the inertial power system is larger. [5] Therefore, we have established a suitable mathematical model for this purpose, which can be used to analyze the complex nonlinear process of blast furnace ironmaking process in order to achieve reasonable and effective next prediction.

2.TIME SERIES BASED PREDICTION ALGORITHM

In production and scientific research, a measure of a certain or a set of variables x (t) is observed in a series of time t1, t2, . . ., tn (‘t’ is an independent variable) in chronological order and used to explain the variables and Mathematical Expressions of Interrelationships. (t2), = "" . . ., = "" x (tn), we call it for time series, this time-sensitive sequence is also called dynamic data.

3. THE MODEL IS ESTALISHED AND VERIFIED

3. 1BUILD AND SOLVE

Using SPSS software to describe the known Si statistics can be obtained outliers. (As shown in Fig 1, the ordinate is greater than three, and less than the negative three is an outlier). And to process new samples.

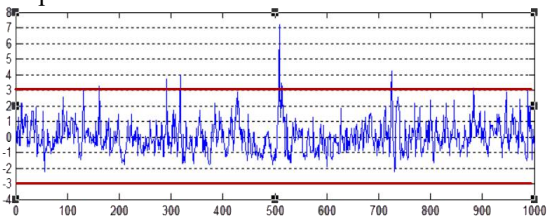

Figure 1 1000 furnace silicon content of the data

Blast furnace production is a continuous strong inertia of the process, in normal operation, [Si], [S] does not appear too much change. Since the molten iron and slag are once per hour, the collected data is time-dependent chronological sequence. So the time series analysis method can be well applied to the [Si] to make one-step prediction and two-step prediction. In general, historical data is less likely to affect the future as the time interval increases. Therefore, a

more realistic approach should be to carry out the weighted average of the observed values in time order as a predictive value. The exponential smoothing method satisfies this requirement and has a simple recursive form

Single exponential smoothing

Let the observed value of [Si] be . . ., the weighting factor, 0 <. The exponential smoothing formula is:

$$S_t^{(1)} = \alpha y_t + (1-\alpha) S_{t-1}^{(1)} = S_{t-1}^{(1)} + \alpha\left(y_t - S_{t-1}^{(1)}\right) \quad (1)$$

By a simple moving average formula available:

$$M_{t-1}^{(1)} = M_{t-1}^{(1)} + \frac{y_t - y_{t-N}}{N} \quad (2)$$

With $M_{t-1}^{(1)}$ as the best estimate of y_{t-N}, there are

$$M_t^{(1)} = M_{t-1}^{(1)} + \frac{y_1 - M_{t-1}^{(1)}}{N} = \frac{y_1}{N} + (1-\frac{1}{N}) M_{t-1}^{(1)} \quad (3)$$

Let $\alpha = \frac{1}{\mathrm{N}}$, substitute S_t for $M_t^{(1)}$, That is

$$S_t^{(1)} = \alpha y_t + (1-\alpha) S_{t-1}^{(1)} \quad (4)$$

In order to further understand the essence of the index smooth, the above type in order to start, there are

$$S_t^{(1)} = \alpha y_t + (1-\alpha) S_{t-1}^{(1)} \quad (5)$$

Three exponential smoothing method

When the time series changes linear trend, with a exponential smoothing method to predict, there are still significant lag bias. Therefore, it must be amended. The modified method is the same as the trend moving average method, that is, the second exponential smoothing. When the time series changes in the performance of the quadratic trend, you need to use the third exponential smoothing method. The third exponential smoothing is based on the second index smoothing, and then a smooth. The formula is:

$$\begin{cases} S_t^{(1)} = \alpha y_t + (1-\alpha) S_{t-1}^{(1)} \\ S_t^{(2)} = \alpha S_t^{(1)} + (1-\alpha) S_{t-1}^{(2)} \\ S_t^{(3)} = \alpha S_t^{(2)} + (1-\alpha) S_{t-1}^{(3)} \end{cases} \quad (6)$$

The third - order exponential smoothing model is:

$$\hat{y}_{t+m} = \alpha_t + b_t m + C_t m^2, m = 1,2,... \quad (7)$$

among them

$$\begin{cases} a_t = 3S_t^{(1)} - 3S_t^{(2)} + S_t^{(3)} \\ b_t = \frac{\alpha}{2(1-\alpha)}\left[(6-5\alpha)S_t^{(1)} - 2(5-4\alpha)S_t^{(2)} + (4-3\alpha)S_t^{(3)}\right] \\ c_t = \frac{\alpha^2}{2(1-\alpha)^2}\left[S_t^{(1)} - 2S_t^{(2)} + S_t^{(3)}\right] \end{cases} \quad (8)$$

The choice of weighting factor

The choice of weighting coefficients is very important for exponential smoothing. The size specifies the proportion of the new data and the original forecast value in the new forecast value. If the next forecast is the same as this period, the effect of the new factor is not considered at all; if the new forecast does not believe the past observations at all. If the time series is relatively stable, it should take a little smaller; if the time series fluctuates, it should be closer to 1. In the use of similar moving average method, based on the observed time series, take several values to observe, to find the smaller value of the error. Through the experimental comparison found that the predicted value and the actual value of a good fit.

Determination of initial value

It is also important to determine the appropriate initial values when using the exponential smoothing method. The initial value is predicted or specified by the predictor. When the time series is large, the initial value is small and the first group of data is preferable. When the time series is small, the initial value has a great influence on the forecast value. Initial value. In general, we select the average of the initial data as the initial value. We select the average of the two sets of [Si] data as the initial value.

3.2 THE TEST AND EVALUATION OF THE MODEL

We selected 150 sets of [Si] samples for constructing the model, by setting the values determined by the debugger and the stable model system. And then 40 sets of data for prediction and verification, one step prediction results shown in Fig 2:

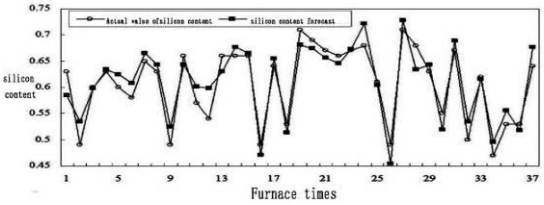

Figure 2 Silicon content prediction

In the prediction of silicon, the use of this model is in a more stable environment through the collection of molten iron silicon content analysis, one-step prediction and two-step prediction. In the forecast, the general concern one step to predict whether there is a high accuracy in order to facilitate the adjustment of wind pressure, coal and other factors. Although the number of samples increases, the hit rate will increase. However, due to the factors such as the amount of blast, the amount of coal injected, and so on, the number of samples will not increase indefinitely, and the number of samples is too large and the calculation amount is large. The number of samples is important and needs to be analyzed by actual situation Although the hit rate is not high, but from the long-term point of view, according to some of the forecast to make adjustments to ensure a stable blast furnace, high-yielding operation.

4. CONCLUSION

When the silicon content in molten iron is solved, the exponential smoothing model of the time series is established, and the α value and the initial value of the error are determined by the analysis of the data, and a good one step is predicted for the silicon. Model in the one-step prediction based on the two-step forecast, although the two-step prediction, although the hit rate is not high, but from the

long-term point of view, in practice can still be based on some predictions to make adjustments to ensure a stable, The operation.

Compared with the silicon-based silicon content prediction model based on single silicon-based blast furnace, the data-driven model based on multiple time series has the advantages of high precision, simple form, low computational complexity and fast operation speed. However, Multi-blast furnace data detection equipment and more adequate data analysis, etc. At the same time with the introduction of more blast furnace variables, the optimal thresholds σ and δ will become more difficult to determine.

At present, the research on the data model of silicon content in blast furnace molten iron based on multi-time series is still in the exploratory stage. The model is based only on the silicon content of molten iron and the sulfur content of molten iron, and it is linear. The model has great potential in describing the development and change of the silicon content in blast furnace molten iron, and it is expected that by increasing the model order (non-linearity), introducing more blast furnace variable information, seeking the global optimal value of thresholds σ and δ To further improve the accuracy of the model, the ultimate realization of blast furnace molten iron silicon content of the precise control.

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Application of Fuzzy Hierarchy Evaluation in Matching Degree of Taxi

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Abstract: Aiming at the problem of "supply and demand matching" in the "Internet +" era, this paper establishes the matching index, mileage utilization ratio, passenger satisfaction index of three indicators. In order to avoid the influence of the human's subjectivity on the evaluation results of the matching degree, we propose a method for evaluating the degree of taxi resource matching based on AHP and fuzzy comprehensive evaluation. Using analytic hierarchy process to determine the proportion of each evaluation index, the proportion of the three indicators were 0.591 2, 0.173 0, 0.235 8. Then choose Beijing, Xi'an, Urumqi three different levels of the cities, combined with MATLAB programming, we evaluated the matching degree of each city taxi. the results show that the degree of supply and demand of taxi resources from big to small are Xi'an, Beijing and Urumqi.

Keywords: Taxi resources; matching degree; AHP; fuzzy comprehensive evaluation

1. INTRODUCTION

With the coming of “the Internet plus” era, there are a number of companies rely on the mobile Internet established taxi service software platform to realize information exchange between passengers and taxi drivers, so in the past two years the Internet search rate is greatly improved, because the taxi resources matching degree is a multi-index, multi factor complex dynamic system, with the characteristics of accuracy and fuzziness, uncertainty and uncertainty, [1] cannot make a comprehensive and authoritative evaluation according to a single evaluation index. Therefore, the fuzzy comprehensive evaluation method is selected to objectively reflect the fuzziness and continuity of the matching degree, in order to make the comprehensive evaluation results obviously reasonable. By investigating taxi call status and customer satisfaction, to establish a reasonable index, evaluate the matching degree of taxi software resources in different areas quantitatively and achieve a comprehensive evaluation of the city sample level.

2. AHP METHOD TO DETERMINE INDEX WEIGHT

2.1 CONSTRUCTION HIERARCHY MODEL

According to the system structure of taxi drivers and passengers and the basic principles of index system, the index system model of matching index, mileage utilization and passenger satisfaction is established. The first level of the model is the target layer, that is, the matching index (C); the second index is the criterion layer, which reflects the different side of the matching index, including two level indicators of three, which are the correlation degree (B1) and the reliability (B2), convenience (B3).The third level is the project level, which reflects the main influencing factors of each aspect of the study, including matching index (A1), mileage utilization (A2) and passenger satisfaction (A3).

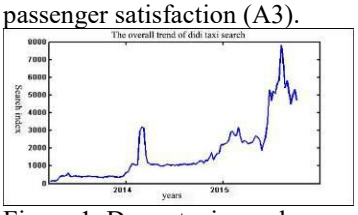

Figure 1. Drops taxi search overall trend map

2.2 Weight WEIGHT CALCULATION OF MATRIX

In determining the weight of each index, the 1-9 judgment method of A.L.Satty is used to score the comparison judgment matrix.[2-5] First of all, please Transportation Bureau staff put forward opinions of indexes, then interviewed different levels of city taxi drivers and passengers each case index value. Finally, the relative score of each index in the comparison matrix is completed.

2.3 HIERARCHICAL SINGLE ORDER AND TEST

For the consistency judgment matrix, each column is normalized to be the corresponding weight, and then the arithmetic average of the n column vectors is taken as the last weight [3], and the specific formula is:

$$W_i = \frac{1}{n}\sum_{j=1}^{n}\frac{a_{ij}}{\sum_{k=1}^{n}a_{ki}} \quad (1)$$

Consistency tests are followed, and the test procedure is:

The first step is to compute the consistency index. The formula is as follows:

$$C.I. = \frac{\lambda_{\max} - n}{n-1} \quad (2)$$

The second step is to determine the corresponding average random consistency index R.I.

According to the different order lookup table 1 of the judgment matrix, the average random consistency index R.I. is obtained

Table 1 table R.I. of average random consistency index

Matrix order	1	2	3	4	5	6
R.I.	0	0	0.52	0.89	1.12	1.26

The third step is to compute the consistency ratio, C.R., and judge

$$C.R.=\frac{C.I.}{R.I.} \tag{3}$$

Finally, the weight and order of each sort of judgment matrix are obtained, and the results are shown in Tab. 2.

Table 2. Weight vector and sorting at hierarchy

	Single sort weight	Program layer	Single sort weighe($C.R.$)
Relational grade B1	0.691 0	Match exponents A1	0.6910
		Kilometres utilization A2	0.091 4
		Passenger satisfaction A3	0.2176
Reliability B2	0.2176	Match exponents A1	0.6586
		Kilometres utilization A2	0.0786
		Passenger satisfaction A3	0.2628
Convenience B3	0.0914	Match exponents A1	0.5816
		Kilometres utilization A2	0.1095
		Passenger satisfaction A3	0.3090

When $C.R.<0.1$, the consistency of the judgment matrix can be accepted; on the contrary, the judgment matrix does not conform to the consistency requirement, and the judgment matrix needs to be revised.

2.4 TOTAL SORTING AND CHECKING OF HIERARCHICAL STRUCTURE

By using the top-down computing method, the relative weights of the following factors for the target layer (top layer) are synthesized step by step, wherein the total ordering result of the k layer element for the total target is as follows:

$$w^{(k)}=\left(w_1^{(k)},w_2^{(k)},\cdots,w_n^{(k)}\right)^T=p^{(k)}w^{(k-1)} \tag{4}$$

$$w_i^{(k)}=\sum_{j=1}^{m}p_{ij}{}^{(k)}w_j{}^{(k-1)}I=1,2,\cdots,n \tag{5}$$

Finally, the hierarchy, the total ranking and the consistency test of the 3 indexes are obtained, and the total weight distribution table of the three indexes is obtained. The result is shown in Tab. 3.

Table 3 Total weight allocation table

	Mileage utilization	Passenger satisfaction
A1	0.591 2	0.173 0	0.235 8

It can be seen from the calculation results that the matching index has the highest weight, the passenger satisfaction is the next, and finally the mileage utilization rate. This result can also be reflected from the side of the taxis and passengers in space and time to "tacit agreement", so passengers can quickly through the software called a taxi car, the satisfaction will naturally improve, but also to avoid the taxi because of the dead time caused by the high cost of losses, improve the utilization of mileage the real rate, to achieve a win-win situation.

3. FUZZY COMPREHENSIVE EVALUATION METHOD IS USED TO DETERMINE THE MATCHING DEGERR OF DIFFERENT CITIES

Select a more representative first tier cities Beijing, second tier cities Xi'an, three-line city of Urumqi as the evaluation object, in order to evaluate the distribution of taxi resources better and more comprehensive. Using the sky internet intelligent travel platform software data, [4] access to 3 cities within a week of 3 indicators, the number of days, and the number of high and low grades, the specific frequency distribution shown in Tab 4.

Table 4 frequency distribution of matching degree of supply and demand in different cities within one week

Index		Height(/day)	Medium(/day)	Low(/day)
Match exponents	Beijing	2	4	1
	Xi’an	3	2	2
	Urumqi	1	3	3
Kilometres utilization	Beijing	3	3	1
	Xi’an	2	3	2
	Urumqi	2	2	3
Passenger satisfaction	Beijing	2	3	2
	Xi’an	3	2	2
	Urumqi	1	4	2

According to AHP, 3 indicators, weight index, mileage utilization rate, passenger satisfaction values were 0.5912, 0.1730, 0.2358., consider the 3 indicators of the matching degree of the same time in different parts of the taxi. Fuzzy comprehensive evaluation is also carried out .[5]

The presented evaluation grade set V= {high, intermediate, low}, then construct the evaluation matrix of 3 cities in Beijing, Xi’an and Urumqi are R_1,R_2 and R_3 respectively.

$$R_1=\begin{bmatrix}2/7,4/7,1/7\\3/7,3/7,1/7\\2/7,3/7,2/7\end{bmatrix}=\begin{bmatrix}0.286,0.571,0.143\\0.429,0.429,0.143\\0.286,0.429,0.286\end{bmatrix}$$

$$R_2=\begin{bmatrix}0.429,0.286,0.286\\0.286,0.429,0.286\\0.429,0.286,0.286\end{bmatrix}\quad R_3=\begin{bmatrix}0.143,0.429,0.429\\0.286,0.286,0.429\\0.143,0.571,0.286\end{bmatrix}$$

The following is the fuzzy product operation of the weight coefficient matrix W and the evaluation matrix R: $S_i=W.\mathrm{R_i}$ .Among them"." As a fuzzy composition operator, there are usually four kinds of fuzzy composition operators;

① M(∧,∨)operator

$$s_k=\bigvee_{j=1}^{m}(\mu_j\wedge r_{jk})=\max_{1\le j\le m}\{\min(\mu_j,r_{jk})\},k=1,2,...,n \tag{6}$$

The symbol for "∧" small "∨" for large.

