Transactions on Comparative Education (2021) Vol. 3: 33-37
Clausius Scientific Press, Canada
DOI: 10.23977/trance.2021.030206
ISSN 2523-5818

Research on knowledge return Model based on Fuzzy Comprehensive genetic algorithm

Sen Liu

School of Artificial Intelligence, Wuhan Textile University, Wuhan 430200, China

Keywords: fuzzy synthesis, factor analysis, genetic algorithm, BP neural network, Markov model, policy

Abstract: Higher education is very important to the current era. Having a healthy higher education system in each country is the key to education functioning the paperll. To assess the health status of the higher education system, the paper established an evaluation model based on a fuzzy comprehensive method. Based on the results, the paper proposed a policy entitled "Knowledge Back to Homeland" to improve the higher education system in these countries with poor educational systems. The paper firstly analyzed the data of five countries (i.e. the United States, China, Australia, Russia, and Brazil) for the past ten years. The paper used factor analysis to select and retain five factors that have the deepest impact on the health of higher education: cost of higher education, national government investment, values of the degree, equitability, and quality of education. The paper obtained the the paperights of the above factors adopted by the analytic hierarchy process, equal to [0.1225 0.2849 0.4555 0.0771 0.060]. Furtherly, the paper constructed a fuzzy comprehensive model for these 5 factors. The paper selected 3 countries (i.e. China, Russia, and Brazil) and collected data from their national statistical bureaus. In a percentile system to evaluate, China got 85.0012 points, Brazil got 78.7705 points and Russia 79.8585 points. So the paper chose Brazil with the lothe paperst score as the target country for the improvement. Finally, the paper conducted a sensitivity analysis, which indicated our model was stable for multiindex evaluation and also had high prediction accuracy.

1. Introduction

With the progress of the times, the level of education has gradually become an important basis for whether a country is developed. Higher education has also received more and more attention from the society [1]. Higher education not only cultivates talents in many aspects, but also provides abundant human resources for social development. At the same time, it provides strong support for the rapid development of social technology and economy and becomes a pothe paperrful driving force for sustainable social development. According to the ranking of education quality of the countries in the world published by a survey agency, three-fifths of the top 20 countries are European countries

[2]. Looking around the world, each country's distinctive higher education methods are deeply embedded in a country's cultural, social and political framework. Each country's higher education system knows its strengths and the paperaknesses.

For the external society, factors such as the fairness of opportunities, multi-channel funding policies, the value of degrees, the level of teaching quality, and the output of research results play a decisive role in the evaluation of the higher education system.

2. Factor analysis method

The paper have obtained indicator data for the past 10 years from statistical bureaus of various countries [3]. As the paper have obtained too many interdisciplinary indicators, it will lead to inconsistent data dimensions, redundant data and noisy data, so the paper need to reduce the dimension. The paper convert each index value aijinto standardized index f aij, and the formula is as follows:

$$\widetilde{a_{ij}} = \frac{a_{ij} - \mu_j}{s_j}, \left(i = 1, 2, \cdots, n;\ j = 1, 2, \cdots, m\right) \tag{1}$$

In this formula: $\mu_j = \frac{1}{n}\sum_{i=1}^{n} a_{ij}, s_j = \frac{1}{n-1}\sum_{i=1}^{n}\left(a_{ij} - \mu_j\right)^2$

Accordingly, the standardized index vector I $\tilde{x}_j = \frac{x_j - \mu_j}{s_i}, \left(j = 1, 2, \cdots, m\right)$

Calculation of elementary load matrix: The eigenvalue $\lambda_i \left(i = 1, 2, \cdots, m\right) \lambda_1 \geq \lambda_2 \geq \cdots, \geq \lambda_m \geq 0$ is obtained by solving the characteristic equation$|\lambda I - R = 0$, and the eigenvector of the corresponding eigenvalue is obtained. The obtained elementary load matrix is $\Lambda_1 = \left[\sqrt{\lambda_1}u_1, \cdots, \sqrt{\lambda_m}u_m\right]$.

In general, the paper select the k main factors that make the cumulative contribution rate $\frac{\sum_{i=1}^{k}\lambda_i}{\sum_{i=1}^{m}\lambda_i} \geq$ 85%, and then rotate the load matrix of k factors. ↤1(k)represents the first k columns of ↤1, and T represents the orthogonal matrix to obtain matrix ↤2= ↤1(k)T. The established factor model is

$$\begin{cases} \widetilde{x_1} = \alpha_{11}F_1 + \cdots + \alpha_{1k}F_k \\ \quad\quad\quad\quad \vdots \\ \widetilde{x_m} = \alpha_{m1}F_1 + \cdots + \alpha_{mk}F_k \end{cases} \tag{2}$$

Get the score function of a single factorc $\widehat{F_j}, \widehat{F_{ij}}$ represents the estimated score of the ith sample on the price factor [4]; Y represents the matrix after the standardization of the original data, and then the total score is

$$\hat{F} = \left(\widehat{F_{ij}}\right)_{n\times k} = YR^{-1}\Lambda_k \tag{3}$$

The results show that family costs, state investment, degree value, equity of access to school, and

quality of higher education These five indicators have a greater impact. Therefore, through factor analysis, the paper incorporate these five factors into the scoring criteria for modeling evaluation and comparison. At the same time, the paper carried out a custom formula to transform the five indicators of family cost, national investment, degree value, fairness of everyone ' s access to school, and education quality [5].

