Multiple Linear Regression Evaluation Method for Computer Aided Art and Design Course Grades

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Abstract. With the update and development of current computer technology, the use of relevant computer technology for auxiliary design in art and design courses is one of the basic course contents of art and design majors. At present, there are some problems such as fuzzy evaluation in the evaluation of students' performance in computer art and design courses, and the lack of strong guidance for students' learning. Due to the phenomenon of vague or missing standards in the performance evaluation of art design majors, in order to increase the scientific nature of the evaluation of the test scores in the teaching process, based on the multiple linear regression theory of statistics, the test score indicators were quantified, and a test score evaluation method was established. The regression model systematizes and modularizes the evaluation framework, which can scientifically quantify the teaching effect, clarify the teaching purpose, and provide a theoretical reference for standardizing the teaching management of design majors. The research results show that the model is used to reasonably evaluate the data, and under sufficient conditions, the simulation test results are used to verify that the predicted results are reliable and reasonable.

Keywords: Computer aided; multiple linear regression; evaluation; course grades

1   INTRODUCTION

With the continuous development and updating of computer technology, CAD (computer-aided design) has also been gradually improved, as shown in Figure 1. This technology has been used in many practical projects. Zhu [1] considers that many industries such as art, machinery, construction and other related engineering and technical personnel are designing, analyzing when designing products, this auxiliary design software will be the first choice. In various colleges and majors, the content and objectives of the computer-aided design courses set by them will also be different, but their impact on teaching work is significant. Petra [2] thinks that taking art design

major as an example, in art design major teaching, teachers can optimize the content and methods of CAD classroom teaching, so as to improve students' enthusiasm for learning, help them improve their practical ability, and finally achieve the best teaching effect.

Figure 1: Computer-aided design.

Ingrid and Kim [3] consider the computer-aided design course is one of the basic courses for the current art and design majors. Computer-aided design is a specific expression of artistic creativity, which requires students to have an in-depth understanding and mastery of the theoretical knowledge of art and design, and also requires students to have a higher level of computer operation. At present, Li et al. [4] thinks the learning time of computer-aided design courses for art and design majors in most colleges and universities in my country is relatively short. Many students can only do two-dimensional drawing or three-dimensional drawing in classroom learning, and cannot practice and operate all drawing designs of computer-aided design. This reduces the practical ability of students to a certain extent. This requires art and design majors to update and improve the current teaching mode, expand the breadth and depth of students' learning, and enhance students' design practice ability. In the flipped classroom teaching mode, students can learn by themselves based on the rich learning resources in the online teaching platform, and then interact with teachers online and offline. According to the computer-aided design teaching video of online learning, students can use time to conduct simulation practice, which is very beneficial to enhance the operation ability of art and design majors.

Bhimsen and Megha [5] think computer art and design courses are a new type of teaching courses generally offered by major colleges and universities. Most of the relevant teachers come from computer majors or art majors; the relevant teaching itself involves the issue of professional integration; the relevant performance evaluation is a multi-factor evaluation. Among them, it also involves the setting of points, the distribution of grades and other issues. In specific teaching, it is shown as:

The characteristics of artistic works are intuitive and vivid, and the performance evaluation of such courses is usually difficult to quantify. The problems in the evaluation of works are: too many subjective components, fuzzy scoring, unclear evaluation standards, unconvincing evaluation results, and lack of guidance for students' specific learning [6].

When teaching and assessing students, computer teachers can usually set the scoring points reasonably according to the computer technology used by students in their works, and try to quantify the scores as much as possible. However, they tend to pay too much attention to technology and ignore the teaching principle of "technology should serve art", which makes students' works lack artistry and vitality. The objections to the results of the grade assessment of

the design art major courses are mainly formed by the different understandings of the relevant course teachers on the purpose and entry point of the course assessment, as well as the teachers' own knowledge background, experience and even personal preferences and many other factors. As a comrade engaged in design art education or design work, you may be able to understand this phenomenon, but the education of design art cannot accept such a completely unscientific evaluation method just because of "understanding". There are a series of problems in the evaluation method dominated by teachers' subjective consciousness, which are mainly reflected in: First, it is not conducive to students' innovative consciousness. Since the evaluation standard of the course is subjectively determined by the teacher, some students will pay attention to the teacher's design preferences in the relevant courses, try to figure out the teacher's preferences, but not pay attention to the teaching purpose of the course itself, which inhibits the students' willingness to design innovation. Second, it is not conducive to students to establish a correct design concept. Due to the inherent uncertainty of teachers' subjective consciousness, there may be inconsistent assessment standards between today and tomorrow, and different assessment requirements between last week and this week, making students confused about what to do to meet the requirements of the class. Coursework is required by the teacher. Such a phenomenon will seriously dampen the students' creative enthusiasm, and is not conducive to their establishment of a scientific design concept [7,8].

