Important Evaluation Model of University Mathematics Curriculum

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Abstract. Mathematics is the foundation of all subjects, and every great progress of human beings has the strong support of mathematics. Mathematics has shown an extremely important role in university education and the importance of mathematics is increasing. With the differentiation of objective environment, the personalization of individual disciplines, the subjective learning attitude, and the interactive influence between various disciplines, a lot of precise statistical requirements are put forward. In this context, the study of the importance model of university mathematics curriculum is helpful for college students to better study and plan, and also provides a reference for other industries such as education. This paper combines the performance data of mathematics students of each major and each class. It also combines the relevant characteristics of college students themselves, and puts forward suggestions on the connection of middle school and university mathematics and the subsequent study.

Keywords: Data envelope analysis; Entropy weight method; ARIMA module; Neural network.

1. Introduction

With the most widely practical data envelope analysis (DEA), it is the crossover research of a new field, according to multiple input index and multiple output index, using the linear planning method, the effectiveness of comparable type unit evaluation of a quantitative analysis method [1]. At present, DEA has been widely used in different industries and departments, and reflects its unique advantages in dealing with multi-index input and multi-index output. Since it is often difficult to compare the connection between indicators in the data analysis of univariate single-output mode, the multivariate parameter approximation fit will be selected to achieve good fitting accuracy [2].

In determining the weight, the paper use the entropy weight method and the empowerment model of subjective and objective combination [3]. Hierarchical analysis is a kind of subjective empowerment, which is powered according to the knowledge and experience of experts. The index weight determined by this method inevitably lacks objective scientific basis and cannot overcome the influence of subjective factors. In essence, the entropy weight method is an objective empowerment method, which fully excavates the internal laws and information of the raw data, and the weight derived from it is independent of the subjective preference and experience of the decision makers, so that the evaluation process can be supported by a strong mathematical theoretical basis, The evaluation results are more objective [4]. When dealing with the key indicators that affect bank failure, the empowerment model combining entropy weight method and hierarchical analysis of subjective and objective can be used to make the built model more reference value.

2. Models and Methods

This paper studies the analysis and evaluation of the importance of college student mathematics curriculum by a series approaches. Some mathematical models, including data preprocessing, model hypothesis, model establishment and solution, are established [5]. The error sensitivity analysis is also presented. Below are a few important models that are used in the data analysis.

2.1. Multivariate Model

The underlying principle of DEA is to compare the analogy and correlation of multiple groups of variables. In terms of the processing of 64 indicators, the Charnes-Cooper-Rhodes model is selected for screening, and then to find out the indicators affecting the bank efficiency, so as to measure the bank efficiency. For the DEA model, it is built from the formula $h_j = (u^T\ class_j)/(v^T\ X_j)$ where $j = 1,2,\ldots n$. By proper choosing of coefficients v and u, the target aim is that [6]

$$\begin{cases} \max h_j = \frac{\sum_{r=1}^{n} u_r y_{rj_0}}{\sum_{i=1}^{n} v_i x_{ij}} \\ s.t. \frac{\sum_{r=1}^{n} u_r y_{rj_0}}{\sum_{i=1}^{n} v_i x_{ij}} \leq 1, j = 1,2,\ldots < n\ . \\ u \geq 0, v \geq 0 \end{cases} \quad (1)$$

Here, $\lambda(X_i)$ is a vector that contains k elements. The analysis of the decision data, among which the important indicators can be screened out, and the demarcation can be given through the decision tree model, by which the bank efficiency is measured.

2.2. Decision Tree Model

The action function is a function of the stimulus pulse intensity of the upper node, also called the stimulus function, generally take (0,1) Continuous value Sigmoid function $f(x) = 1/(1 + e^{-x})$. Through entropy weight method and hierarchical analysis of subjective and objective combination empowerment model to determine the weight, after standardization, the bank efficiency and the most important five indicators as the input layer, and divide the training set, test set, prediction set, will be bankrupt as the output layer, using BP neural network classification model training, extract effective weight, the weight of the five indicators respectively: 0.2376, 0.1979, 0.1953, 0.1857 and 0.1844. The schematic diagram is shown in Fig. 1 [7]. Mathematically, the formula is that $X_{ki} = \frac{X_{ki} - \overline{X_i}}{\sqrt{S^*_{ii}}}$ $(k = 1,2,\ldots,m)$, where $\overline{X_i} = \frac{1}{n}\sum_{k=1}^{n} X_{ki}$, $S^*_{ii} = \frac{1}{n-1}\sum_{k=1}^{n}(X_{ki} - X_i)^2$, and $RI_j = \frac{|S_i|}{\sum_{j=1}^{N}|S_i|} \times 100\%$.