② M(*,∨)operator

$$s_k=\bigvee_{j=1}^{m}(\mu_j * r_{jk})=\max_{1\le j\le m}\{\min(\mu_j * r_{jk})\},k=1,2,...,n \tag{7}$$

③ M(∧,⊕)operator

" ⊕ "is bounded and arithmetic, that is, under the bounded limit of ordinary wig operations, the T number of real $x_1,x_2,x_3...,x_t$:

$$x_1\oplus x_2\oplus\ldots\oplus x_i=\min\{1,\sum_{i=1}^{t}x_i\} \tag{8}$$

By use of M(∧,⊕), their is:

$$s_k=\min\{1,\sum_{j=1}^{m}\min(\mu_j,r_{jk})\},k=1,2,...,n \tag{9}$$

④ M(*,⊕)operator

$$s_k=\min\{1,\sum_{j=1}^{m}\mu_j r_{jk}\},k=1,2,...,n \tag{10}$$

Table 5 characteristics of four operators in comprehensive evaluation

Characteristic	operator			
	M(∧,∨)	M(*,∨)	M(∧,⊕)	M(*,⊕)
Embodied weighting	Not obvious	Obvious	Not obvious	Obvious
Comprehensive degree	Weak	Weak	Strong	Strong
Using R information	Inadequate	Inadequate	Adequate	Fully
Type	Main factor prominent type	Main factor prominent type	Weighed average type	Weighed average type

According to the characteristics of the subject, we select the M(*, ⊕)which is obvious and comprehensive, the result is:

$S_1=(0.3107,0.5130,0.1767)$

$S_2=(0.4043,0.3107,0.2860)$

$S_3=(0.1677,0.4377,0.3953)$

Finally, the weighted average principle is used to analyze the fuzzy judgment vector S. The result is represented as :

$$u^*=\sum_{i=1}^{n}\mu(v_i)*s_i^k/\sum_{i=1}^{n}s_i^k \tag{11}$$

Among them, k ($k=1$ or $k=2$) is the undetermined coefficient, the purpose is to control the role of the larger S_j , After the weighted average principle is calculated, it can be obtained:

$S_1=3.4445$, $S_2=3.5221$, $S_3=2.9193$

From the final evaluation results can be seen, Xi'an city taxi supply and demand matching the highest, Beijing ranked the second, Urumqi's supply and demand of the lowest level of matching. Compared with the actual situation of taxi industry in these big cities, the fuzzy comprehensive evaluation method is reasonable.

4. CONCLUDING

(1) The evaluation results have certain practical significance. The reason why the supply and demand of such first-tier cities such as Beijing is not as good as second-tier cities because of its high population density, coupled with some of the city's unique traffic management policies such as limit numbers, Yaohao, and urban planning issues Car supply is much smaller than the demand, Therefore, there has been a second tier cities such as Xi'an taxi supply and demand configuration more reasonable phenomenon.

(2) The objective difference of the index weight is combined with the subjective preference of the expert, gives a more reasonable index weight; In addition to the fuzzy evaluation of each scheme, the final fuzzy comprehensive evaluation results can use the information contained in each scheme to evaluate the relative merits.

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Optimization Model of Shared Bicycle Scheduling Based on Time Window

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Abstract: In recent years, shared bicycles have gradually entered people's lives. At the same time, it is an urgent problem to reasonably schedule shared bicycles and make reasonable evaluation of scheduling methods. In this paper, the scheduling model of single time center soft time window is constructed, and the bicycle scheduling problem is optimized. And through the integration and processing of sample data, it is analyzed from two aspects of static and dynamic. From a static point of view, bike usage is more significant during 6 o'clock to 8 o'clock. From the dynamic analysis, the number of bicycles used in the region 1 and region 2 was higher in one day, and the bicycle usage was less in area 5 and region 10. Finally, the optimal scheduling path is as follows: 1-8-10-7-2-4-6-9-5-3-1. Through investigation and comparison, with the increase of shared bicycles, taxi trips will be reduced. When shared bikes arrive at a certain amount, the number of shared bikes will no longer significantly affect the number of taxi drivers.

Keywords: Time window scheduling optimization; static analysis; dynamic analysis; Analysis and prediction

1. INTRODUCTION

With the emergence of “excellent step” and “drop taxi” and its great success, the mode of sharing economic development has attracted extensive attention of the whole society, and it has absorbed a large amount of social capital investment [1-3]. As a hot spot in the field of sharing in 2016, shared bicycles have developed rapidly. As an important, emerging and low carbon means of transportation, the supply and demand of shared bikes have received extensive attention from all walks of life. Therefore, it is necessary to monitor vehicle data and ride distribution data dynamically and provide all-weather forecast of supply and demand for vehicle delivery, scheduling and operation and maintenance. For this reason, it is particularly important to analyze the spatial and temporal distribution of shared bicycles, and to establish a model for shared bicycle use in cities [2-7].

In recent years, with the increasing scale of urban population, the daily traffic is very important to our life. However, with the continuous development of social economy, there are more and more family cars in cities. In urban traffic system, the traffic jam of morning peak and evening peak has become a common occurrence, which brings a lot of inconvenience to our study and life. Moreover, the subway is often not the destination we are going to. In this context, sharing bikes came into being. In the campus, subway stations, bus stations, residential areas, and other places where large traffic flow, there are shared bike figure. But with the long-term operation of shared bicycles, some problems also arise. These problems are urgently to be solved in society [3-5].

2. DATA PROCESSING AND ANALYSIS

2.1 STATIC ANALYSIS OF DATA

Through the collection of data, 1000 shared bicycles within one day of the use of records were preliminary processing, obtained 11647 sets of preliminary data statistics. A total of two cycles per hour, a total of shared bike usage in each area during each time period, as shown below:

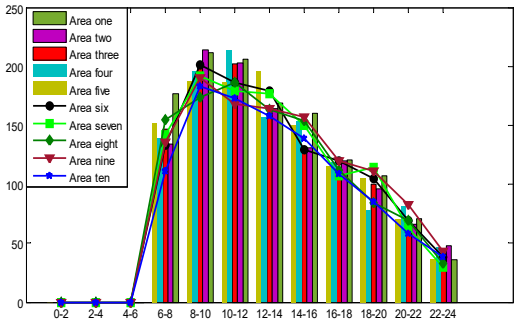

Figure 1 The use of shared bicycles under different time and space

The fig.1 above reflects the use of 1000 shared bicycles in a single day. As you can see from the figure above, from 0 to 6 in the morning, the number of shared bicycles is 0 in each area, that is, no one uses a shared bike. From 6 to 12, the number of shared bicycles in each region has been increasing over the time period. This may be due to the early morning rush hour. For the same period of time, the number of shared bicycles used in different areas is also different. For example, from 6 to 8, the share of shared bicycles was the highest in zone 1, while the number of shared bicycles in the region 10 was the least used [5-10].

1.2 DYNAMIC ANALYSIS OF DATA

The meaning of Tab.1 is the number of shared bicycles used in the region to the region within one

day. From this table, it is obvious that the maximum number of people from 6 to 5 in one day is 248, and that from 9 to 1, there are at least 86 people.

Table 1 Percentage of area and area between days

area	1	2	3	4	5	6	7	8	9	10
1	0	122	117	110	117	133	111	123	98	122
2	228	0	127	99	123	119	125	144	112	94
3	95	221	0	141	110	130	116	122	110	111
4	101	115	230	0	107	126	130	129	123	125
5	133	117	96	247	0	121	113	129	103	116
6	105	120	107	133	248	0	119	133	134	101
7	91	114	112	117	132	222	0	134	105	131
8	112	122	111	117	115	114	231	0	110	226
9	86	113	139	115	99	122	97	238	0	121
10	97	137	115	117	110	112	112	123	230	0

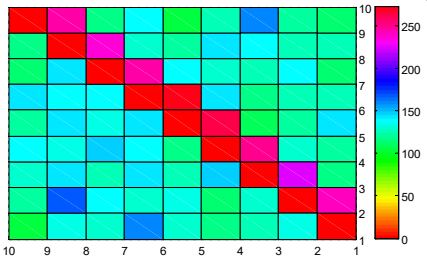

Figure 2. Flux between region

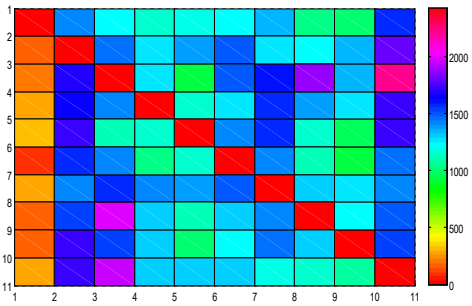

Figure 3 Interval between regions

In order to clearly and visually express the number of people leading to each area, the above table is processed to get what is shown in the following fig.2 Fig.2 and fig.3 can be found between the two regions, when the distance between 1000 to 2000 meters, the use of vehicles more frequently.

3. TIME WINDOW SCHEDULING MODEL

Suppose there are 1 scheduling centers in a city PBS system, and there are ten regions from the sample data. The distance from i to j can be shown as $d = (d_{ij} = d_{ji})$, and $(i, j = 1,2,3,...,10)$. When the region i needs to transfer bike, the quantity demanded is p_i , the supply is $q_i = 0$. The demand time window of region i is $[c_i, d_i]$. If it is earlier or later than this time window, a certain penalty will be imposed. In case of the time that dispatching vehicle to region i is t_i , the service time of every bike is t_i , t_{ij} is the travel time of the dispatching vehicle from region i to region j. Each dispatch center has a number of dispatching vehicles, and the dispatching car can accommodate up to c_i bicycles. The initial number of bicycles is Q, the maximum distance of the dispatching car is R, and the speed of the dispatching vehicle is V. Set $R_i = \{r_i \mid i = 1,2,3,...,10\}$ means that in the scheduling path, the scheduling vehicle carries out scheduling service to zone i. r_d is the first area in the scheduling path to accept scheduling services, and r_0 is the scheduling center. Since there is only one dispatching center in the PBS system of a single dispatching center, the scheduling vehicle must return to the dispatching center after completing the scheduling task so as to carry out the next scheduling task. According to the time and speed in the scheduling process, the punishment of scheduling activities that are earlier or later than the schedule window can be achieved by distance [6-9]. The mathematical model of single scheduling center, soft time window sharing and single vehicle scheduling problem is given for different driving distance and actual driving distance:

S.t.

$$\min L = a \bullet [\sum_i N \sum_j Nc_j x_{ij} d_{r_i r_j} + d_{r_d r_0}] + \beta \bullet V \sum_{i=1}^{N} (t_i - c_i) + z \bullet \sum_{i=1}^{N} (d_i - t_i) \quad (1)$$

The formula (1) is the objective function, which means that the total mileage (converted mileage) is minimum when the scheduling vehicle completes the scheduling task. Constraint condition:

$$\forall i_0 \le Q_0 + \sum_{i=1} N(q_{r_i} - p_{r_i}) \le c_0 \quad (2)$$

The formula (2) ensure that the scheduling vehicle can meet the scheduling requirements of any path at any time.

$$[\sum_i N \sum_j Nc_i x_{ij} d_{r_i r_0}] + d_{r_d r_0} \le c_0 \quad (3)$$

The formula (3) ensures that the total travel length of the scheduling path does not exceed the maximum distance traveled by the dispatching vehicle.

$$\sum_{i=1} Nx_{ij} = \sum_{j=1} Nx_{ij} \le 1 \quad i = 1,2,3,..., N \quad (4)$$

The formula (4) ensures that the dispatching vehicle starts from the dispatch center and performs the dispatching task, and then returns to the dispatching center after the scheduling task is completed.

In the above formula model, $\alpha + \beta = 1 \ (\alpha, \beta \ge 0)$, that is, the actual mileage of the dispatching vehicle and the failure to complete the task within the dispatching window, and the penalty accepted is added to the total mileage within a certain proportion.

4. EMPIRICAL ANALYSIS

4.1 CALCULATION RESULT

In this case, the dispatching vehicle is required to start the dispatch from the dispatch center at 6:00, and the scheduling task is completed at 7:15. The dispatching car can load up to 50 shared bikes. And the running speed of dispatching car is V =30 km/h. Moreover, the operation of the dispatching vehicle is not disturbed by external factors, and the service time of each bike is 30s. In case of the mean of α is 0.9, the mean of β is 0.1.

Table. 3 Regional demand and demand time windows

Serial number	Demand	Time Window	Soft time window
2	-10	[6:20-6:25]	[6:20-6;27]
3	-11	[6:55-7:00]	[6:55-6:32]
4	15	[6:25-6:30]	[6:25-6:32]
5	5	[6:40-6:45]	[6:40-6:47]
6	-12	[6:40-6:47]	[6:40-6:47]
7	8	[6:20-6:25]	[6:20-6:27]
8	-20	[6:15-6:20]	[6:15-6:22]
9	7	[6:30-6:35]	[6:30-6:37]
10	-11	[6:20-6:25]	[6:20-6:27]
11	-5	[6:05-6:10]	[6:05-6:12]

According to the running results, the optimal scheduling path of the example is 1-8-10-7-2-4-6-9-5-3-1. That is, the dispatching vehicle starts from the dispatch center, successively passes through the ordinal number 8, 10, 7, 2, 4, 6, 9, 5, 3, and then returns to the dispatching center, and then completes the dispatching task. If the dispatcher selects the nearest regional scheduling from the scheduling center, and the scheduling path is 1-9-5-3-4-6-8- 7-10-11-2-1. Through calculation, it is found that the total length of the optimal path calculated by the model and algorithm is 16871. The dispatching vehicle selects the dispatching path of the nearest regional dispatch, and the conversion result is 26095. The total length of the optimal path is reduced by 54.7%, which greatly reduces the loss of scheduling.

4.2 QUANTITATIVE RESEARCH

Since 2016, sharing bicycles has gradually entered our life. The mobile and ofo as representative of the shared bike company, in order to seize the market, never broken off in all parts of the country layout. They come to us with a healthy lifestyle concept, which has become a major factor in the growth of shared bike companies. The new business model has become possible for the sharing team [6-10]. Sharing bikes also affected the number of local taxis. Taking shared bike data in Shanghai as an example, the processing results are as follows:

From the data in question, with the increase in the number of shared bicycles, people choose to travel gradually away from the taxi travel mode, thus greatly reducing the travel expenses. So the emergence of shared bicycles has greatly affected the taxi business in the region. As can be seen from the table, from 1000 to 2000 vehicles, the number of taxi decreased linearly. From 2000 to 4000 vehicles, the number of taxi sharp decline, and then gradually flat. As a result, demand for shared bicycles in this region ranges from 4000 to 5000 vehicles, reaching saturation at this point. That is, even increasing the number of shared bicycles will not have a greater impact on the number of people taking a taxi. Therefore, it is suggested that the share of shared bicycles in this region will be 4000 to 5000 vehicles.

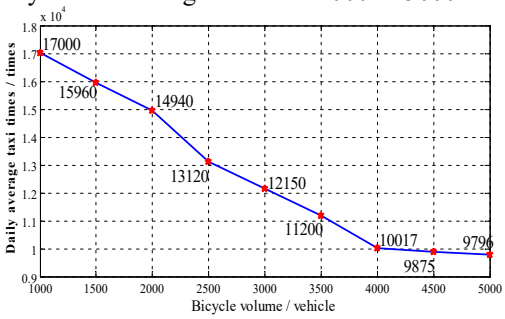

Figure 3. The number of biopsy and taxi deal

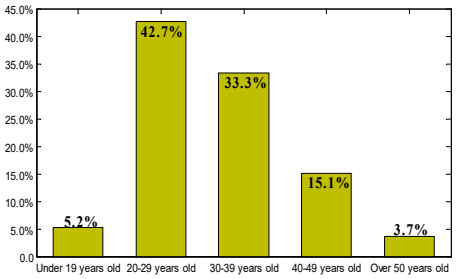

Figure 4 Shared bicycle age profile

As shown above, the majority of users sharing bicycles are 20-39 years old, the user's age is relatively concentrated, users over the age of 40 are less. So sharing bikes still has much room for improvement, and the impact on taxis in the future will not be less than it is now. With the continuous development of society and the increase of users, sharing bicycles will have greater impact on taxis in the future. Because of the increased use of shared bicycles, there will be less use of taxis.