3. Analysis Hierarchy Process (AHP)

The paper are prepared to establish a fuzzy comprehensive model. First of all, since the cost of higher education is lothe paperr and better in real life, which is a negative indicator, the paper take its reciprocal to convert it into a positive indicator. Therefore, the paper determine the fuzzy comprehensive evaluation index. U={1/ The cost of higher education, national investment, the value of degree, fairness, education quality,}(marked as 1, 2, 3, 4, 5 in accordance with the order). Then the paper establish the evaluation set V = {very high, high, general, low} of comprehensive evaluation. Then the paper use the Delphi method to write out the single factor fuzzy evaluation of different countries. For example, if the paper obtain the following evaluation matrix according to the survey results.

$$R = \begin{pmatrix} 0.2 & 0.5 & 0.3 & 0.0 \\ 0.1 & 0.3 & 0.5 & 0.1 \\ 0.0 & 0.1 & 0.6 & 0.3 \\ 0.0 & 0.4 & 0.5 & 0.1 \\ 0.5 & 0.3 & 0.2 & 0.0 \end{pmatrix} \tag{4}$$

Then the analytic hierarchy process is used to calculate the the paperight of each indicator. Firstly, in order to make the model organized and hierarchical, the paper decide to construct a hierarchical structure diagram, in which the target layer (the highest level) represents the purpose of decision-making and the problems to be solved. The criterion layer (factor layer) refers to the criterion of considering factors and target decision; Scheme layer refers to the alternatives of decision-making.

Because analytic hierarchy process is a combination of qualitative analysis and quantitative calculation method, the paper then construct the pairwise comparison matrix from the criterion layer to the target layer, and determine the method of pairwise comparison matrix: repeatedly consulting experts, according to the criterion of the discriminant matrix, which is important for pairwise comparison of elements, how much is important, and the importance is assigned according to 1 to 9. At the same time, the pairwise comparison matrix has the following characteristics: aij > 0, and aij = 1 / aji. Constructed pairwise comparison matrix

$$A1 = \begin{pmatrix} 1 & 2 \\ \frac{1}{2} & 1 \end{pmatrix} \tag{5}$$

Because the difference betthe paperen the rows of the matrix is a multiple, so the matrix is a consistent matrix, so the paper choose any column vector and do normalization to get the the paperight vector w0 = [0.67 0.33], Then write the pairwise matrix of the scheme layer to the criterion layer

$$D1=\begin{pmatrix} 1 & \frac{1}{3} & \frac{1}{5} & 2 & 3 \\ 3 & 1 & \frac{1}{3} & 3 & 3 \\ 5 & 3 & 1 & 5 & 7 \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{5} & 1 & 1 \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{7} & 1 & 1 \end{pmatrix} \quad D2=\begin{pmatrix} 5 & \frac{1}{5} & \frac{1}{4} & 2 & 3 \\ 5 & 1 & 2 & 4 & 7 \\ 4 & \frac{1}{2} & 1 & 3 & 5 \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{3} & 1 & 2 \\ \frac{1}{3} & \frac{1}{7} & \frac{1}{5} & \frac{1}{2} & 1 \end{pmatrix} \tag{6}$$

This shows that among the five indicators, the value of degree is the most important, follothe paperd by the funds invested by the state, the third and fourth are the cost and fairness of higher education, and the quality of education is in the last position. Then the paper use the main factor decision type to determine the evaluation model: and normalize it to obtain S = [0.1273 0.2958 0.4731 0.1038]. At the same time, in order to make the country's health more intuitive, the paper will be very high, high, general, low four evaluations constitute a 15-level score matrix: F = (100, 85, 70, 55), the country's score J = S * F = 76.699 (total score 100), so that it can be judged by the country 's score of higher education health.

4. Analysis Hierarchy Process (AHP)

Because the paper are in the higher education system, the paper want to investigate the factors that affect the sustainability of this system. The paper aim to work out some ective improvement measures entitled the "Knowledge Back to the Homeland policy". In an aspect of cautiousness, the paper created two predictive models to confirm mutually, to ensure that our strategies based on these evaluation models are effective.

The paper established an evaluation model based on the fuzzy comprehensive method. Firstly, the five most essential indicators the paperre selected by factor analysis based on the data in five countries (i.e. the United States, China, Australia, Russia, and Brazil) in the past ten years. Secondly, a scoring system (with a full score of 100) was adopted to evaluate the health status of the higher education of each country. Take China, Brazil, and Russia for examples, the scores of the three countries the paperre: China 85.0012 points, Brazil 78.7705 points, and Russia 79.8585 points. The results indicated that Brazil's higher education had the greatest space for improvement. The paper comprehensively analyzed and evaluated the results, advantages, and disadvantages of our models to help to improve the policies. In consideration of the actual situation, the paper explained the necessity and the advantages of implementing the above-mentioned policies. In the future, the paper can continue to optimize our model if necessary.

References

[1] Zheng Lei, "A Comparative study on the influencing factors of higher Education demand betthe paperen China and Foreign countries", School of Economics and Business Administration, Beijing normal University, No. 9, 2008: 51-55 pages.

[2] Jiang Qiyuan Xie Jinxing Ye Jun, "Mathematical Model (third Edition)": higher Education Press, August 2003.

[3] Li Xueshu, "Research Trends and Reflections on the influencing factors of Teaching quality in Foreign Universities", Department of Development and Research, Shanghai Open University, 75-78 pages, August 6, 2000.

[4] Xia Xiufang, "Construction and Application of Markov Model, Department of Finance and Economics", Qingdao Institute of Architecture and Engineering, January 2020: 44-45 pages.
[5] Tang Xiaoling, "Research on the Competitiveness of BRICS higher Education-- based on the comparison of data from Brazil", Russia, India and China, Sichuan Foreign Studies University, Modern Education Management, No. 9, 2018: 123-128 pages.