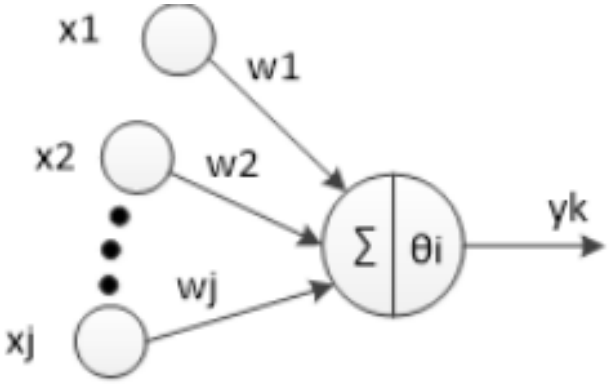

Fig 1. Illustration of the decision tree model.

2.3. ARIMA Model

ARIMA It is a differential integrated moving average autoregressive model, and also an integrated moving autoregressive model, and is one of the analysis methods of time series prediction. In ARIMA (p, d, q), AR is "autoregressive", p is the number of auto-regressor terms, and d is the number of differences (order) to make it a smooth sequence. The word "difference", though not appearing in the English name of the ARIMA, is a key step. During the process of building ARIMA model, the $class$ is defined as p, the $class_t$ is defined as d, while the ACF (k) is defined as q. Namely, $class = u + e + \sum_{i=1}^{q}\theta_i e$, $class_t = u + \sum_{i=1}^{p} r_i class + e + \sum_{i=1}^{q}\theta_i e$, $ACF(k) = p = \frac{Cov(class_t, class_{t-k})}{Var(class_t)}$.

3. Applications

3.1. Data Envelope Analysis

In the process of data processing, one should first find out all abnormal data through python and conducts data cleaning. Then, the effective index is preliminarily screened out through the dimension reduction algorithm to ensure the unity of the index. Data envelope analysis was used to evaluate the effectiveness of the importance of mathematics curriculum parameters: first, the input and output variables were determined [8]. This paper successively selects college influence, professional influence, class influence, management level and teacher level as the input variables. In each set of data, the ratio is about 1:1, so as to facilitate the intuitive and comprehensive analysis of the results. As shown in Fig. 2, the effectiveness analysis of X1 as an indicator is illustrated.