5. CONCLUSION

Through time window scheduling optimization, the optimal scheduling path is 1-8-10-7-2-4-6-9-5-3-1. That is, the dispatching vehicle starts from the dispatch center, successively passes through the ordinal number 8, 10, 7, 2, 4, 6, 9, 5, 3, and then returns to the dispatching center, and then completes the dispatching task. If the scheduling center starts, the dispatcher selects the nearest regional scheduling, and the scheduling path is 1-9-5-3-4-6-8- 7-10-11-2-1. Through the integration and processing of sample data, it is analyzed from two aspects of static and dynamic. From a static point of view, the amount of bicycle use is significant between 6 a.m. and 8 p.m. From the dynamic analysis, the number of bicycle

usage in region 1 and region 2 was higher in one day, and the bicycle usage in area 5 and area 10 was less. Through the investigation and comparison, with the increase of the number of bike sharing, taxi passengers with reduced, but when the shared bicycle reaches a certain number, the number of bike sharing increased is no longer a major influence on taxi passengers.

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Simulation Modeling of Motor Spraying

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Abstract: Spray trajectory optimization model is the foundation; it reflects the spray surface accumulation. In this paper, a method of modeling the torch model and its application in the optimization of the spray trajectory plane. According to the physical model, using simplified mathematical model describing T. band flow field. Based on this, further spray deposition according to the comparison equation. The simulation results and practical spraying data. The correctness of the model.
Keywords: off-line programming; simulation; spray-painting

1. INTRODUCTION

In the sanitary ceramics production process, glazing technology is the key. China's ceramic industry is now widely used in the way of artificial glazing, hand glaze and the operator's proficiency, operating habits, and even emotional factors are directly related to product quality is difficult to guarantee, Workers labor intensity, but also on human health damage [1-2]. In other countries, the robot glaze has become a more mature technology, but also the ceramic production process easier to achieve automation links [3]. As of the end of 1998, the world's active spraying robot 25122 units, in general, the robot spray has a more extensive application abroad, and has a good effect [4].

One of the problems that must be solved with the use of robots is how to teach the glazed robots. The existing spray production lines, robots generally use manual teaching, this method is a lot of defects, the use of less flexible [5-6]. Therefore, it is necessary to carry out effective guidance on teaching and mapping, that is, it is necessary to carry out spray trajectory planning. The important problem to be solved by spray trajectory planning is that when the robot moves in a certain trajectory in its working space, Glaze accumulation, which requires studying the spatial distribution model of the spray moments and determining the glaze action of the robot according to this model.

In this paper, through the study of the physical characteristics of the torch, a mathematical model is established to describe the physical characteristics of the spray gun, the glaze and the influence of the various changes in the spraying process on the spray. To study the distribution of the surface flow at any point on the torch The establishment of the model will make it possible to describe the spraying process mathematically, which can lay an important foundation for the development of the offline teaching system [7-9].

2. THE SPATIAL DISTRIBUTION MODEL OF GLAZE

In order to design an optimal spray trajectory for each specified surface, it is first necessary to know the coating growth rate (um / s) at any point on the work piece, that is, the gun model, since the gun model determines the thickness of the coating on the surface Distribution, therefore, the first step in the study of the spraying process is to establish a corresponding surface of the gun mathematical model. In the broad sense, the gun model is relative to the plane[10]. To establish the coating growth rate model on the plane, we must first consider the influence of spraying characteristics, spraying equipment and the spatial distribution of the coating. On this basis, to create a simple and practical spray model.

2.1 Spraying characteristics and the impact of spraying equipment

The characteristics of the torch directly affect the distribution of the coating, because the spraying effect by a number of factors: such as the complexity of the work piece surface, the gun position and the distance from the work piece surface. By studying the characteristics of the torch to find a more accurate model of the spatial distribution of the coating, we can study the distribution of the coating surface of the complex free surface, so as to further optimize the gun trajectory. Here the plane spray characteristics for the study. Spraying equipment has a great influence on the characteristics of the torch. The main influencing factors are spray gun and nozzle. The cross section of the torch formed from the nozzle is generally circular and has the same coverage in all respects. The current spray gun angle is generally less than 600, and high efficiency, good operating performance, can be sprayed with sticky and quick-drying paint, both can achieve uniform and beautiful results. This torch is generally isotropic, that is, the torch in the cross-section in all directions are the same nature, where the isotropic torch as the object of study.

2.2 The influence of the spatial distribution of coatings

The process of spraying is a very complicated process. In order to analyze it scientifically, a series of hypotheses are established according to the need of research, and a mathematical model is established to describe the spraying process.

(1) Jet continuity hypothesis

According to the test, most of the nebulizer generated droplets are in microns, that is, their diameter is

relatively small. Experimental and theoretical data show that the spray gun produces an average droplet diameter of less than 100 μm . For such dense and small particles, we can think that the jet is continuously distributed on a macro scale. The concentration of the coating depends on the spatial distribution function of the torch. This assumption is consistent with the actual situation, but also can simplify the establishment of mathematical model.

(2) Influence factor hypothesis

The establishment of the spatial distribution model of paint is the first problem to be solved in the mathematical modeling of spraying. The influence factors of the space distribution model are: gun, air, nozzle and nozzle. Changing any of the factors will affect the spatial distribution of the coating, this paper assumes that its influencing factors remain unchanged.

At present, some scholars have carried out a series of studies on the spatial distribution of coatings, for instance: β distribution model, double β elliptic distribution model and finite range model. In this paper, the spray pattern of spray glaze from the spray pattern, combined with the diffusion characteristics of the coating particles to simulate. According to the results of the existing tests, the thickness of the torch sprayed within the θ range is uniform. The presence of this spray pattern is premised on the moderate pressure, the smaller the opening angle of the spray and the good atomization. As shown in Figure 1.

The no uniform part of the spray pattern is determined by a number of factors, which are generally considered to be due to the diffusion of particles, that is, the result of free movement. In the process of free movement and diffusion, the uniform and no uniform parts of the spray pattern and the contours of the surface of the work piece should be continuous, where we simulate with a function as shown in Figure 2.

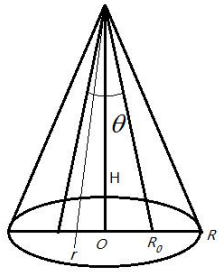

Figure 1 Spatial distribution model for coatings

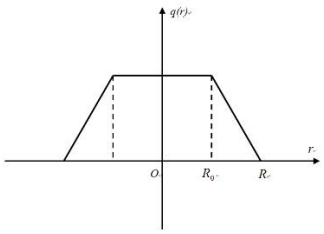

Figure 2 Coating growth rate model

Thus, the following equation is obtained [11]:

$$q(r)\begin{cases} A & 0 \le r \le R_0 \\ A \cdot \dfrac{R-x}{R-R_0} & R_0 < r < R \end{cases} \tag{1}$$

$q(r)$ indicates the ratio of the thickness of the coating to the A at the point r from the torch axis, and R_0 represents the radius of the coating to a uniform range, and R represents the radius of the coating coverage

In Figure2.1, $R_0 = H\tan(\theta/2)$ .The weight of the coating is measured according to the different gun test, which indicates that the coating thickness is uniform within the range of the spray angle θ and the thickness of the coating outside R is 0.

In the actual spraying process, it is necessary to obtain the thickness of the coating required for the surface of the workpiece, using mathematical formulas to describe it more intuitive. Taking into account isotropic, the flow Q on the entire cross section is:

$$Q = \frac{1}{3}\pi A(R_0 + R)^2 \tag{2}$$

So

$$A = \frac{3Q}{\pi(R_0 + R)} \tag{3}$$

The formula for calculating the coating thickness per unit time is:

$$q(r)\begin{cases} \dfrac{3Q}{\pi(R_0+R)} & 0 \le r \le R_0 \\ \dfrac{3Q}{\pi(R_0+R)} \cdot \dfrac{R-r}{R-R_0} & R_0 < r < R \end{cases} \tag{4}$$

The above coating thickness equation is calculated by the spatial distribution model of the primary function. Therefore, the thickness unevenness is continuous from thick to thin, which fully reflects the process of diffusion of paint molecules in the actual spraying process.

3. SPRAY SIMULATION EXPERIMENT

Based on the modeling of the plane spray gun model in the previous section, the rationality and validity of the model of the gun model are verified by the simulation of the coating distribution at any point on the plane.

Assume that the gun moves at a constant speed along the straight line and remains at a constant distance from the work plane. According to the right hand theorem, the direction perpendicular to the x-axis on the plane is the y-axis. If the amount of spray on the plane is set to z-axis, the three-dimensional Displayed as a bottom radius of R_o, the bottom of the radius of R, high A cone of Figure3 .

Figure 4 in the gun moving process, the spray range from the torch center r is equivalent to the point from the an into the spray area, from the b point away from

the spray area.

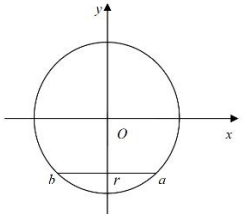

Figure 3 Schematic diagram of spraying

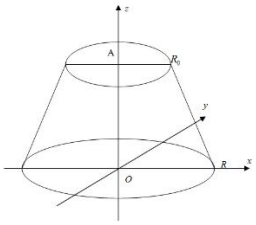

Figure 4 overlooking the diagram

The cumulative thickness of the point is the cumulative thickness of all points on the straight line ab[12], that is

$$Q_r = \int_s^e q(r)dt \tag{5}$$

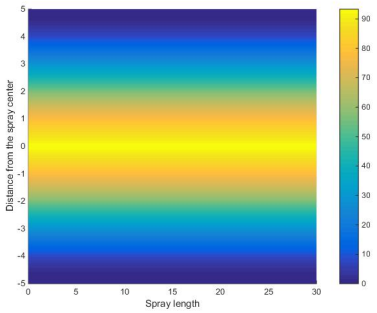

Figure 5. Simulation of the spray effect when $v=1$

Q_r for the cumulative thickness of r points, s into the spray range of time, e to leave the spray range of time. The value of which corresponds to the cross-sectional area cut in the vertical direction at a distance r from the center of the cone in Figure 3. According to the definition of the parabola, the cross-sectional shape is a parabolic and a line segment consisting of:

$$S = \frac{2}{3}lh \tag{6}$$

l for the length of the line, h is the parabola vertex to the line distance. Set the gun to move the speed of v, by the formula 4, 5, 6 get

$$Q = \begin{cases} \frac{8}{3}A\sqrt{R^2-r^2}\cdot\frac{R-r}{R-R_0}\cdot\frac{\sqrt{R^2-r^2}}{v} & R_0 \le r \le R \\ \frac{8}{3}A\cdot\left(\frac{R-r}{R-R_0}\sqrt{R^2-r^2}-\frac{R_0-r}{R-R_0}\sqrt{R_0^2-r^2}\right)\cdot\frac{\sqrt{R^2-r^2}}{v} & 0 \le r < R_0 \end{cases} \tag{7}$$

When $R=5, R_0=2, A=1, v=1$, by using Matlab, get simulated spray effect shown in Figure 5.

When $v=2$, other conditions remain unchanged.

In this paper, the gun model can describe the actual spray pattern of the gun to a certain extent, which verifies the feasibility of the model modeling method.

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Influence of Open District Based on Queuing Theory on Road Traffic Capacity

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Abstract: In order to study the influence of the open cell on the traffic capacity of the surrounding roads, the queuing theory is used to consider the local single channel hybrid model. Then, consider the change of the traffic capacity caused by the traffic into the cell opening port. On the basis of the model to increase the population density, crossing the mouth density, the opening of the vehicle inflow rate of the relevant factors, so as to further improve the road capacity model. According to the above framework, the capacity of the internal roads of the same path is solved according to the above framework, and the parameters are integrated into the above model to make the model holistic. Combined with simulation software TransCAD to calculate the impact of various types of district on the road before and after opening. It is concluded that all the types of open areas have improved the traffic on the surrounding roads and can optimize the capacity of the road system.
Keywords: transportation planning and management; queuing theory; single channel hybrid model; simulation software TransCAD

1. INTRODUCTION

The State Council issued "on Further Strengthening the administration of city planning and construction of a number of opinions" in February 21, 2016, sixteenth of them on the promotion of the block system, in principle no longer closed residential construction, has built residential area and the unit compound should gradually open views, has aroused widespread concern and discussion [1-2].

One of the focal points of discussion is: open cell [3] can achieve the optimization of network structure, improve the road capacity, to improve traffic conditions, and how to improve the effect. The first view is that the closed area destroyed the city road network structure, blocking the city "capillary", likely to cause traffic jams. The second view this area that position, external and internal road conditions and many other factors, cannot be generalized. The third view area after the opening, although the road has increased, accordingly, the area surrounding the intersection of the main road and District vehicles will also increase, may also affect the main road Traffic speed [4-5].

In this paper, the queuing theory is used to study the influence of the open cell on the capacity of the surrounding roads, so as to provide suggestions for future urban planning and construction.

2. SINMIXE CHANNEL MIXED MODEL OF OPEN CELL

In order to make the model closer to reality, starting from the local analysis, figure 1 plots after the opening of the local analysis is shown, considering entering the cell is a system, not to enter the area is another system in the queuing system into the area in the waiting queue and queue up two. The situation is more complex, so the use of queuing theory, a single channel mixed model [6] (queuing time limit) to better solve the problem.

The calculation formula of vehicle entry rate in cross section of residential area is as follows [7-9]:

$$v_i = \omega_i r \qquad \omega_i = \frac{\theta}{t'} \tag{1}$$

Symbolic description:

v_i ——Rate of vehicle entry at cross section of district entrance

r ——Take the front of the car and abstract it as a particle. The radius is the radius of the turning curve of the car

κ ——Saturation influence coefficient

ω_i ——Angular velocity of vehicle entering a section of residential entrance

2.1 CONSIDER THE BARKING DISTANCE

Because the lane for queuing on the rear of the vehicle after the formation of obstacles, need a braking distance, therefore also has influence on the following vehicles, combined with the opening of the vehicle outflow, the model of this area surrounding the road caused by vehicles to enter the area open to the traffic capacity.

According to the idea that the maximum capacity of the whole network is not open, the average capacity of the road around the open cell is obtained [10]:

$$\overline{k_0}' = \frac{\sum_{i=1}^{n}\sum_{j=1}^{m}(\sum k_{0r_{ij}\%} \bullet v_{ij} \bullet b)(1 - v_{p \cdot q})}{\sum S_{ij}} \quad (2)$$

After further optimization, the maximum capacity of the road around the open cell in the flow time is obtained:

$$k_0' = \begin{cases} \overline{k_0}' \sum S_{ij}(f-g) \cdot z & , f > g \\ \overline{k_0}' \sum S_{ij} \cdot z + \overline{k_0}' \sum S_{ij} \cdot z \cdot (f-g) & , g > f \end{cases} \quad (3)$$

3. CONSIDER THE POPULATION DENSITYl

On the basis of the above model, we can increase the population density, the intersection density of roads, and the related factors of the vehicle inflow rate at the open end, so as to further improve the road capacity model.

Taking into account the internal area as a whole factor, the internal capacity of the district has a certain impact on imports and exports, that is, the internal capacity of the district affects the import and export of the distric[11]t:

$$\kappa = \frac{v}{D} \quad (4)$$

Symbolic description:

κ ——saturation level, when is 0-0.6, 0.6-0.8, smooth road; road slightly plugging; 0.8-1, road congestion; >1, serious road congestion. Obviously, the greater the saturation of the cell, the greater the impact on the outside vehicle into the area.