With the continuous improvement of living standards and economic levels, people's aesthetic level has also been effectively improved. Therefore, the current development prospects of art and design majors in my country are good. Generally speaking, art design majors mainly include art design, environmental design and visual design. Art and design majors involve a wide range of disciplines, and they use a lot of auxiliary tools, and have relatively high requirements on students' practical ability. At present, the most critical auxiliary learning tool in the learning process of art and design majors is the computer. Therefore, the computer-aided design course is one of the main course contents of art and design majors. Especially in computer drawing, graphic design and model building, the use of relevant computer software is essential. Therefore, attaching importance to computer-aided design courses for art and design majors is the key to improving the teaching quality and teaching level of art and design majors.

In addition, in order to enhance the learning ability of students majoring in art and design, it is necessary to have a comprehensive and specific understanding of the characteristics of students majoring in art and design. According to relevant investigation and research, the learning characteristics of art and design majors are mainly reflected in the following two aspects: First, basic cultural knowledge is relatively weak, and art majors have outstanding specialties. Compared with non-art majors, art majors have richer practical ability and social experience. Second, pay more attention to the learning of diversified knowledge. Students majoring in art and design have relatively weak concentration, especially in the Internet age, students are relatively more receptive to graphics, sound, and video content. Therefore, it is also one of the important learning characteristics of the current art and design students to be more receptive to the knowledge of diversified content. Moreover, the traditional computer-aided design courses are out of touch with the creative thinking training of art design, and the computer-aided design method has not been effectively used in the specific design practice process. Innovative and individual, the picture is blunt and rigid. In the process of learning, students lack cultural connotation, have no design creativity, and rely too much on pictures and design materials on the Internet. Although the design works are gorgeous and exquisite, they are seriously plagiarized, the pictures are chaotic, the form is single, the lack of personal characteristics, the design thinking is wrong, and the design is seriously out of reality. Design structure can't create excellent and personalize design works [9,10].

Therefore, it is necessary to give a scientific evaluation standard, assign the score reasonably, quantify what can be quantified, and refine what cannot be quantified. This will not only help to mobilize students' enthusiasm for learning, improve the quality of teaching, but also make teachers' performance evaluation fair.

2   COMPUTER AIDED INSTRUCTION

Since the computer is a modern product, the use of computer-aided art design and related courses is also rising with the advancement of technology. In the teaching team, there is a lack of high-quality comprehensive college teachers who can flexibly use auxiliary art design software and have experience in art design teaching. This leads to the fact that in the actual teaching work, the teaching method is exactly the same as the previous method, which is still inculcating education, showing obvious dogmatic phenomena in teaching work, lacking the necessary flexibility and pioneering. In the practical training class, the teacher will first explain and demonstrate the content of the textbook, and then let the students conduct computer practical training according to the teaching content. Such practical training cannot be combined with the design example, and the students are only mechanically operating the software during learning rather than conducive to improving the overall quality of students. Thus, there is no way to mobilize students' interest in learning.

Students are required to conduct demand analysis based on actual cases, the actual background and requirements of design; students are required to master the design process and methods, use knowledge in design, and conduct professional design; students are required to master the process of design implementation, including collecting pictures and texts materials, comparative analysis materials, picture and text synthesis, project proposals, etc.; finally, students are required to optimize their works. In teaching, we have arranged different training projects for students, which are completed in groups. While students are studying in the course, each group simultaneously completes the tasks of the corresponding training stage. When the course ends, each group also the creation of the system is completed. Practice has proved that students' engineering practice ability has been effectively exercised in this way, so that students can learn more effectively in the process of implementing projects.

The development of the Internet has made the coverage of network resources more and more diversified, and students can easily find the materials they need on the Internet. When students are creating and designing, due to excessive reliance on ready-made pictures and materials on the Internet, although the designed works look "remarkable", there is actually a serious plagiarism phenomenon, the form is single, and the design features are lacking.