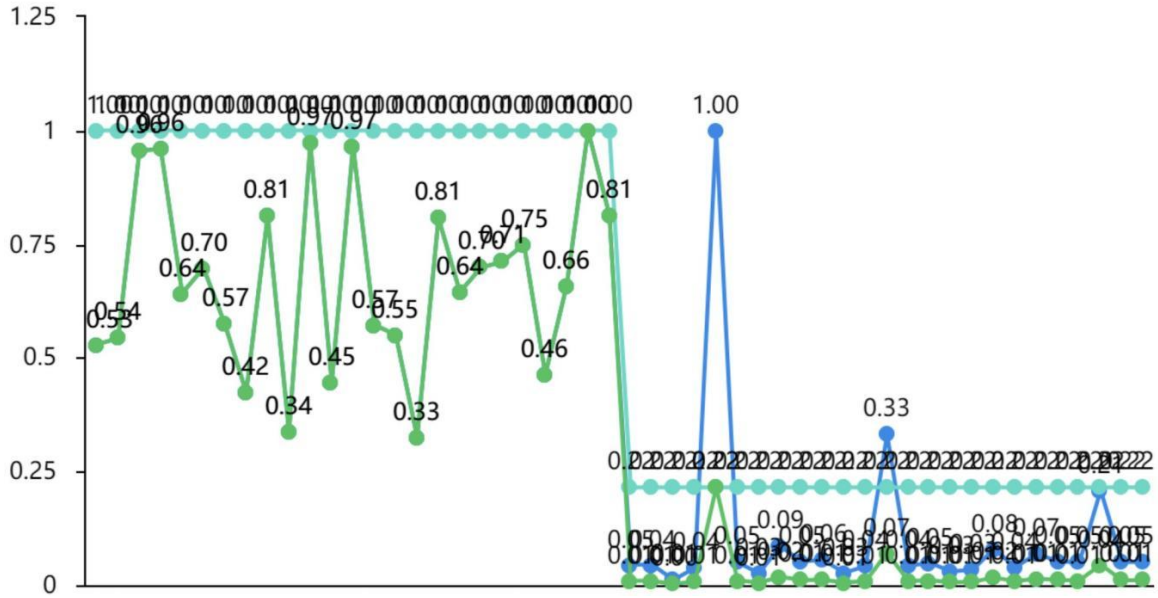

Fig 2. Effectiveness analysis of X1 as an indicator.

On the basis of knowing the occurrence probability of various situations, this paper is a decision analysis method that makes the most important indicators to obtain the most important indicators and judge their feasibility, which is a diagram method that uses probabilistic analysis intuitively. In order to ensure the unity of the index, the main index is selected by the dimension reduction algorithm and based on ID3 [9].

The decision tree algorithm has screened out the relevant indicators. It is difficult to obtain analytical solutions for this system of differential equations. In this paper, the fourth-fifth-order Runge-Kutta algorithm is used to calculate the numerical solution of the differential equations. A constrained minimal optimization method is also used to optimize the squared error between the numerical solution and the data to find the corresponding model parameters when the error is the minimum value.

3.2. The Neural Network Model

The effect of the model is required to reach more than 85%. Based on this, the researchers constructed a neural network prediction model, see Fig. 3. Model construction is performed as follows. One is the determination of input layer neurons includes transmission, while the other is the entry parameters and to select the number of neurons in the input layer. According to the above analysis and study, the comprehensive influence between the relevant parameters is considered [10].

To establish to neural network model, it is useful to assume that the statistical table (x, y, h) has the following nonlinear relationship: $Z = g\ (x, y, h)$. After that, the simulation is trained with the neural network. The neural network model can be specifically divided into the following four steps.

Step 1：Input layer data selection：result.csv、user_info.csv、login_day.csv.

Step 2：Use the processed data to train the network, as follows: A. Establish the model and train with the trainlm function; B. Set the learning rate is 0.065; C. The maximum training cycle is 5000 times; D. Set the standard error as 0.025; E. Start to train the network.

Step 3：Simulate the raw data;

Step 4：The simulation results are compared with the original data. If the error is less than 0.025, the training will end.

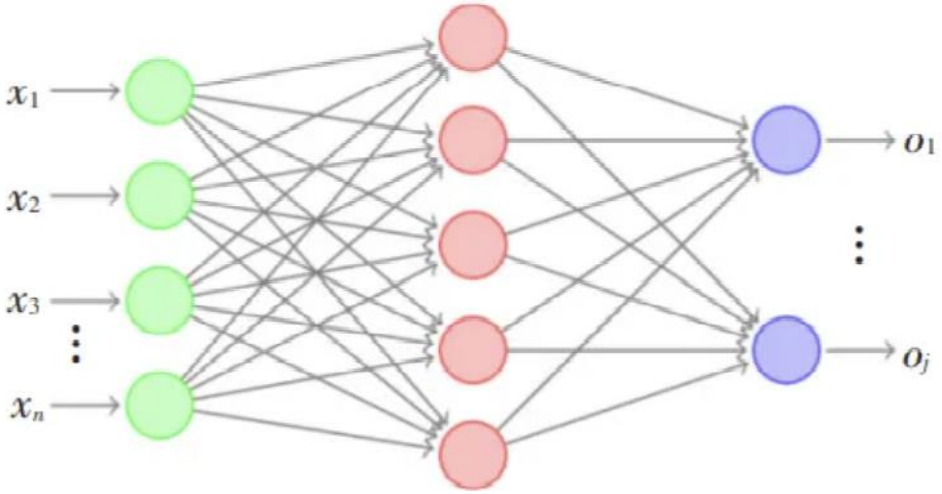

Fig 3. BP Neural network structure.