4. HYPOTHESIS

Assuming the unit time, the arrival of a vehicle with Poisson distribution and Poisson distribution is through the stationary test. But in reality, the traffic in each time period is not consistent, namely traffic does not meet the normal distribution. The removal of traffic data within a week of a lane through traffic through the Chinese Yearbook >[3] <2015 in the China statistical database in traffic flow shows a strong regularity, in the daytime 8-16 time to the peak at 0-6 in the evening time period for the low peak period. Therefore, in order to traffic can meet the normal distribution of the data collected in the 7 days a week at 11 To 12 points at this time period data normalization processing, obtained frequency distribution histogram, can be obtained K-S test, Z value is 0.669, P value =0.762>0.05, so the data is approximately normal distribution [12].

Through the above test can fully explain, when the data does not meet the stability test, the normalization of the data so that the data was similar to normal distribution, so as to satisfy the stability test. It is therefore assumed that the data satisfy the stability test by normalization, so we can use the queuing theory model.

5. CONCLUSION

Through <2015 Chinese traffic at some point in the Yearbook > area traffic flow data in the Chinese statistical database, and the basic types of [4] after that area into four kinds: block type, axis type, composite type, metaphor type, using the software of TransCAD [5][6] these four kinds of basic data of simulation area before and after the opening of on the surrounding road traffic flow:

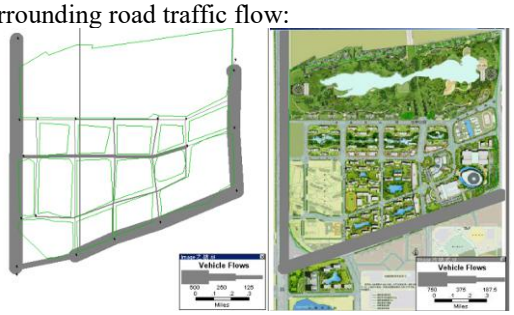

Figure 1 Comparison of traffic flow between open and open blocks

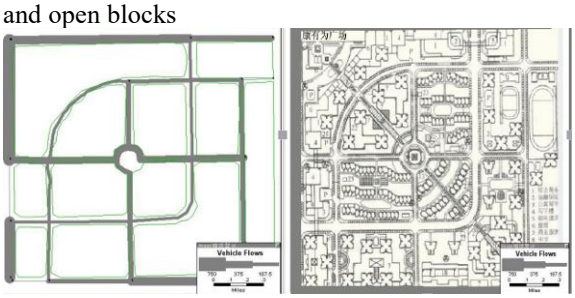

Figure 2 Comparison of traffic flow between open and opened traffic in axial area

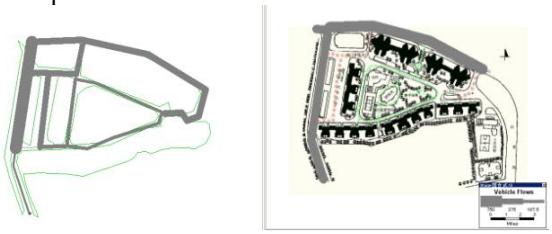

Figure 3 Comparison of flow between open and opened traffic in enclosed residential area

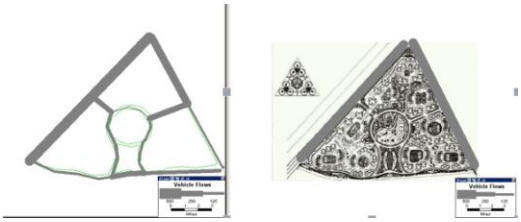

Figure 4 Comparison of traffic flow between open and open areas of metaphorical residential area

It can be seen that the opening of all types of residential areas has improved the surrounding road traffic, and can optimize the traffic capacity of the road system. When other residential areas, if one of the four categories, the corresponding proportion of supporting the above formula for calculation, you can draw an open area on the surrounding roads have an impact. Comments made to the traffic management department: Through the calculation of third questions, can be obtained when to calculate what type of cell need to open, by calculating the optimum factors its general proportion difference with second Q calculation method and third asked to calculate before and after the opening of surrounding road

traffic capacity, when it is positive, it indicates that the opening is valuable otherwise, without opening. Comments made to the town planning department: The second number for Q area surrounding the road density, road network structure, the formula can be measured through the traffic on the residential location, so as to design the area surrounding the road density, the number of road network structure, so as to determine the open area surrounding the road type, traffic and city roads make clear contribution.

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Research on Comprehensive Performance Evaluation of Intelligent Engine Start - up System Based on Fuzzy Comprehensive Evaluation

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Abstract: Objective: Which provides a quantitative algorithm for the evaluation of the comprehensive performance of the intelligent engine start and stop system, with a view to providing guidance for the development of intelligent start and stop system. Methods: Fuzzy comprehensive evaluation algorithm. Process: On the basis of summarizing the comprehensive performance evaluation model of intelligent start and stop system, the index system of evaluating the comprehensive performance of intelligent start and stop system is constructed. Application of questionnaire survey, information literature, mathematical statistics to collect the indicators and the weight of the indicators to solve. The fuzzy comprehensive evaluation model is used to quantitatively evaluate each criterion layer and comprehensive satisfaction degree. Conclusion: The algorithm model is suitable for the evaluation of the comprehensive performance. The result shows that the safety and price of the intelligent start and stop system are concerned. At the same time, the comprehensive performance evaluation of intelligent start and stop system is" Satisfied".
Keywords: Intelligent start and stop; Fuzzy comprehensive evaluation; Index system; Quantitative assessment

1. INTRODUCTION

In many developed countries in Europe, people's awareness of energy conservation and environmental protection is relatively strong, they will be idle as a waste, in the presence of lights, there will be prompted the driver to close the engine warning signs, used to prompt the driver will be in idle state Find compositions'. In the 1980s, Germany installed many similar hints, and in Japan if the car was idle and did not turn off the engine, it would be fine [1-2].

In China, people are not enough attention to energy consumption and environmental pollution, which led to the development of this technology is relatively backward. China's auto industry development lagged behind the developed countries, while fuel consumption and environmental pollution attention is not enough, for the car start and stop technology research and development relatively late. Chery, Changan, Geely and other car companies are also around 2010, have been introduced to load idle start and stop the car.

2. INTELLIGENT STAR AND STO SYSTEM INTEGRATED PERFORMANCE EVALUATION MODEL

2.1 BACKGROUND

With the increase in private cars and public vehicles, car travel in the process of environmental issues cause people's attention. In recent years, with the progress of science and technology and people's awareness of environmental protection, the engine's intelligent start and stop gradually into the people's vision. According to China's social development statistics bulletin statistics, from 2010 to 2016 car ownership as shown in Fig.1.

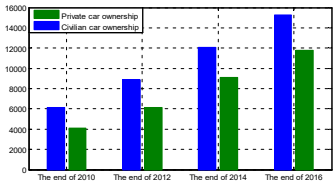

Figure 1 Trends in the number of cars

It is clear from the Fig.1 that between 2010 and 2016, private car ownership and civilian car ownership have nearly tripled in the past six years.

At the same time, according to the relevant statistics, start the car engine fuel consumption is only required at idle speed 0.7s fuel consumption, so encounter a red light or road congestion when the engine flame is restarted is necessary, the engine idling start and stop The system can effectively reduce the vehicle idling conditions caused by fuel consumption and exhaust emissions [3-5].

Fig. 2 reflects the use of intelligent start and stop systems in recent years in China. Intelligent start and stop system from 800, 000 times in 2011 to the use of more than 320 million in 2016, the use of nearly four times. From the growth trend, the use of intelligent start and stop system is still rising year after year [6-7].

Table 1 Exhaust emissions under different operating

conditions

Condition Emissions	Idle Speed 0	Accelerate 0-40	Constant Speed 40	Slow Down 40-0
CO(%)	4.0-10.0	0.5-1.0	0.7-5.0	1.5-4.5
HC(10-6)	300-2000	200-400	300-600	1000-3000
NOX(10-6)	5-100	1000-3000	1000-4000	5-50

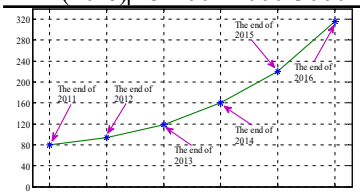

Figure 2. Intelligent start and stop system usage

2.2 THE ESTABLISHMENT OF THE MODEL

The face of increasingly large intelligent start and stop system using the crowd, start and stop the system R&Dis facing unprecedented pressure. At the same time, how to judge a smart start and stop system is also very important. Therefore, this paper establishes a comprehensive evaluation model of intelligent engine start and stop system based on fuzzy comprehensive evaluation to evaluate the advantages and disadvantages of a start-stop system. The flow chart is shown in Fig. 3.

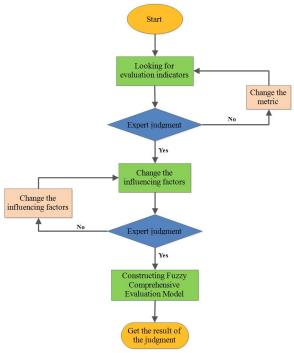

Figure 3 Intelligent start and stop system comprehensive performance evaluation model flow chart

3. METHOD

The fuzzy comprehensive evaluation model is based on the construction of the index system. Based on the evaluation system of the comprehensive performance of the intelligent start and stop system of the automobile engine, it is necessary to follow the comprehension, independence, order step by step, importance, system, comparability and practicability. Basic principles [8-10]. On the basis of literature review and questionnaire survey, this paper establishes the evaluation index system of intelligent start and stop system as shown in Fig. 4.

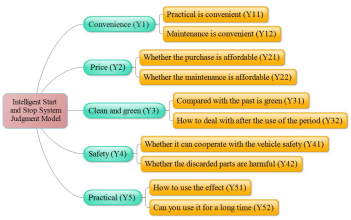

Figure 4 Comprehensive performance evaluation index system of intelligent start - stop system

4. RESULTS AND DISCUSSION

4.1 DATA SOURCES

This paper mainly through the use of questionnaire survey, literature, mathematical statistics, in order to carry forward the spirit of environmental protection and conservation, and shorten the questionnaire survey time, through the use of online survey survey, questionnaire design mainly around the primary indicators Y1 -Y5 expansion, and thus along the primary indicators targeted research secondary indicators, to reflect the intelligent start and stop the overall performance of the system. In order to ensure the effective number of samples, the actual survey published 500 copies of online questionnaires, recycling 445, the recovery rate of 89%, due to some questions such as incomplete questionnaire, the final effective file a total of 425, the effective rate of 85%. The weights of each index are calculated using the judgment matrix in the AHP method (see Tab. 2).

4.2 RESULT ANALYSIS

Intelligent start and stop system comprehensive performance evaluation model calculation process is as follows: The weight of the secondary index under each level index is determined, and the weighting vector is constructed, and the fuzzy evaluation set of the secondary index is extracted and formed into a fuzzy evaluation set matrix.Y1 under the secondary indicators Y11 and Y12 weight line vector $\mathbf{w}_1 = (0.580, 0.420)$, $\mathbf{w}_2 = (0.642, 0.358)$; $\mathbf{w}_3 = (0.433, 0.567)$; $\mathbf{w}_4 = (0.687, 0.313)$; $\mathbf{w}_5 = (0.452, 0.548)$.

Y1 under the secondary index Y11 and Y12 fuzzy evaluation matrix

$$R_1 = \begin{bmatrix} 0.146 & 0.473 & 0.173 & 0.177 & 0.031 \\ 0.163 & 0.469 & 0.217 & 0.077 & 0.074 \end{bmatrix}$$

$$R_2 = \begin{bmatrix} 0.264 & 0.361 & 0.165 & 0.115 & 0.095 \\ 0.209 & 0.399 & 0.269 & 0.058 & 0.065 \end{bmatrix}$$

$$R_3 = \begin{bmatrix} 0.341 & 0.250 & 0.183 & 0.221 & 0.005 \\ 0.281 & 0.387 & 0.135 & 0.106 & 0.091 \end{bmatrix}$$

$$R_4 = \begin{bmatrix} 0.241 & 0.380 & 0.188 & 0.125 & 0.066 \\ 0.218 & 0.388 & 0.227 & 0.135 & 0.032 \end{bmatrix}$$

$$R_5 = \begin{bmatrix} 0.472 & 0.216 & 0.173 & 0.067 & 0.072 \\ 0.226 & 0.351 & 0.260 & 0.125 & 0.038 \end{bmatrix}$$

STEP2. Use the formula (6) to solve the comprehensive evaluation set matrix $\boldsymbol{B}$

$$B = \begin{pmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \\ B_5 \end{pmatrix} = \begin{pmatrix} \omega_1 \bullet R_1 \\ \omega_2 \bullet R_2 \\ \omega_3 \bullet R_3 \\ \omega_4 \bullet R_4 \\ \omega_5 \bullet R_5 \end{pmatrix} = \begin{pmatrix} 0.153 & 0.471 & 0.191 & 0.135 & 0.049 \\ 0.244 & 0.375 & 0.202 & 0.170 & 0.084 \\ 0.307 & 0.328 & 0.156 & 0.156 & 0.054 \\ 0.234 & 0.383 & 0.200 & 0.128 & 0.055 \\ 0.337 & 0.290 & 0.221 & 0.099 & 0.053 \end{pmatrix} \quad (2)$$

STEP3. Evaluation of the vector's level, use the formula (7) to determine the satisfaction of Y1 ~ Y5;

$$P = \begin{pmatrix} P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{pmatrix} = \begin{pmatrix} B_1 \bullet h^T \\ B_2 \bullet h^T \\ B_3 \bullet h^T \\ B_4 \bullet h^T \\ B_5 \bullet h^T \end{pmatrix} = \begin{pmatrix} 0.636 \\ 0.669 \\ 0.670 \\ 0.653 \\ 0.690 \end{pmatrix} \quad (3)$$

Table 2 Survey weight list

First grade index		Second grade index		First grade index		Second grade index	
Symbol	Weight	Symbol	Weight	Symbol	Weight	Symbol	Weight
Y1	0.185	Y11	0.580	Y4	0.207	Y41	0.687
		Y12	0.420			Y42	0.313
Y2	0.287	Y21	0.642	Y5	0.128	Y51	0.452
		Y22	0.358			Y52	0.548
Y3	0.193	Y31	0.433				
		Y32	0.567				

Using the formula (5) to obtain the fuzzy evaluation of the indicators (see Tab. 2).

$$v_{im} = N_{mj} / \sum_{j=1}^{5} N_{mj} \quad (1)$$

Table 3 Fuzzy evaluation set

Second grade index	Satisfaction evaluation comment				
	★★★★	★★★☆	★★☆☆	★☆☆☆	☆☆☆☆
Y11	0.146	0.473	0.173	0.177	0.031
Y12	0.163	0.469	0.217	0.077	0.074
Y21	0.264	0.361	0.165	0.115	0.095
Y22	0.209	0.399	0.269	0.058	0.065
Y31	0.341	0.250	0.183	0.221	0.005
Y32	0.281	0.387	0.135	0.106	0.091
Y41	0.241	0.380	0.188	0.125	0.066
Y42	0.218	0.388	0.227	0.135	0.032
Y51	0.472	0.216	0.173	0.067	0.072
Y52	0.226	0.351	0.260	0.125	0.038

STEP4. Calculate the comprehensive performance of the intelligent engine start and stop system C.

$$C=\begin{pmatrix}0.185 & 0.287 & 0.193 & 0.207 & 0.128\end{pmatrix}\begin{pmatrix}0.636\\0.669\\0.670\\0.653\\0.690\end{pmatrix}=0.762 \quad (4)$$

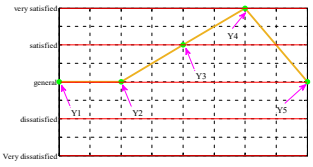

Figure 5 Intelligent start and stop the system of the indicators of satisfaction

The comprehensive evaluation results show that the overall performance of the intelligent start and stop system is Satisfied (★★★☆), and its comprehensive performance makes people have better satisfaction. In this survey, people on the intelligent start and stop system of the indicators of the satisfaction of the coordinates shown in Fig. 5:

5. CONCLUSION

The comprehensive performance evaluation of the intelligent start-stop system of the automobile engine provides a reference for the development and development of the intelligent start-stop system. It is found that the safety and price of the intelligent start-stop system And other indicators of concern more widely, while the comprehensive performance of intelligent start and stop system evaluation Satisfied (★ ★ ★ ☆), the results show that the intelligent start and stop system, its overall performance so that people have better satisfaction.