Assess the learning process, and the performance evaluation focuses on assessing the comprehensive ability. Teachers emphasize the learning process in the course scoring, and grade the learning process, breaking the traditional assessment method based on the final exam results and focusing on assessing the comprehensive quality of students. The grading and assessment system is based on the final exam results of the subject, supplemented by the assessment results of the usual subject learning process. So as to the attitude of students in the teaching process and mobilize the enthusiasm of students in the learning process, and the content of the final exam should increase the specific design scheme as the assessment content, and encourage students to use their personal design creativity to carry out actual design, so as to fully assess the comprehensive quality of students.

In the teaching process of computer-aided design courses, under the promotion of related models, we adopt a variety of teaching methods to improve students' enthusiasm for learning. For theoretical content, various methods such as teacher lectures, video demonstrations, student self-study, and classroom discussions are used, multimedia teaching methods are used for teaching, and animation technology and even virtual reality visualization technology are used to prepare lessons. In the part of self-study, students complete the study of repeated content or crossed content in other subjects, and expand the corresponding amount of knowledge.

In the teaching process, we take the exemplary, standardized, targeted and inspiring design examples to explain, follow the teaching method from plane to three-dimensional, from simple to complex, and integrate various knowledge points of the teaching material into the design examples. To explain, stimulate the students' interest in learning and mobilize the enthusiasm of learning. According to the different professional directions, the focus of teaching is different. For example,

for the Photoshop course, in the teaching of graphic design, it focuses on the design and application of posters, posters, and signs, and the environmental art design focuses on the post-modification of architectural renderings. Practice shows that the comprehensive application of multiple teaching methods can better mobilize the enthusiasm of students.

3   MULTIPLE LINEAR REGRESSION EVALUATION METHOD

Linear analysis refers to the study of the relationship between one variable and another, and to study the closeness and nature of the relationship between variables. Simply put, the main task of linear regression analysis is to describe quantitative relationships. Regression analysis can determine the relationship of functions according to the relationship of non-deterministic variables. When studying the regression relationship of two variables, it is called simple regression or univariate regression, and when studying the regression relationship of three or more variables, it is called complex regression or multiple regression. Linear regression can analyze the linear relationship between one or more independent variables and a dependent variable. SPPS provides 5 methods for creating regression equations, residual analysis, parameter estimation and other methods. The value variation is shown in Figure 2.
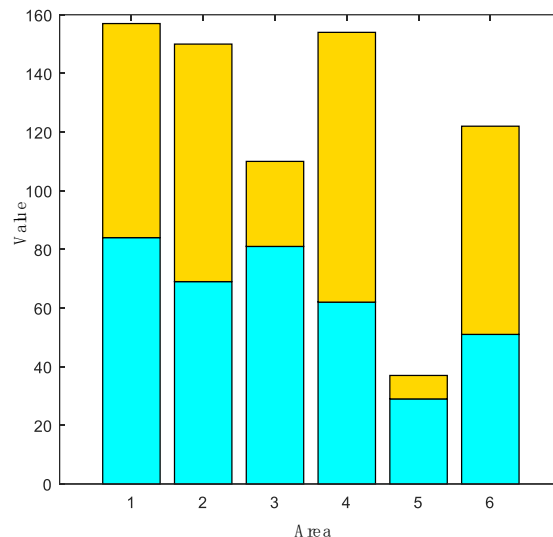

Figure 2: Value variation.

Mathematical modeling is the main method to solve practical problems through data tools. There are many methods. Multiple linear regression is a common method of multi-factor model analysis. However, in regression analysis, how to use multiple factors to select appropriate factors affects the results of model analysis. The multiple linear analysis prediction method refers to the use of two or more dependent variables and independent variables to create a prediction model. When the dependent variables and independent variables have a linear relationship, that is, multiple linear regression analysis. The independent variable and the dependent variable have a close linear relationship, and the independent variable is mutually exclusive to the dependent variable, and the estimated number of regression coefficients cannot exceed the sample size.