With the above steps in mind, one can make use of the neural network toolbox in the Matlab software to perform the simulation. It is observed that the error decreases gradually during the iteration. As shown in Fig. 4, the trend of the predicted value is basically consistent with the true value. The relative error basically fluctuates around 0, and very a few errors are relatively large, so the trained neural network can get the propagation law very well. At this point, $Z = g\ (x, y, h)$ can describe the user very well.

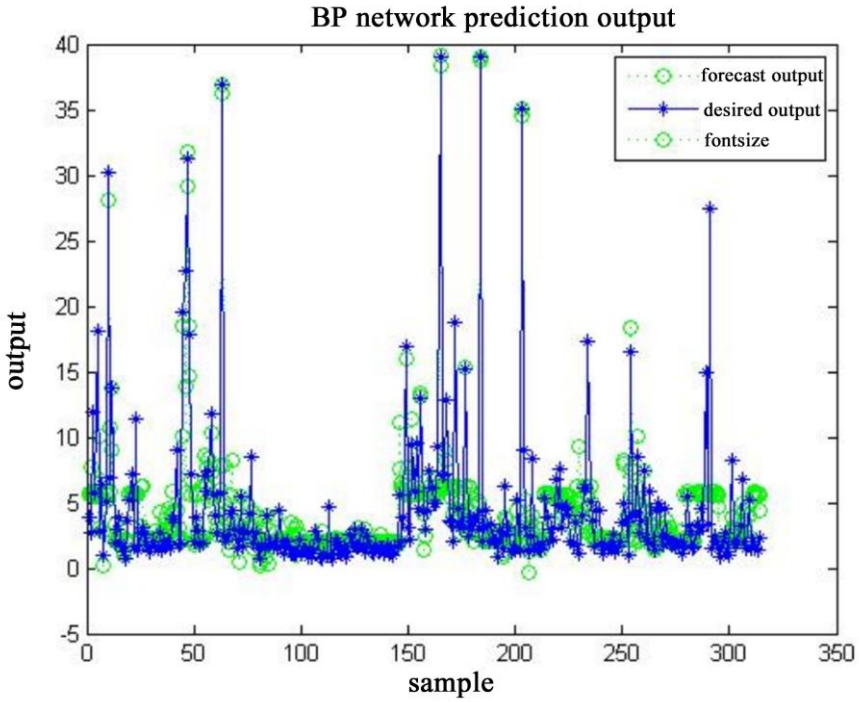

Fig 4. Plot lots of the predicted and true values.

4. Conclusion

To conclude, the study of the importance model of university mathematics curriculum is helpful for college students to better study and plan, and also provides a reference for other industries such as education. In the study of this paper, the researchers draw the following conclusions: In view of problem 1, higher mathematics is the most closely connected with middle school. Combined with the examination results and several higher mathematics scores provided in the attachment, the influence of middle school mathematics on university mathematics is around 0.2386. In view of problem 2, the course order in the attached table is not reasonable enough. The order of the course schedule does not conform to the process of college students' learning from easy to difficult, and the series between them is not very strong, which does not conform to the overall logic of mathematics learning. In this paper, the influence of mathematics on other subjects is also analyzed extensively. In view of problem 3, mathematics learning in the whole university is a very complex system engineering. In addition to the course setting, the school, major, class, management level, teacher level and so on will have adverse effects to different degrees.

In this paper, students' subject performance is used as the effective feedback of relevant factors and evaluated. Combined with the characteristics of college students themselves, the primary mathematics of middle and high school has a certain basic role in the higher mathematics of universities, among which the accumulated mathematical thinking and typical mathematical ideas can be used for reference and use, and grasping the cohesion can help researchers to learn university mathematics better.

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