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Generalized Fractional-Order Legendre Function to Solve Variable Order Linear Cable Equation and Error Analysis

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Abstract: In this paper, the generalized fractional-order Legendre functions (GFLFs) are constructed to obtain the numerical solution of variable order fractional linear Cable equation. Firstly, the fractional differential operational matrices of GFLFs are derived, these matrices combine with Tau method to transform the problem to systems of linear algebraic equations. By solving the linear algebraic equations, we can obtain the numerical solution. The error estimation, residual correction of the algorithm and convergence analysis of GFLFs are also given. In addition, we give an upper bound of the absolute errors for the corrected solution. By using the residual correction procedure, the corrected solutions are better than the preceding approximate solutions, the precision of our numerical solution is improved. Numerical examples show that the GFLFs method is effective.

Keywords: Generalized fractional-order Legendre functions; Variable order fractional linear Cable equation; residual correction; Error estimation, corrected solutions

1. INTRODUCTION

Recently, there has been considerable interest and motivation in solving fractional differential equations (FDEs) due to the growing applications in acoustics, viscoelasticity, and electrochemistry, electromagnetic and material science [1-2]. Fractional derivatives arise in many physical and engineering problems such as fluid mechanics, viscoelasticity, modeling of speech signals, electric transmission, wave propagation in viscoelastic horns, ultrasonic wave propagation in human cancellers bone and modeling the cardiac tissue electrode interface [3, 4].The fractional derivatives are considered as a superset of integer-order derivatives, which is a major advantage. Thus, fractional derivatives have better potential in modeling practical phenomena than integer-order derivatives [5].

Developing numerical methods for solving the fractional differential equations has especially been of great importance. The most commonly used methods are like Variational Iteration Method [6], Finite Difference Method [7], Generalized Differential Transform Method [8-9], Adomian Decomposition Method [10-11], Wavelet Method [12] and Operational Matrix Method [13-14].

With the development of fractional differential equations, variable order fractional differential equations rise rapidly which makes calculus theory more perfect. Since the kernel of the variable order fractional operators is too complex for having a variable-exponent, the numerical solutions of variable order fractional differential equations are quite difficult to obtain, and have not attracted much attention. Coimbra [15] employed a consistent approximation with first-order accuracy for the solution of variable order fractional differential equations. Soon [16] proposed a second-order Runge–Kutta method which is consisting of an explicit Euler predictor step followed by an implicit Euler corrector step to numerically integrate the variable order fractional differential equation. Sun [17] et al. introduced a classification of the variable-order fractional diffusion models to the diffusion curve of the variable order differential operator model based on the possible physical origins, which motivated the variable-order and developed the Crank–Nicholson scheme. Chen [18] proposed a numerical method to solve a class of nonlinear variable order fractional differential equations (FDEs), the idea is to use Legendre wavelets functions and operational matrices. Cao [19] derived a high order numerical scheme for variable order fractional ordinary differential equation by establishing a second order numerical approximation to variable order Riemann–Liouville fractional derivative.

The cable equation, as one of the most fundamental equations, successfully modeled so many complex problems appearing in neuronal dynamics. From the Rall's pioneering work [20], more and more researchers have focused on the study of neuronal dynamics in recent years [21-34]. For example,

Langlands [35] et al. have proposed and investigated the fractional cable equation which can be viewed as macroscopic models for electrodiffusion of ions in nerve cells when molecular diffusion is anomalous subdiffusion due to binding, crowding or trapping.

However, as far as we know, very few had attempted to seek the numerical solution of the variable order fractional linear Cable equation. Liu [36] proposed Bernstein polynomials method for the numerical solution of a class of variable order fractional linear cable equation.

In this paper, we consider the following variable order fractional linear Cable equation:

$$\frac{\partial u(x,t)}{\partial t} = D_t^{1-r_1(x,t)}\frac{\partial^2 u(x,t)}{\partial x^2} - \mu D_t^{1-r_2(x,t)}u(x,t) + f(x,t)$$

* MERGEFORMAT (1)

With the initial and boundary conditions

$u(x,0) = g(x)$, $0 \le x \le X$, $u(0,t) = \phi(t)$, $u(1,t) = \varphi(t)$, $0 \le t \le T.$

* MERGEFORMAT (2)

Where $0 < r_{\min}^{(1)} \le r_1(x,t) \le r_{\max}^{(1)} < 1$, and $0 < r_{\min}^{(2)} \le r_2(x,t) \le r_{\max}^{(2)} < 1$. $\mu > 0$ is a constant, here $D_t^{1-r(x,t)}g(x,t)$ is the variable order Caputo fractional partial derivative of order $1-r(x,t)$.

In this paper, we define generalized fractional order Legendre functions based on fractional-order Legendre functions. Since fractional-order Legendre functions (FLFs) can well reflect the properties of the fractional order derivative, and the fractional derivatives of the Legendre functions are still fractional-order Legendre functions, it is a crucial feature of these bases by using fractional-order Legendre functions for numerical solution of the fractional differential equations.

The outline of this paper is as follows: In Section 2, Basic definitions and properties of the variable order fractional integrals and derivatives are given. Description of the generalized fractional-order Legendre function are given in Section 3, where operational matrices are put forward. In Section 4, we present the numerical algorithms to solve the variable order linear cable equation. In Section 5, we give existence of uniqueness and convergence analysis of the present method. In Section 6, Error estimation and residual correction are given and an upper bound of the absolute errors for the corrected solution is put forward. In Section 7, the proposed method is applied to two numerical examples. Finally, conclusions are drawn in Section 8.

2. BASIC DEFINITIONS AND PROPERTIES OF THE VARIABLE ORDER FRACTIONAL INTEGRALS AND DERIVATIVES

In this section, we recall the essentials of the variable order fractional calculus theory that will be used in this article.

Definition 1. The Riemann-Liouville definition of variable order fractional differential operator is given by

$${}^{RL}\mathrm{D}_{a+}^{\alpha(t)}f(t) = \frac{1}{\Gamma(m-\alpha(t))}\frac{\mathrm{d}^m}{\mathrm{d}t^m}\int_a^t \frac{f(\tau)}{(t-\tau)^{\alpha(t)-m+1}}\mathrm{d}\tau$$

$(m-1 \le \alpha(t) < m)$

* MERGEFORMAT (3)

Definition 2. The Caputo definition of variable order fractional differential operator is defined as

$${}^{C}\mathrm{D}^{\alpha(t)}u(t) = \frac{1}{\Gamma(1-\alpha(t))}\int_{0+}^{t}(t-\tau)^{-\alpha(t)}u'(\tau)\mathrm{d}\tau \quad (4)$$

$(0 < \alpha(t) < 1)$

Variable order fractional Caputo derivative has the basic property which is needed in this paper as follows:

$${}_0\mathrm{D}_t^{q(x,t)}\left(x^m t^n\right) = \begin{cases} \dfrac{\Gamma(n+1)}{\Gamma(n+1-q(x,t))}x^m t^{n-q(x,t)}, & n=1,2,\cdots \\ 0, & n=0 \end{cases} \quad (5)$$

where $0 < q(x,t) \le 1$.

3. GENERALIZED FRACTIONAL-ORDER LEGENDRE FUNCTION

Fractional-order Legendre and generalized fractional-order Legendre functions definitions

We define the fractional-order Legendre function [37] (FLFs) by transformation $t = x^\alpha$ and $\alpha > 0$ based on shifted Legendre polynomials. These fractional-order Legendre functions are denoted by $Fl_i^\alpha(x), i = 1,2,\cdots.$ They are particular solution of the normalized eigenfunctions of the singular Sturm–Liouville problem [38].

The function $Fl_i^\alpha(x)$ has a recursive form, as follows:

$$Fl_{i+1}^\alpha(x) = \frac{(2i+1)(2x^\alpha-1)}{i+1}Fl_i^\alpha(x) - \frac{i}{i-1}Fl_{i-1}^\alpha(x), \quad \text{i=1,2,…}$$

(6)

We noted $Fl_0^\alpha(x)=1$, $Fl_1^\alpha(x)=2x^\alpha-1.$

Then we can derive the analytic form $Fl_i^\alpha(x)$ of degree $i\alpha$ as follows

$$Fl_i^\alpha(x) = \sum_{s=0}^{i} b_{s,i}x^{s\alpha}, i = 0,1,2,\ldots, \quad (7)$$

where $b_{s,i} = \dfrac{(-1)^{i+s}(i+s)!}{(i-s)!(s!)^2}$ and $Fl_i^\alpha(0)=(-1)^i$, $Fl_i^\alpha(1)=1.$

The FLFs are orthogonal with the weight function $\omega_l^\alpha(x) = x^{\alpha-1}$ on the interval $[0,1]$, then the orthogonal condition is

$$\int_0^1 Fl_n^\alpha(x)Fl_m^\alpha(x)\omega_l^\alpha(x)dx = \frac{1}{(2n+1)\alpha}\delta_{nm},$$

where δ_{nm} is the Kronecker function.

In order to use FLFs on the interval $[0,h]$, we define the so-called generalized fractional-order Legendre functions (GFLFs), devoted by $Fl_i^{h\alpha}(\mathrm{t})$, which is defined by introducing the change of variable $t = xh,$ so the GFLFs have recurrence formula as follows

$$Fl_{i+1}^{h\alpha}(\mathrm{t})=\frac{(2i+1)(2(t/h)^{\alpha}-1)}{i+1}Fl_i^{h\alpha}(\mathrm{t})-\frac{i}{i+1}Fl_{i-1}^{h\alpha}(\mathrm{t}),\quad i=1,2,\ldots$$

Where $Fl_0^{h\alpha}(t)=1$, $Fl_1^{h\alpha}(t)=2(t/h)^{\alpha}-1.$

The analytic form of the GFLFs $Fl_i^{h\alpha}(x)$ of degree $i\alpha$ as follows

$$Fl_i^{h\alpha}(\mathrm{t})=\sum_{s=0}^{i}b_{s,i}\frac{t^{s\alpha}}{h^{s\alpha}},i=1,2,\ldots$$

Theorem 1. The GFLFs are orthogonal with the weight function $\omega_l^{\alpha}(t)=t^{\alpha-1}$ on the interval $[0,h]$, then the orthogonally condition is

$$\int_0^h Fl_n^{h\alpha}(t)Fl_m^{h\alpha}(t)t^{\alpha-1}dt=\frac{h^{\alpha}}{(2n+1)\alpha}\delta_{nm}.$$

Suppose $u(x)\in L^2[0,h],$ it can be expanded in terms of the GFLFs as follows:

$$u(x)=\sum_{i=0}^{\infty}c_iFl_i^{h\alpha}(x),\tag{8}$$

If we consider truncated series in Eq. (8), we obtain

$$u(x)\approx u_m(x)=\sum_{i=0}^{m-1}c_iFl_i^{h\alpha}(x)=\mathbf{C}^{\mathrm{T}}\Phi(x),$$

Where

$$\mathbf{C}=[c_0,c_1,\ldots,c_{m-1}]^{\mathrm{T}},\ \Phi(x)=[Fl_0^{h\alpha}(x),Fl_1^{h\alpha}(x),\ldots,Fl_{m-1}^{h\alpha}(x)]^{\mathrm{T}}.\tag{9}$$

Theorem 2. Suppose $D^{i\alpha}u(x)\in C[0,h]$ for $i=0,1,2,\ldots,m-1$, $(2m+1)\alpha\geq 1$ and $P_m^{\alpha}=span\left\{Fl_0^{h\alpha}(x),Fl_1^{h\alpha}(x),\ldots,Fl_{m-1}^{h\alpha}(x)\right\}.$ If $u_m(x)=\mathbf{C}^T\Phi(x)$ is the best approximation to $u(x)$ from P_m^{α}, then the error bound is presented as follows

$$\left\|u(x)-u_m(x)\right\|_{\omega}\leq\frac{M_{\alpha}}{\Gamma(m\alpha+1)}\sqrt{\frac{h^{\alpha}}{(2m+1)\alpha}},\tag{10}$$

where $M_{\alpha}\geq\left|D^{m\alpha}u(x)\right|,x\in[0,h].$

The error bounds shows approximation converges of GFLFs to function $u(x)$.

For arbitrary function $u(x,t)\in L^2([0,h]\times[0,l])$, it can be expanded as the below formula

$$u(x,t)=\sum_{i=0}^{\infty}\sum_{j=0}^{\infty}u_{ij}Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t),\tag{11}$$

Where

$$u_{ij}=(2i+1)(2j+1)\alpha\beta\times h^{-\alpha}l^{-\beta}\int_0^h\int_0^l u(x,t)Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t)\omega_i^{\alpha}(x)\omega_l^{\beta}(t)dxdt,$$

$i,j=0,1,\ldots$

If we consider truncated series in Eq. (11), we obtain

$$u(x,t)\approx\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}u_{ij}Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t)=\Phi^T(x)U\Phi(t),\tag{12}$$

Where

$\Phi(x)=[Fl_0^{h\alpha}(x),Fl_1^{h\alpha}(x),\ldots,Fl_{m-1}^{h\alpha}(x)]^{\mathrm{T}}$;

$\Phi(t)=[Fl_0^{l\beta}(t),Fl_1^{l\beta}(t),\ldots,Fl_{m-1}^{l\beta}(t)]^{\mathrm{T}}$;

$U=\left\{u_{ij}\right\}_{i,j=0}^{m-1,n-1}$.

The GFLFs fractional order operational matrices of derivative

Firstly, we will obtain the operational matrices of differential order $\alpha=2$ about $\Phi(x)$

$$\Phi(x)=Fl_i^{h\alpha}(x)=[Fl_0^{h\alpha}(x),Fl_1^{h\alpha}(x),\ldots,Fl_m^{h\alpha}(x)]^{\mathrm{T}},i=0,1,\ldots,m$$

$$\varphi(x)=\left[1,\ \left(\frac{x}{h_l}\right)^{a_1},\ \left(\frac{x}{h_1}\right)^{2a_1},\ \cdots,\ \left(\frac{x}{h_1}\right)^{ma_1}\right]$$

The matrix of relation between $\Phi(x)$ and $\varphi(x)$ is denoted as B

$$Fl_i^{h\alpha}(x)=\sum_{s=0}^{i}b_{s,i}\frac{x^{s\alpha}}{h^{s\alpha}}$$

Because

$$\begin{bmatrix}Fl_0^{h\alpha}(x)\\Fl_1^{h\alpha}(x)\\\vdots\\Fl_m^{h\alpha}(x)]\end{bmatrix}=\begin{bmatrix}b_{00}&&&\\b_{01}&b_{11}&&\\\vdots&\vdots&\ddots&\\b_{0m}&b_{1m}&\cdots&b_{mm}\end{bmatrix}\begin{bmatrix}1\\\left(\frac{x}{h_1}\right)^{a_1}\\\vdots\\\left(\frac{x}{h_1}\right)^{ma_1}\end{bmatrix},\tag{13}$$

Namely $\Phi(x)=B\varphi(x)$ where $b_{s,i}=\frac{(-1)^{i+s}(i+s)!}{(i-s)!(s!)^2}$, $s=0,1,\ldots,m$ $\quad i=0,1,\ldots,m$

Suppose that the operational matrices of differential order $\alpha=2$ about $\varphi(x)$ is B1. Hence

$D^2\varphi(x)=B_1\varphi(x)$

$$B_1=\begin{bmatrix}0&0&0&\cdots&0\\0&\frac{\Gamma(a_1+1)}{\Gamma(a_1+1-2)}x^{-2}&0&\cdots&0\\0&0&\frac{\Gamma(2a_1+1)}{\Gamma(2a_1+1-2)}x^{-2}&\cdots&0\\\vdots&\vdots&\vdots&\ddots&\vdots\\0&0&0&\cdots&\frac{\Gamma(ma_1+1)}{\Gamma(ma_1+1-2)}x^{-2}\end{bmatrix}$$

$D^2\Phi(x)=D^2B\varphi(x)=BD^2\varphi(x)=BB_1\varphi(x)$ and $\varphi(x)=B^{-1}\Phi(x)$

$$D^2\Phi(x)=BB_1B^{-1}\Phi(x).\tag{14}$$

Therefore, the operational matric of derivative about $\Phi(x)$ is noted as $D_x^2=BB_1B^{-1}$.