Use the grouped data to calculate the log-occurrence ratio, use the conventional least squares method to calculate the regression model, group the individual data according to the independent variables, then estimate the time probability pj for each group, and estimate the log-occurrence ratio according to the event probability for each group, Therefore, it becomes the dependent

variable of the linear regression model, and the linear regression independent variable belongs to the categorical variable. The power evaluation is compared in Figure 3.
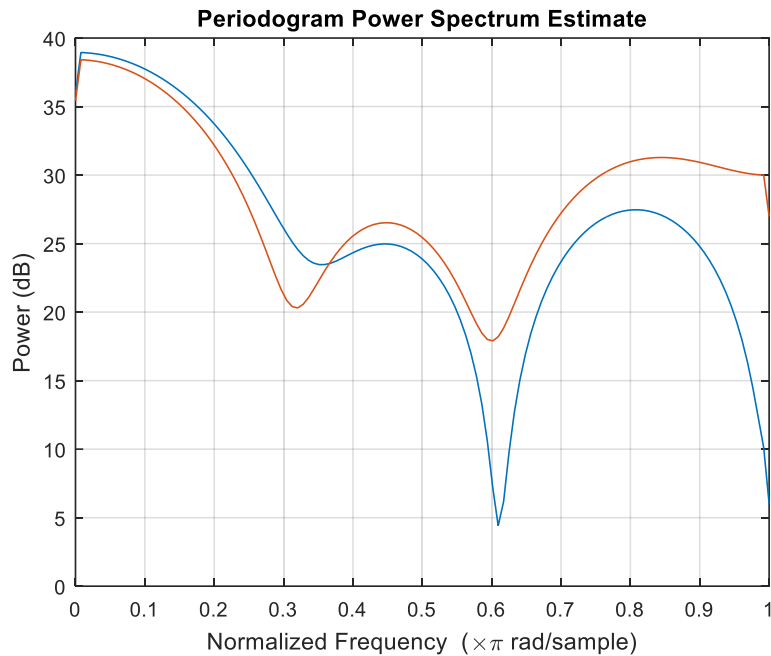
Periodogram Power Spectrum Estimate

Figure 3: Power evaluation.

There is heteroscedasticity in the model, because each group of residual items is closely related to the probability of occurrence of events in this group, and is related to the frequency of observations in this group. Then, data analysis can be achieved using the least squares method GLS. This paper adopts the least squares model, in which all the original variables are constant terms requiring weighted transformation, and the weights are the standard error coefficients of the residual terms. Since the residual standard errors depend on fj, and fj is constantly changing, the variance of the related residual terms has different assumptions. If this heteroscedasticity problem cannot be resolved, the significance construction of the relevant parameter estimates is ineffective. To correct for heteroskedasticity, the data are transformed before model estimation.

The evaluation of students' curriculum design works is mainly based on factors such as learning attitude, internal logic of design, format specification, formal aesthetics, and degree of innovation. It is often difficult to describe the logical relationship between these evaluation factors with a clear mathematical relationship. They are random, and we can find the law through the statistics and analysis of the data. The final score of the course has a linear relationship with its related evaluation factors, and the statistical analysis method of multiple linear regression is applicable. Regression analysis theory is a widely used multivariate linear statistical analysis method. Through the form of regression equation, we can examine the relationship between data variables and provide a strong scientific basis for prediction and control.

Based on multivariate linear theory, combined with practical considerations, the weights of the evaluation factors in the previous article are delineated as follows. Among them, the proportion of process evaluation is 0.35. The proportion of effect evaluation is 0.65. Due to the emphasis on design innovation, the weight of innovation degree is higher, which is 0.35. The inner logic of the design and the aesthetic feeling of the form each account for 0.20. The formal beauty of good design must have its rigorous internal logic and thinking, and a logical creative thinking process

can create good design, and they have a good mutual progressive relationship. In addition, the proportion of learning attitude is 0.15. The proportion of format specification 0.10. These two evaluation factors seem to be relatively dogmatic, but serious discipline, good study style, and standardized format are the solid foundation for learning design well. As shown in Table 1, the design art major courses are comprehensively evaluated from 2 dimensions and 5 evaluation factors. The established multiple linear regression model is:

$$Y = 0.15x_1 + 0.2x_2 + 0.1x_3 + 0.2x_4 + 0.35x_5 \tag{1}$$

Evaluation factors	Process evaluation		Evaluation		
	learning attitude	inner logic	format specification	form beauty	degree of innovation
weight	0.15	0.2	0.1	0.2	0.35

Table 1: The proportion of evaluation weight.