Secondly, we will obtain the operational matric of differential order $\alpha=1$ about $\Phi(t)$ similarly.

$$\Phi(t)=Fl_j^{l\beta}(t)=[Fl_0^{l\beta}(t),Fl_1^{l\beta}(t),\ldots,Fl_n^{l\beta}(t)]^{\mathrm{T}},j=0,1,\ldots,n$$

$$\varphi(t)=\left[1,\ \left(\frac{t}{h_2}\right)^{a_2},\ \left(\frac{t}{h_2}\right)^{2a_2},\ \cdots,\ \left(\frac{t}{h_2}\right)^{na_2}\right].$$

The relationship between $\Phi(t)$ and $\varphi(t)$ is noted as C, namely $\Phi(t)=C\varphi(t)$.

Suppose that the operational matrices of differential order $\alpha=1$ about $\varphi(t)$ is C1.

Namely $D\varphi(t)=C_1\varphi(t)$,

$D\Phi(t)=DC\varphi(t)=CD\varphi(t)=CC_1\varphi(t)$

and $\varphi(t)=C^{-1}\Phi(t)$.

Then we have

$$D\Phi(t)=CC_1C^{-1}\Phi(t). \tag{15}$$

The operational matrices of derivative about $\Phi(t)$ is noted as $CC_1C^{-1}=D_t$.Namely

$$\frac{\partial u(x,t)}{\partial t}=\frac{\partial(\Phi^{\mathrm{T}}(x)U\Phi(t))}{\partial t}=\Phi^{\mathrm{T}}(x)U\frac{\partial\Phi(t)}{\partial t} \tag{16}$$
$$=\Phi^{\mathrm{T}}(x)UD_t\Phi(t)=\Phi^{\mathrm{T}}(x)UCC_1C^{-1}\Phi(t).$$

Similarly, the differential operator matrix of $D_t^{1-r_1(x,t)}\Phi(t)$ is expressed as CC_2C^{-1}, and The differential operator matrix of $D_t^{1-r_2(x,t)}\Phi(t)$ is expressed as CC_3C^{-1}.

$$D_t^{1-r_1(x,t)}\frac{\partial^2u(x,t)}{\partial x^2}=D_t^{1-r_1(x,t)}\Phi^{\mathrm{T}}(x)BN^{\mathrm{T}}U\Phi(t)=$$
$$\Phi^{\mathrm{T}}(x)BN^{\mathrm{T}}UD_t^{1-r_1(x,t)}\Phi(t)=\Phi^{\mathrm{T}}(x)BN^{\mathrm{T}}UCC_2C^{-1}\Phi(t). \tag{17}$$

$$\frac{\partial^{1-r_2(x,t)}u(x,t)}{\partial t^{1-r_2(x,t)}}=\frac{\partial^{1-r_2(x,t)}(\Phi^{\mathrm{T}}(x)U\Phi(t))}{\partial t^{1-r_2(x,t)}}=\Phi^{\mathrm{T}}(x)U\frac{\partial^{1-r_2(x,t)}\Phi(t)}{\partial t^{1-r_2(x,t)}}$$
$$=\Phi^{\mathrm{T}}(x)UD_t^{1-r_2(x,t)}\Phi(t)=\Phi^{\mathrm{T}}(x)UCC_3C^{-1}\Phi(t). \tag{18}$$

4. NUMERICAL ALGORITHMS

We consider the following variable order fractional linear Cable equation

$$\frac{\partial u(x,t)}{\partial t}=D_t^{1-r_1(x,t)}\frac{\partial^2u(x,t)}{\partial x^2}-\mu D_t^{1-r_2(x,t)}u(x,t)+f(x,t)$$

With the initial and boundary conditions as (2).

If we approximate the unknown function $u(x,t)$ by terms of the GFLFs, it can be written as Eq. (12).

Then we have

$$\frac{\partial u(x,t)}{\partial t}=\frac{\partial(\Phi^{\mathrm{T}}(x)U\Phi(t))}{\partial t}=\Phi^{\mathrm{T}}(x)U\frac{\partial\Phi(t)}{\partial t}=\Phi^{\mathrm{T}}(x)UD_t\Phi(t), \tag{19}$$

$$\frac{\partial^2u(x,t)}{\partial x^2}=\frac{\partial^2(\Phi^{\mathrm{T}}(x)U\Phi(t))}{\partial x^2}=\frac{\partial^2\Phi(x)}{\partial x^2}U\Phi(t)$$
$$=[D_x^2\Phi(x)]^{\mathrm{T}}U\Phi(t)=\Phi^{\mathrm{T}}(x)(D_x^2)^{\mathrm{T}}U\Phi(t), \tag{20}$$

$$\frac{\partial^{1-r_2(x,t)}u(x,t)}{\partial t^{1-r_2(x,t)}}=\frac{\partial^{1-r_2(x,t)}(\Phi^{\mathrm{T}}(x)U\Phi(t))}{\partial t^{1-r_2(x,t)}}=\Phi^{\mathrm{T}}(x)U\frac{\partial^{1-r_2(x,t)}\Phi(t)}{\partial t^{1-r_2(x,t)}}$$
$$=\Phi^{\mathrm{T}}(x)UD_t^{1-r_2(x,t)}\Phi(t), \tag{21}$$

$$\frac{\partial^{1-r_1(x,t)}(\frac{\partial^2u(x,t)}{\partial x^2})}{\partial t}=\frac{\partial^{1-r_1(x,t)}(\Phi^{\mathrm{T}}(x)(D_x^2)^{\mathrm{T}}U\Phi(t))}{\partial t} \tag{22}$$
$$=\Phi^{\mathrm{T}}(x)(D_x^2)^{\mathrm{T}}U\frac{\partial^{1-r_1(x,t)}\Phi(t)}{\partial t}$$
$$=\Phi^{\mathrm{T}}(x)(D_x^2)^{\mathrm{T}}UD_t^{1-r_1(x,t)}\Phi(t)$$

$$f(x,t)\approx\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}g_{ij}Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t)=\Phi^T(x)G\Phi(t) \tag{23}$$

Using above equations, we rewrite Eq. (1)

$$\Phi^{\mathrm{T}}(x)UD_t\Phi(t)=\Phi^{\mathrm{T}}(x)(D_x^2)^{\mathrm{T}}UD_t^{1-r_1(x,t)}\Phi(t) \tag{24}$$
$$-\mu\Phi^{\mathrm{T}}(x)UD_t^{1-r_2(x,t)}\Phi(t)+\Phi^T(x)G\Phi(t)$$

Based on the orthogonal property, we have

$$UD_t=(D_x^2)^{\mathrm{T}}UD_t^{1-r_1(x,t)}-\mu UD_t^{1-r_2(x,t)}+G \tag{25}$$

For the boundary conditions, we have

$$u(0,t)\approx\Phi^{\mathrm{T}}(0)\mathrm{U}\Phi(\mathrm{t});\quad u(x,0)\approx\Phi^{\mathrm{T}}(x)\mathrm{U}\Phi(0). \tag{26}$$

Thus, linear algebraic equations can be obtained by Eq. (25) together with Eq. (26). Then, unknown coefficients can be solved by solving the linear algebraic equations.

5. EXISTENCE OF UNIQUENESS AND CONVERGENCE ANALYSIS

Theorem 3. [39] If the series $\sum_{i=0}^{\infty}\sum_{j=0}^{\infty}u_{ij}Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t)$ converges uniformly to $u(x,t)$ on the interval $[0,h]\times[0,l]$, then we have

$u_{ij}=(2i+1)(2j+1)\alpha\beta\times h^{-\alpha}l^{-\beta}\int_0^h\int_0^l u(x,t)Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t)\omega_i^{\alpha}(x)\omega_i^{\beta}(t)dxdt$.

Theorem 4. [39] If the series $\sum_{i=0}^{\infty}\sum_{j=0}^{\infty}u_{ij}Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t)$ converges uniformly to continuous function $u(x,t)$ on $[0,h]\times[0,l]$, then the series $\sum_{i=0}^{\infty}\sum_{j=0}^{\infty}u_{ij}Fl_i^{h\alpha}(x)Fl_j^{l\beta}(t)$ is the GFLFs expansion of $u(x,t)$.

Theorem 5. [39] If two continuous functions on the interval $[0,h]\times[0,l]$ have the identical GFLFs expansions, then the two functions are equivalent.

6. RESIDUAL CORRECTION AND ERROR ANALYSIS

In this section, error analysis of the generalized fractional-order Legendre functions approximation is introduced for the Variable order fractional linear Cable equation. Initially, an error estimation for the solution is given by means of the residual function and then the solution is corrected by using obtained error function. Finally, a theorem is given for the upper bound of the absolute errors of the corrected approximate solution.

6.1 Error estimation and residual correction

Now, we give an error estimation for the generalized fractional-order Legendre functions solution with the residual error function and thus we improve the solution with the aid of the residual error function. For this purpose, we consider the residual function of the generalized fractional-order Legendre functions approximation as

$$R_N(x,t)=L[u_N(x,t)]-f(x,t)$$
$$L[u_N(x,t)]=R_N(x,t)+f(x,t)$$

Here, $u_N(x,t)$ is the approximation solution. Thus,

$u_N(x,t)$ satisfies the problem

$$L[u_N(x,t)] = \frac{\partial u_N(x,t)}{\partial t} - D_t^{1-\eta_1(x,t)} \frac{\partial^2 u_N(x,t)}{\partial x^2} + \mu D_t^{1-\eta_2(x,t)} u_N(x,t) = f(x,t) \quad (27)$$

Let us define the error function by

$$e_N(x,t) = u(x,t) - u_N(x,t)$$

Such that $u(x,t)$ is the exact solution of the problem. Then we get the error differential equation

$$\begin{aligned} L[e_N(x,t)] &= L[u(x,t)] - L[u_N(x,t)] \\ &= 0 + f(x,t) - R_N(x,t) - f(x,t) \\ &= -R_N(x,t) \end{aligned}$$

Clearly, the error problem is

$$\frac{\partial e(x,t)}{\partial t} - D_t^{1-\eta_1(x,t)} \frac{\partial^2 e(x,t)}{\partial x^2} + \mu D_t^{1-\eta_2(x,t)} e(x,t) = -R_N(x,t) \quad (28)$$

The exact solution of the equation (28) is $e_N(x,t)$, and the approximation solution is noted as $e_m^*(x,t)$.

The absolute errors $|e_N(x,t)| = |u(x,t) - u_N(x,t)|$ can be efficiently estimated by the absolute error function $|e_m^*(x,t)|$.

As a result, by means of the polynomials $u_N(x,t)$ and $e_m^*(x,t)$, we obtain the corrected solution

$$u'(x,t) = u_N(x,t) + e_m^*(x,t). \quad (29)$$

Here

$$E(x,t) = e_N(x,t) - e_m^*(x,t) = u(x,t) - u'(x,t) = u(x,t) - u_N(x,t) - e_m^*(x$$

$e_N(x,t)$, and $e_m^*(x,t)$ denote respectively the error function, the corrected error function and the estimated error function.

6.2 An upper bound of the absolute errors of the corrected solution

Theorem 6. Let $u'(x,t)$ and $u(x,t)$ be the corrected solution and the exact solution of the Eq. (1) respectively. Assume that the continuous function $u: R^2 \to R, \quad (x,t) \to u(x,t)$ has fractional partial derivative of order $k\alpha$, for any positive integer k and any α, $0 < \alpha \le 1$, then the following inequality holds, $|u(x,t) - u'(x,t)| \le \sum_{m=0}^{n} |R_m|$.

Where R_m represents its reminder term.

Proof. Suppose that $u(x,t)$ is continuous within a certain neighborhood of point (x_0, t_0), and $(x_0 + h, t_0 + k)$ is any point in the neighborhood. Then we have the following equality,

$$\begin{aligned} &u(x_0 + h, t_0 + k) = E_\alpha(h^\alpha D_{x_0}^\alpha) E_\alpha(k^\alpha D_{t_0}^\alpha) u(x_0, t_0) \\ &= E_\alpha(k^\alpha D_{t_0}^\alpha) E_\alpha(h^\alpha D_{x_0}^\alpha) u(x_0, t_0) \\ &= E_\alpha\{(hD_x + kD_t)^\alpha\} u(x_0, t_0) \end{aligned},$$

the proof is based on the equality

$E_\alpha((u+v)^\alpha) = E_\alpha(u^\alpha) E_\alpha(v^\alpha)$.

$E_\alpha(z)$ is called the Mittag–Leffler function which is frequently used in the solutions of fractional-order systems, defined as

$$E_\alpha(z) = \sum_{m=0}^{\infty} \frac{z^m}{\Gamma(m\alpha + 1)},$$

where $\alpha > 0$ and $z \in C$ (complexes set).

Then we have multivariate fractional Taylor Series of $u(x,t)$

$$\begin{aligned} u(x_0 + h, t_0 + k) &= E_\alpha\{(hD_x + kD_t)^\alpha\} u(x_0, t_0) = \sum_{m=0}^{\infty} \frac{(hD_x + kD_t)^{m\alpha}}{\Gamma(m\alpha + 1)} u(x_0, t_0) \\ &= \sum_{m=0}^{n} \frac{(hD_x + kD_t)^{m\alpha}}{\Gamma(m\alpha + 1)} u(x_0, t_0) + R_n \end{aligned},$$

So that

$$R_n = \frac{1}{\Gamma((n+1)\alpha + 1)} (hD_x + kD_t)^{(n+1)\alpha} u(x_0 + \theta h, t_0 + \theta k), \quad 0 < \theta < 1,$$

is the reminder term of the Taylor expansion.

Similarly, Let us show the $(n-1)$ th degree Taylor polynomial of $u(x,t)$ with $u^n(x,t)$,

$$\begin{aligned} u^n(x_0 + h, t_0 + k) &= \sum_{m=0}^{\infty} \frac{(hD_x + kD_t)^{m\alpha}}{\Gamma(m\alpha + 1)} u(x_0, t_0) \\ &= \sum_{m=0}^{n-1} \frac{(hD_x + kD_t)^{m\alpha}}{\Gamma(m\alpha + 1)} u(x_0, t_0) + R_{n-1} \end{aligned}$$

Then

$$u(x,t) - u^n(x,t) = R_n$$

By aid of triangle inequality, we have

$$\begin{aligned} |u(x,t) - u'(x,t)| &= |u(x,t) - u'(x,t) + u^n(x,t) - u^n(x,t)| \\ &\le |u(x,t) - u^n(x,t)| + |u^n(x,t) - u'(x,t)| \\ &= |R_n| + |u^n(x,t) - u'(x,t)| \\ &\le |R_n| + |R_{n-1}| + |u^{n-1}(x,t) - u'(x,t)| \\ &\le |R_n| + |R_{n-1}| + \cdots + |R_0| = \sum_{m=0}^{n} |R_m|. \end{aligned}$$

As a result, an upper bound of the absolute errors is obtained for the corrected approximate solution.

7. NUMERICAL EXAMPLES

In this section, the efficiency of the proposed method is demonstrated by numerical examples. Meanwhile, the numerical algorithm proposed in Ref. [36] is applied to have a comparison to better verify the GFLFs method. In addition, by using the residual correction procedure, the absolute error can be estimated and our approximate solution can be corrected.

Example 1. We consider the following variable-order linear cable equation:

$$\frac{\partial u(x,t)}{\partial t} = D_t^{1-\eta_1(x,t)} \frac{\partial^2 u(x,t)}{\partial x^2} - 2D_t^{1-\eta_2(x,t)} u(x,t) + f(x,t),$$

$$u(x,0) = 0 \quad u(0,t) = 0 \quad u(1,t) = 2t^2 \qquad (x,t) \in \Omega = [0,2] \times [0,1]$$

Where $r_1(x,t) = \frac{1 + \sin(xt)}{3}$, $r_2(x,t) = \frac{1 + \cos(xt)}{3}$

$$f(x,t)=2t(x^{\frac{2}{3}}+x^3)-(6x-\frac{2}{9}x^{-\frac{4}{3}})$$
$$\frac{\Gamma(3)}{\Gamma[\frac{7}{3}+\frac{1}{3}\sin(xt)]}t^{\frac{4}{3}+\frac{1}{3}\sin(xt)}+2(x^{\frac{2}{3}}+x^3)$$
$$\frac{\Gamma(3)}{\Gamma[\frac{7}{3}+\frac{1}{3}\cos(xt)]}t^{\frac{4}{3}+\frac{1}{3}\cos(xt)}$$

The exact solution of the equation is $u(x,t)=(x^{\frac{2}{3}}+x^3)t^2$.

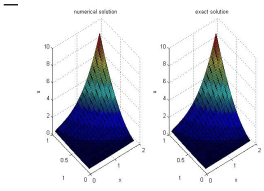
We solved the problem by adopting of the technique described in Section 3 and by making use of MATLAB R2012a.

Taking $m=n=11$, $a_1=a_2=\frac{2}{3}$.

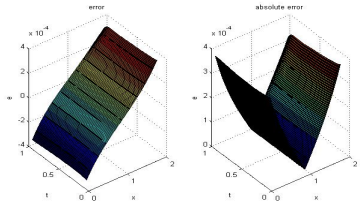
By applying the method which is developed in Section 6 to estimate the error and correct our approximate solution. The absolute errors and the error of corrected approximate solutions are represented in the following figures.

Table 1. Comparison of the absolute error obtained by our proposed method and in Ref. [36] for Example 1.

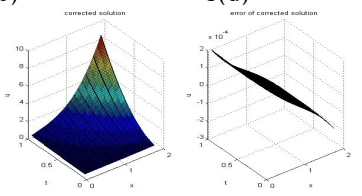
x	Our method $a_1=a_2=\frac{2}{3}$			In Ref.[36] $n=4$		
	$t=0.2$	$t=0.5$	$t=0.8$	$t=0.2$	$t=0.5$	$t=0.8$
0.1	1.90e-04	1.87e-04	1.91e-04	1.32e-01	2.24e-02	3.49e-01
0.5	9.08e-05	8.70e-05	8.72e-05	7.83e-02	1.15e-01	3.31e-01
0.9	1.70e-05	1.61e-05	1.61e-05	4.08e-02	3.18e-02	4.67e-02
1.3	5.23e-05	4.97e-05	4.96e-05	1.97e-02	2.81e-01	4.11e-01
1.7	1.37e-04	1.31e-04	1.30e-04	1.23e-01	7.94e-01	1.33



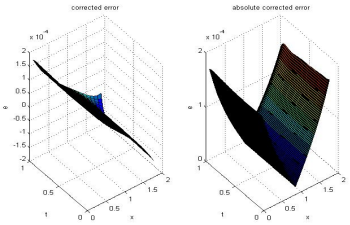
1(a) 1(b)



1(c) 1(d)



1(e) 1(f)



1(g) 1(h)

Fig.1. The numerical solution, error, error of corrected solution and corrected error for Example 1 when $m=n=11$, $a_1=a_2=2/3$.

It is noticed from the figures that residual correction procedure is effective and the error of corrected solutions are better than the error of approximate solutions.

Example 2. Consider the following variable-order linear cable equation:

$$\frac{\partial u(x,t)}{\partial t}=D_t^{1-r_1(x,t)}\frac{\partial^2 u(x,t)}{\partial x^2}-2D_t^{1-r_2(x,t)}u(x,t)+f(x,t)$$
$$u(x,0)=x^{\frac{1}{2}}\quad u(0,t)=t^{\frac{1}{2}}\quad u(1,t)=t^{\frac{1}{2}}+t+1$$
$$(x,t)\in\Omega=[0,2]\times[0,1]$$

Where $r_1(x,t)=\frac{x+t}{3}$, $r_2(x,t)=\frac{\sin(xt)+\cos(xt)}{3}$

$$f(x,t)=\frac{1}{2}t^{-\frac{1}{2}}+x+$$
$$2\frac{\Gamma(\frac{3}{2})}{\Gamma[\frac{1}{2}+\frac{1}{3}\sin(xt)+\frac{1}{3}\cos(xt)]}t^{-\frac{1}{2}+\frac{1}{3}\sin(xt)+\frac{1}{3}\cos(xt)}$$
$$+2x\frac{\Gamma(2)}{\Gamma[1+\frac{1}{3}\cos(xt)+\frac{1}{3}\sin(xt)]}t^{\frac{1}{3}\sin(xt)+\frac{1}{3}\cos(xt)}$$

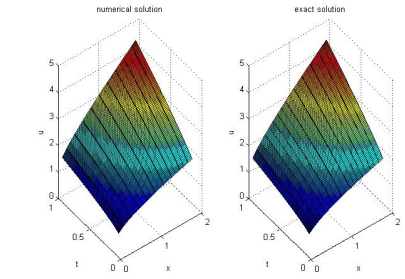
The exact solution of the equation is $u(x,t)=x^{\frac{1}{2}}+t^{\frac{1}{2}}+xt$

Taking $m=n=10, a_1=a_2=\frac{1}{3}$

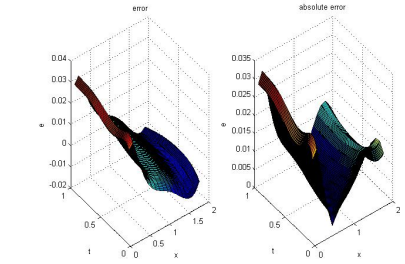
Table 2. Comparison of the absolute error obtained by our proposed method and in Ref.[36] for Example 2.

x	Our method $a_1=a_2=\frac{1}{3}$			In Ref.[36] $n=3$		
	$t=0.2$	$t=0.5$	$t=0.8$	$t=0.2$	$t=0.5$	$t=0.8$
0.1	1.00e-03	4.94e-04	2.42e-04	2.60e-01	6.80e-03	2.17e-01

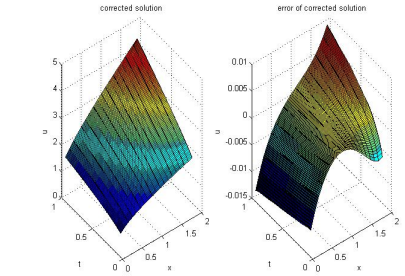
0.5	5.52e-04	3.07e-04	1.88e-04	6.19e-02	2.46e-01	3.81e-01
0.9	7.88e-05	4.28e-05	2.55e-05	2.32e-02	1.06e-01	1.87e-01
1.3	1.43e-04	7.12e-04	3.72e-05	2.10e-01	1.22e-01	8.54e-02
1.7	1.51e-04	5.39e-05	6.65e-06	1.18e-01	7.47e-02	8.17e-02



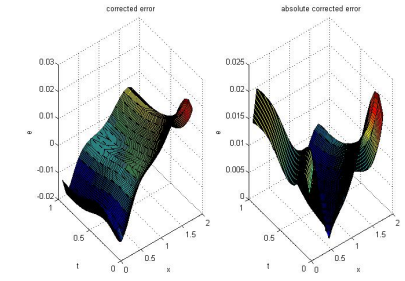
2(a) 2(b)



2(c) 2(d)



2(e) 2(f)



2(g) 2(h)

Fig.2.The numerical solution, error, error of corrected solution and corrected error for Example 2 when $m = n = 5$, $a_1 = a_2 = 2/3$.

According to the above two examples, the proposed method can be effectively used in solving the numerical solution of the variable order linear cable equation. The numerical errors are given and for the sake of the simplicity of those matrices in the method, the time consuming is also pretty less. Compared with the algorithm proposed in Ref. [36], it can also conclude that the GFLFs method is more effective to get the numerical solution of variable order fractional differential equations.

8. CONCLUSION

In this paper, we define a series of GFLFs and obtain its operational matrices of fractional differential. These matrices together are used to simplify and effectively calculate the numerical solution of the variable order linear cable equation. Numerical examples show our algorithm is simple and effective. Compared with other numerical methods, our algorithm avoids using the integral operational, thus greatly reduces the calculation difficulty and the calculation time is shortening as well. The GFLFs method can accurately represent properties of fractional calculus. Moreover, the special feature of the proposed approach is when the function defined on the interval $[0,h]\times[0,l]$ and the differential order is variable fractional order, our numerical solution can also get good agreement with exact solution.

By using the residual function, an error differential equation is constructed and thus the approximate solution obtained by generalized fractional-order Legendre functions method is corrected. Also, we give an upper bound of the absolute errors for the corrected solution.

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Research on Professional Leadership of College Physical Education Teachers in China

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Abstract: Since the deepening reform of physical education curriculum in China, In the process of teaching, research and management, college PE teachers have been trying to optimize the teaching objectives, teaching content, teaching design and methods, in this context. This paper analyzes the connotation, significance and development bottleneck of PE Teachers' professional leadership, and from the perspective of teaching effectiveness, expounds the functions and functions of PE Teachers' professional leadership in teaching, in order to provide a useful reference for the development of College Physical Education in China.

Keywords: professional leadership; teaching; physical education teachers; colleges and Universities

1. INTRODUCTION

Bennis W, Nanus B are famous experts in the field of western leadership, they pointed out that leadership is influence, is in the direction, process, behavior and view the guidance［1］; Chinese scholar Wu Weiku puts forward that leadership is the ability to influence others [2]. Teacher leadership was born in 1980s under the background of American educational reform and teacher professionalization; it is a new angle of view for the study of leadership development. It is also the product of the change of teacher's role and quality structure. It is the ability of teachers to carry out leadership to themselves and students in and out of the classroom [3]. Teacher professional leadership refers to teachers in the teaching and academic research, through his personality, professional power, professional knowledge and ability, thus forming the students, teachers and other professionals in the field of influence [4]. Wei Yan pointed out that the connotation of teacher professional leadership includes professionalism, system thinking ability, curriculum leadership, classroom leadership and extracurricular influence [5].

2.THE CONNOTATION OF PE TEACHERS' PROFESSIONAL LEADERSHIP

(1)PE Teachers' classroom and extracurricular leadership is mainly manifested in the ability to guide students' learning and development in two aspects. Classroom leadership is the comprehensive performance of PE teachers play communication, coordination, language, psychology, culture and sports special skill shows the ability of organic unity through classroom teaching content, means and methods, to show the charm of professional, not only to mobilize students' learning interest and participation, and by improving the physical quality and skills effectively. Enhance students' confidence and self-worth to meet. Extracurricular leadership is the extension of PE Teachers' classroom leadership, focusing on the extension of classroom teaching content and creating a team-learning environment.

(2)The ability of PE teachers to lead the school development mainly refers to the school leadership derived from curriculum leadership [6]. PE teachers' curriculum leadership is a sports school teachers need to participate in the study various types of curriculum overall balanced coordination, prioritize, sequential improvement scheme; participation in curriculum; participate in the improvement of intrinsic motivation based on teaching evaluation mechanism. With the further attention of the national education departments to the school physical education in Colleges and universities. The PE teachers put forward new requirements in terms of sports course construction, requirements of physical education teachers in the setting of the syllabus, teaching goals, teaching effect and complete evaluation, textbook revision and other aspects of development must have the curriculum leadership.

(3)Professional leadership of PE teachers is a special leadership ability with sports discipline characteristics and project characteristics. It shows the personal charm, professional power, professional knowledge and ability, which are embodied in the teaching, training, competition, scientific research and management of school physical education [7], Thus forming influence on students, other teachers and the whole field of expertise.

3.THE SIGNIFICANCE OF DEVELOPING PROFESSIONAL LEADERSHIP OF COLLEGE PE TEACHERS

(1) It is beneficial to improve the teaching effectiveness of PE Teachers. The effectiveness of teaching is the key link in the teaching process. Donald, R, C, Deborah, L, B and other experts pointed out that in the process of teaching, the teachers with higher efficiency have the following individual characteristics: motivational personality (enthusiastic, enthusiastic, humorous and trustworthy), success oriented (high expectations and encouragement and support for success), professional

conduct (erudite, methodical and flexible, adaptable) [8]. These personality characteristics are consistent with the characteristics of PE Teachers' professional leadership.

The higher the professional leadership level of PE teachers, the greater the influence and influence on teaching, training and scientific research, the better the teaching effect and the higher the teaching quality. Therefore, the development of PE Teachers' professional leadership is conducive to the improvement of the effectiveness of education and teaching.

(2) Conducive to the professional development of College Physical Education teachers. At present, the biggest problem in the process of College Teachers' professional development is that teachers' indigeneity is not enough. Whether they are on campus or outside, there are fewer opportunities for teachers to do business, study and training. Therefore, in order to adapt to the new situation and improve the endogenous development of teachers, it is the core task to solve the professional development of physical education teachers. At present, the form of education built by crash education and exam-oriented education has weakened the internal motivation of teachers who have been marginalized in physical education. According to Maslow's hierarchy of needs, everyone has the highest spiritual pursuit of self-worth. In order to realize their own values and leadership in physical education, physical education teachers are developing and improving themselves, through continuous and effective teaching and training, in the context of job enlargement and job enrichment, we should actively promote professional development.

(3) Conducive to the development of future sports and related fields of leadership. Leadership is one of the key capabilities of the nation. The United States and other western countries have set up leadership courses at the elementary school stage, but they have not received due attention in China. At the university stage, students' association activities are carried out by students themselves, and students' self-awareness and self - development desire are the best period for training their leadership. [9]. The higher proportion of sports associations in University societies shows that sports have more influence on students. This requires college sports teachers to give full play to professional leadership, to guide students in all aspects of the quality of balanced development, and inspire and exercise leadership ability of students.

4.THE MAIN BOTTLENECK OF THE DEVELOPMENT OF PROFESSIONAL LEADERSHIP OF COLLEGE PE TEACHERS

(1) The professional leadership of PE teachers in Colleges and universities is not released. School administrative structure leads to the general PE teachers discourse power is weak. The teaching design, the reform and development of voice and influence are not concerned, positive attention and development for their own development in the school is reduced, this vicious spiral, will show to the development of the school. The students of their professional development the development of not paying attention, in a passive acceptance of work and tasks, resulting in personal professional leadership development is greatly hindered.

(2) Attention is paid to the cultivation of professional leadership of College PE teachers. The national education department for the instruction and training of teachers through different forms, but the training involved in teacher professional leadership is less, for the function of education, teaching effect and goal of teacher professional leadership, analysis of personal development and personnel training are not enough. Therefore, the attention and development of the professional leadership development of PE teachers are beneficial to both the theoretical and practical abilities of PE teachers.

(3) The development momentum of PE Teachers' professional leadership is insufficient. For a long time, the examination for higher education under the examination oriented education system has made the subject of sports become an interdisciplinary subject. From the beginning of secondary school, Chinese, mathematics, foreign languages and other disciplines have been paid more attention than physical education. The internal demand and motivation of PE teachers are insufficient, and professional leadership cannot be improved and trained. Moreover, due to the limitation of funds, the professional leadership of the relevant teachers can be emphasized only when the influential sports programs (basketball, football, etc) continue to achieve excellent results.

5. CONCLUSION

Nowadays, the educational value orientation, organizational behavior, organizational structure and campus culture of Chinese colleges and universities show diversified development trends.

Professional leadership has become the motive force and objective of physical education teachers' professional development, and has been through the professional development of physical education teachers. Professional leadership to strengthen awareness of College PE teachers, improve college PE Teachers' professional level of leadership can effectively solve the problem of the physical teachers, but also improve the quality of students in teaching, so as to achieve the goal of cultivating sports talents in Colleges and universities.

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The Evaluation of Whether the Current Shared Cycling Company Model Can Sustain

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Abstract: This paper mainly evaluates the current shared bicycle model and determines whether the model can sustain. Firstly, we select the financial factors, customer satisfaction, the layout as the first indicators to assess whether the company model can last. Then we select the financing capacity, cost, the rate of stolen damage and other six factors as the second indicators. Next, we use AHP to create multiple evaluation matrices, then use SPSS software for matrix consistency test. By calculating the weight of the indicators, obtaining the fuzzy relation matrix. Finally using the fuzzy comprehensive evaluation model, we can conclude that the current corporate model can be sustained.
Keywords: Fuzzy comprehensive evaluation model; Analytic Hierarchy Process; bike sharing

1. INTRODUCTION

OFO was founded in 2014, is the world's first and the first non-pile cycling platform, started on campus, began to gradually move towards the community, which is used in cooperation with the Phoenix and idle resources recycling methods. It is characterized by low cost of cycling, fast recovery costs [1]. The cost of each bicycle is about 300 yuan, in the APP real name registration to pay a deposit of 99 yuan, Return period of 1 to 3 days, the use of 0.5 yuan per hour, But the disadvantage is the lack of scientific and technological content, the lack of GPS positioning; Operating costs are higher, mainly rely on line workers handling; maintenance costs are high, up to 20% to about 30% of the damage rate, "Three high" problem is always the main factor restricting profitability of the profit model.