The evaluation of students' works is mainly to evaluate the application ability of art design theory, the application ability of computer technology, the ability of multi-disciplinary integration and other factors. The relationship between these factors is often difficult to describe with deterministic functional relationship, most of them are random, and only through statistical analysis can find out the law. The value vs number is plotted in Figure 4.
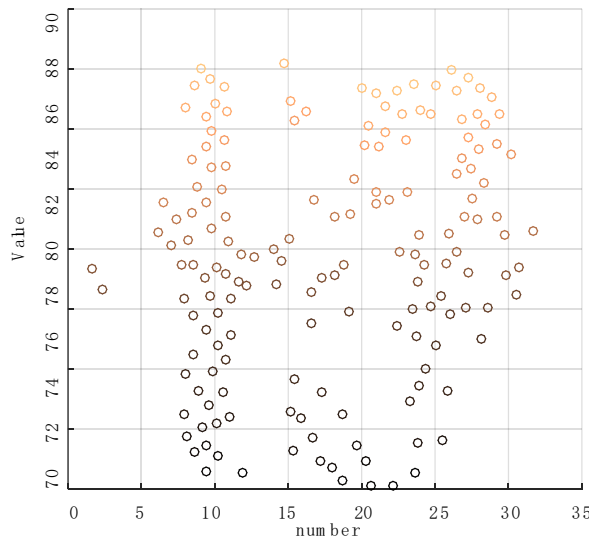

Figure 4: Value vs number.

At the same time, there is a linear relationship between the comprehensive evaluation score and its related factors, which is suitable for the multiple linear regression analysis method in statistics. Regression analysis is a data processing method that uses statistical principles to describe the correlation between random variables. We can obtain the weight of each relevant factor in the total evaluation score according to the change of a group of independent variables, and formulate reasonable evaluation rules. The score is shown in Figure 5.
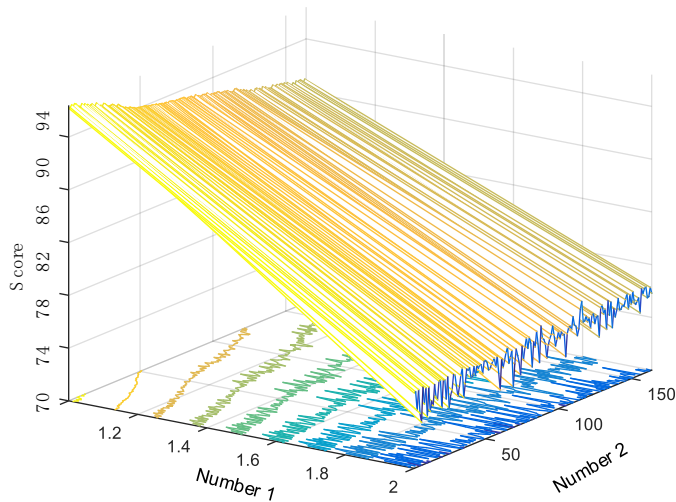
Figure 5: Score.

The following takes a student's design work in the product design course as an example to explain the application of multivariate linear equations in detail. It is carried out from two aspects: process evaluation and effect evaluation. From the attendance record, it can be seen that the student has never been late and left early. He can usually complete his homework on time, and he can actively participate in class discussions and interactive sessions. Considering the learning attitude, he will be awarded 98 points. The process of the design is based on the creative theme of happy eyebrows, from the idea to the sketch creation, to the final effect presentation. It is obtained by the students and group discussions and the whole process of the teacher's guidance. The internal logical relationship of the design creativity is clear, clear and comprehensive. 95 points are awarded for the consideration of the inherent logic of the design. The format of the coursework must conform to the norm to a certain extent, and the student earnestly fulfilled the normative requirements of the coursework and was given 100 points. The student's design works take square and circle as the main body, magpies and plums as decorative graphics, and embellished with red and sapphire. Innovation is the driving force of design. This student's design works well inherit traditional Chinese culture. Square and circle, platinum and gold are respectively given the symbolic imprint of masculinity and femininity. Condensed, making the traditional western gems and eastern culture blended, with high design innovation, giving 96 points. Finally, as shown in Table 2, through the operation of the multivariate linear equation, the student's final score is 95.7. The prediction is shown in Figure 6 and the probability is shown in Figure 7.

Evaluation factors	Process evaluation		Evaluation		
	learning attitude	inner logic	format specification	form beauty	degree of innovation
weight	0.15	0.2	0.1	0.2	0.35
score	98	95	100	92	96
Equation operation	14.7	19	10	18.4	33. 6
total	95.7				

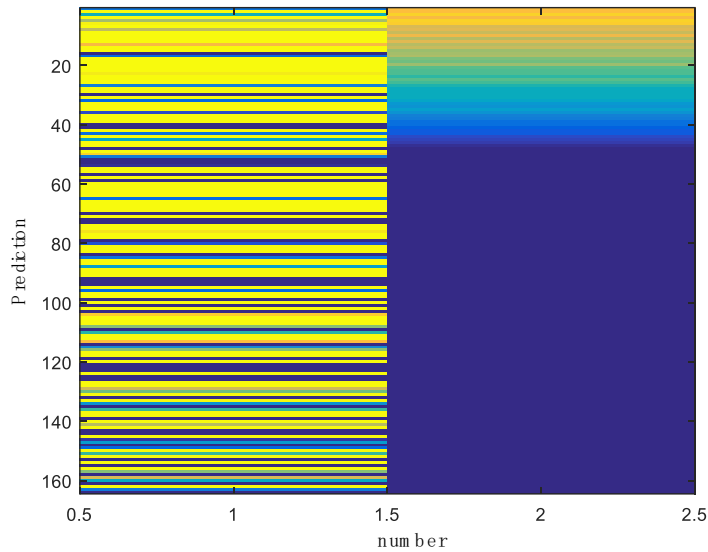**Table 2**: Practical application of multiple linear regression equations.
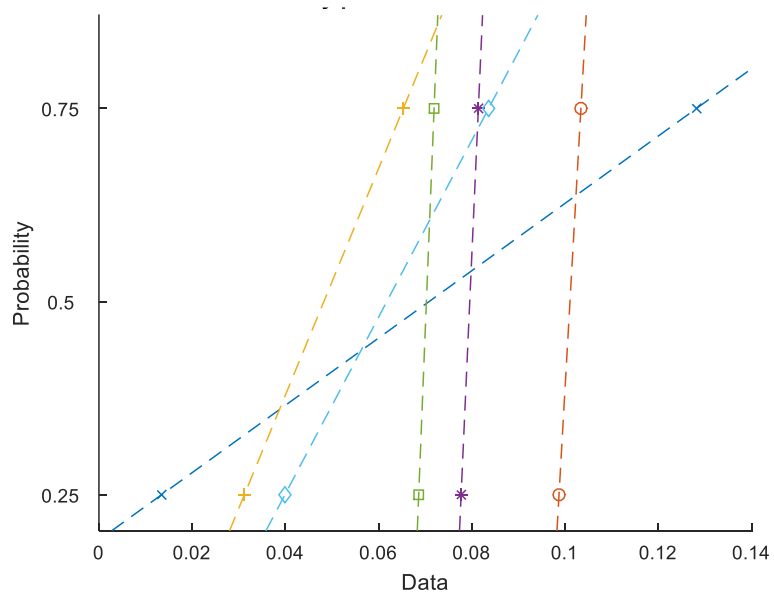
Figure 6: Prediction.

Figure 7: The probability.

4   CONCLUSION

Using the evaluation method based on multiple linear regression theory to evaluate the performance of design art courses can standardize design art teaching and make it more scientific, systematic and rigorous; on the other hand, it provides a model reference for daily teaching management. That is, for students' learning, the purpose and direction of professional learning are more clarified; and for teachers' teaching, it provides a mathematical basis for reference. In

addition, in the actual application of professional performance evaluation, the evaluation factors and weights involved in the multivariate equation can also be adjusted by teachers according to the characteristics of professional courses, optimize the evaluation system, and better design professional teaching services.

The research in this paper shows that the use of regression analysis model can evaluate test scores, and can reasonably predict scores. The validity of the model can be judged by using the model significance check. Through the model regression coefficient significance check, the independent variables with weak influence on the dependent variable can be found and eliminated, thereby simplifying the model and facilitating the use of the model. In the actual forecasting process, the influence of multiple factors should be considered to minimize the error.

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