In April 2016, Mount Mobike was officially launched and put into operation. Different from the OFO, Mobike take the heavy asset line, they choose their own production and Foxconn production, input costs in the pre-period, reduce operating costs, improve the bike's technology and technology content, reduce the user experience, but lengthen the profit cycle. The cost of each bicycle announced in the morning of the mobike is about 3, 000 yuan, the deposit for each bicycle is 299 yuan, Refund period of 2 to 7 days, the discount rate remained at around 10%.[2]

2. EXPERIMENTAL

2.1 ESTABLISH MODEL

To assess whether the shared bicycle model is sustainable, consider sharing the bike company for profitability. We first profitability of the company is divided into three first-level indicators: customer satisfaction, financial factors and layout [3]. And then from the three indicators are separated from the secondary indicators, see Fig. 1 below. Take the marriage and the OFO as an example, collect the relevant data and establish the fuzzy comprehensive evaluation model.

(1) factor gather U={customers satisfaction degree u1, Capital factor u2, overall arrangement u3}

u1={x11, x12, x13}、u2={x21, x22, x23}、u3={x31, x32, x33}

comment set V={profit v1, unbiased v2, loss v3}

determine the weight of each factor by analytic hierarchy process (AHP)

First level indicators, customer satisfaction, funding factors and layout were C1, C2, C3, The ratio of 2. is shown in Tab. 1

Table 1 Weights of first level indicators

A	C1	C2	C3	W
C1	1	1/3	2	0.2439
C2	3	1	4	0.5853
C3	1/2	1/4	1	0.1707

By using MATLAB software, the eigenvalues of the matrix are calculated to be 3.0183, and the consistency is verified. The consistency index CR= <0.1, therefore, the inconsistency is acceptable.

the matrix $\begin{bmatrix} 1 & 1/3 & 2 \\ 3 & 1 & 4 \\ 1/2 & 1/4 & 1 \end{bmatrix}$, The matrix is normalized to get the weight A={0.2439, 0.5853, 0.1707}

Then, according to the above method to calculate the weight of the two indicators, see Tab. 2 below

Table 2 Index weight of customer satisfaction level two

C1	P1	P2	P3	W
P1	1	1/2	3	0.3439
P2	2	1	4	0.5350
P3	1/3	1/4	1	0.1211

After the MATLAB software, the eigenvalues of the calculation matrix are 3.0183, and the consistency is verified. The consistency index CR= 0.0158 <0.1, therefore, the inconsistency is acceptable.

Table 3. Index weights of two levels of financial factors

C2	P4	P5	P6	W
P4	1	2	5	0.5351
P5	1/2	1	4	0.3679
P6	1/5	1/4	1	0.0970

By using MATLAB software, the eigenvalues of the matrix are calculated to be 3.0183, and the consistency is verified. The consistency index CR=0.0212 <0.1, therefore, the inconsistency is acceptable.

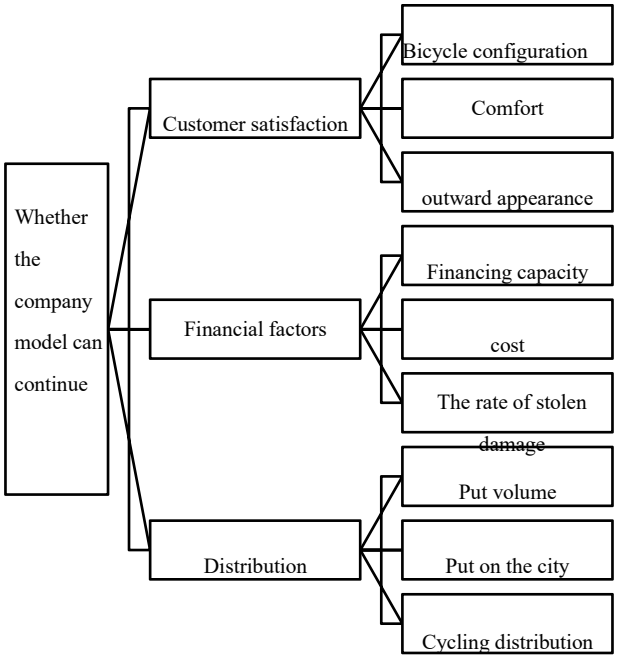

Figure 1 First - level indicators and the selection of secondary indicators.

Table 4. Index weights of two levels of layout

C3	P7	P8	P9	W
P7	1	4	1/3	0.3379
P8	1/4	1	5	0.3960
P9	3	1/5	1	0.2661

The weights of the two indexes are W1={0.3439, 0.5350, 0.1211}, W2={0.5351, 0.3679, 0.0970}, W3={0.3379, 0.3960, 0.2661}

(4) To determine the fuzzy comprehensive evaluation matrix to evaluate each factor of UI.[4] According to the v-mobile and OFO data collected by the bicycle made of Tab. 5, Tab. 6.

Table 5 evaluation of two indicators of the v-mobile bicycle

evaluating indicator		appraise(Mobike)		
class indexes	secondary indexes	can profit	be in equilibrium	no profit
customers satisfaction degree	Bicycle configuration	0.55	0.32	0.13
	degree of comfort	0.50	0.28	0.22
	surface	0.40	0.30	0.30
Capital factor	financing ability	0.63	0.22	0.15
	prime cost	0.51	0.31	0.18
	Rate of stolen damage	0.49	0.26	0.25
overall arrangement	use quantity	0.60	0.21	0.19
	Throw in the city	0.56	0.13	0.31
	Bicycle distribution	0.61	0.23	0.16

The evaluation matrix for Mobike bicycle.

$$R1=\begin{bmatrix}0.55 & 0.32 & 0.13\\ 0.50 & 0.28 & 0.22\\ 0.40 & 0.30 & 0.30\end{bmatrix}$$

$$R2=\begin{bmatrix}0.63 & 0.22 & 0.15\\ 0.51 & 0.31 & 0.18\\ 0.49 & 0.26 & 0.25\end{bmatrix}$$

$$R3=\begin{bmatrix}0.60 & 0.21 & 0.19\\ 0.56 & 0.13 & 0.31\\ 0.61 & 0.23 & 0.16\end{bmatrix}$$

Table 6 OFO level two indicator evaluation form

evaluating indicator		appraise(OFO)		
class indexes	secondary indexes	can profit	be in equilibrium	no profit
customers satisfaction degree	Bicycle configuration	0.51	0.26	0.23
	degree of comfort	0.56	0.26	0.18
	surface	0.44	0.34	0.22
Capital factor	financing ability	0.52	0.25	0.23
	prime cost	0.55	0.28	0.17
	Rate of stolen damage	0.59	0.15	0.26
overall arrangement	use quantity	0.62	0.22	0.16
	Throw in the city	0.52	0.18	0.30
	Bicycle distribution	0.62	0.15	0.23

Therefore, the evaluation matrix of OFO bicycle is obtained.

$$R1=\begin{bmatrix}0.51 & 0.26 & 0.23\\ 0.56 & 0.26 & 0.18\\ 0.44 & 0.34 & 0.22\end{bmatrix}$$

$$R2=\begin{bmatrix}0.52 & 0.25 & 0.23\\ 0.55 & 0.28 & 0.17\\ 0.59 & 0.15 & 0.26\end{bmatrix}$$

$$R3=\begin{bmatrix}0.62 & 0.22 & 0.16\\ 0.52 & 0.18 & 0.30\\ 0.62 & 0.15 & 0.23\end{bmatrix}$$

2.2 SOLVE THE MODEL

Perform matrix synthesis operations.

(1) Mobike

B1=W1·R1=[0.5051, 0.2963, 0.1987]

B2=W2·R2=[0.5723, 0.2569, 0.1707]

B3=W3·R3=[0.5868, 0.1836, 0.2295]

$$R=\begin{bmatrix}B1\\ B2\\ B3\end{bmatrix}=\begin{bmatrix}0.5051 & 0.2963 & 0.1987\\ 0.5723 & 0.2569 & 0.1707\\ 0.5868 & 0.1836 & 0.2295\end{bmatrix}$$

It is the fuzzy relation matrix from the factor set U to the comment set V.

(2) OFO

B1=W1·R1=[0.5283, 0.2697, 0.2020]

B2=W2·R2=[0.5378, 0.2513, 0.2108]

B3=W3·R3=[0.5804, 0.1855, 0.2341]

$$R=\begin{bmatrix}B1\\ B2\\ B3\end{bmatrix}=\begin{bmatrix}0.5283 & 0.2697 & 0.2020\\ 0.5378 & 0.2513 & 0.2108\\ 0.5804 & 0.1855 & 0.2341\end{bmatrix}$$

B=A·R=[0.5427, 0.2445, 0.2126]

Take the maximum value comment as the comprehensive evaluation results, v-mobile and OFO were visible profits, companies operating mode is sustainable.[5]

2.3 MODEL EVALUATION

Owing to the fuzzy comprehensive evaluation method is in the form of vectors, rather than the specific value, which can be more accurate response to the fuzzy state of things themselves. But using fuzzy comprehensive evaluation method in the membership and weight determination, the selection of algorithms and many other aspects with subjectivity. The amount of information on each evaluation index is insufficient, may affect the credibility of the results.

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Design and implementation of mobile air quality detection device based on Arduino

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Abstract:For the use of hand-held air quality detector limitations under the underground mines, sewage treatment pipes, tunnels and other harsh environments.This design is based on the UAV as the carrier, Arduino mega 2560 microcontroller is the main control unit, through the formaldehyde sensor, the temperature and humidity sensor, and laser dust sensor to detect air quality parameters, the use of wireless data communication to the display, to achieve unmanned detection. The experimental results show that the design can receive 500 meters range of test data, and stable performance, easy to operate.

Keywords:Arduino; air quality detection; wireless transmission

1.INTRODUCTION

With the rapid development of our country's economy, the air pollution is more and more serious. Ambient air quality has become the object of great concern, and a variety of handheld air quality detector came into being [1-3]. But in some special occasions such as underground mines, sewage pipes, tunnels and other harsh environment, hand-held air quality detector can not be used in this environment, to design an air quality detector to carry on with the UAV wireless transmission of data has the potential application value.

2.OVERALL DESIGN PLAN

This design uses The Arduino Mega 2560 is used as the processor in this paper. The information from ZE08-CH20 ormaldehyde sensor and DHT11temperature and humidity sensors is transformed PWM wave ,which transmitted to the analog signal input interface of the processor.The internal program reads the analog value, and accumulated 20 times average value [4]. SDL-01 laser dust sensor detects the concentration of particles in the air, and then transfers the information to the processor through the virtual serial port TX/RX. The internal program calculates the concentration value by reading the serial port information. The processor packages the data through the UART interface to the transmitter E51 wireless serial module. The wireless serial module of the sending end transmits the packaged signals to the receiving terminal and the wireless serial module through the 230MHz radio, and the receiving wireless serial module transmits the packaged data through the UART interface to the processor. The processor will receive data decoding, read the valid information, and then transfer it to the LCD12864 LCD screen through SPI communication. The LCD screen displays the measurement values of each module, that is, the concentration of each gas component and the air index.

The system design diagram is shown in figure 1.

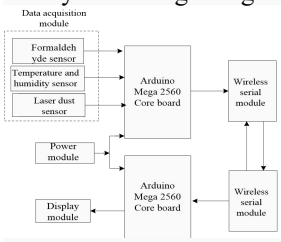

Fig. 1 block diagram of mobile air quality inspection device

3. HARDWARE CIRCUIT DESIGN

ATmega2560 is taken as the processor core, and the external circuits are power module, data acquisition module, communication module and display module.

3.1 Master controller

Arduino Mega 2560[5] is based on the main control development board, with 54 digital input and output, suitable for the need for a large number of IO interface design. Processor core is ATmega2560, and has 54 digital input / output port, 16 analog input, 4 way UART interface, is a very powerful microcontroller.

3.2 Data acquisition module

(1) DHT11 temperature and humidity sensor

DHT11 digital temperature and humidity sensor is a temperature and humidity composite sensor with calibrated digital signal output [6]. It consists of a resistor type humidity sensing element and a NTC temperature measuring element. The dedicated digital module acquisition technique and temperature and humidity sensing technique are applied.

(2) ZE08-CH2O formaldehyde sensor

ZE08-CH2O formaldehyde sensor uses electrochemical principle to detect the CH2O in the air. A temperature sensor is built, which can compensate temperature, and has digital output and analog voltage output at the same time.

(3) SDL-01 laser dust sensor

The sensor is a laser digital PM2.5 sensor [7]. The built-in laser and photoelectric receiving component, using the principle of light scattering, laser scattering light on particles, the photoelectric receiving device into electrical signals, and then through a specific

algorithm to calculate the concentration of PM2.5, the measurement error is small.

3.3 Communication module

E51 230M wireless serial port module, is a work in 225 ~ 237.6MHz band 500mW transparent transmission module, using narrowband RF transmission, has the advantages of centralized power density, long distance transmission; due to a lower frequency, penetration and diffraction of the unique advantages, the complex environment suitable for many obstacles. Serial communication and data exchange can be realized in this paper ,and so on.

3.4 Display module

The FM12864-12L dot matrix liquid crystal display is selected to realize the display function.

This module is Chinese characters graphics LCD 128 * 64 dot matrix display module can display Chinese characters and graphics, built-in 8192 Chinese Chinese characters (16X16 matrix), 128 characters (8X16 matrix) and 64X256 dot matrix display RAM (GDRAM), can directly interface with CPU, provides two kinds of interface to connect the microprocessor: 8- two kinds of parallel and serial connection mode. The SPI serial connection method was adopt in this paper.

3.5 Power module

Using the lithium battery power supply way, reduces the weight, which is easy to carry along with the unmanned aerial vehicle.

4. SOFTWARE CIRCUIT DESIGN

(1) Detection terminal

Start the power, macro definition, each module initialization, wireless module sleep, the processor detects whether the sensor received data returned. If not received, return to module initialization; if received, check whether wireless module boot instructions are received. If the wireless module does not receive the boot instruction and returns to the module initialization, if it is received, the wireless module is started, the data detected by the sensor is packaged, which is sent to the receiver[8]. Flow chart is shown in figure 2(a).

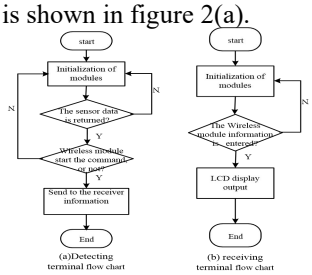

Fig. 2 Software flow chart

(2) Receiving terminal

Start power, macro definition, module initialization, serial port of the wireless module inside the processor to detect whether a message is received, if not received, to return to the module initialization; if the received information, the information decoded by the processor computing by LCD screen display the current gas and air index. Flow chart is shown in figure 2(b).

5. INSTALLATION AND DEBUGGING

All components include two core boards, a DHT11 temperature and humidity sensor, a ZE08-CH2O formaldehyde sensor, a SDL-01 laser dust sensor, two E51 230MHz wireless serial module and a LCD12864 LCD screen in this paper.The object is shown in figure 3.

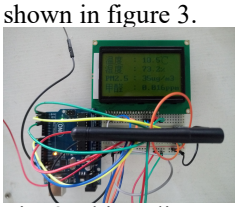

Fig. 3 Object diagram of mobile air test device

6. CONCLUSION

The device can detect the air indicators of Underground mines, sewage pipes, tunnels, Mizunuma, pits and other places within 500 meters, and return the data to the receiving end. The concentration of each gas component is displayed on the LCD screen at the receiver. Mainly detect formaldehyde, PM2.5, temperature, humidity and other common gas components and air indicators.

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