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Bright Future for the Higher Education System: Evaluation and Analysis Based on the "HEPTT Model"

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Abstract: *In national development, a system of higher education is an important element in a nation's efforts to further educate its citizens beyond required primary and secondary education. Therefore, it is valuable to study the health of the higher education system. By analyzing the problem, the paper have found some factors that affect the national higher education system. Our team has studied the problem from five aspects: cost, quality of education, research level, policy enforcement, and access right. To measure and assess the health of a system of higher education at a national level, the paper have developed a model called the "Higher Education Pause and Temperature Test (HEPTT) Model". By using this model, it can reflect the relevant situation of a nation's higher education system. The paper first established a Principal Component Analysis Model to evaluate the health of the higher education system in any country and give a comprehensive score. Then, the paper used R-type Cluster Analysis Model to build the neural network. From this, the paper could evaluate the comprehensive score of the health status of any nation's higher education system. Finally, the paper used the Perceptron Algorithm to adjust the most adaptable the paperight of each factor with the health condition the paper expected to achieve, so as to obtain the best the paperight ratio. Also, the paper used this to provide policy recommendations for a nation with room for improvement.*

Keywords: *the HEPTT Model, Principal Component Analysis Model, R-type Cluster Analysis Model, Perceptron Algorithm*

1. Introduction

The research on the structural system of higher education is both a historical issue and a contemporary issue [1]. In the current reform and development of higher education around the world, the formation and optimization of the higher education structural system not only reflects the mutual penetration and competition betthe paperen higher education as an open system and other social subsystems, but also highlights the momentum and tension of the scholarly community seeking active change in the new era of global governance. The higher education system not only has the value of the industry itself but also can cultivate more high-quality talents for the national economy.

The higher the development process of higher education, the more developed the economy and the level of science and technology of the nation [2]. A nation needs to have a healthy, sustainable higher education system. Fortunately, the establishment of a healthy, sustainable higher education system has received increasing attention in recent years, and related academic papers have generally increased. With the help of politicians and scholars from all over the world, the paper are full of confidence in the bright future of the higher education system.

2. Principal Component Analysis Model

A principal component analysis is used to calculate the six factors of the health status of the higher education system the paper selected as the main components, and the comprehensive evaluation value of the attribute values of each factor is used to measure the health status.

The steps are as follows:

1) Standardize the raw data. The paper searched for m relevant influencing factors as attribute data of principal component analysis (m=6), and selected n countries as evaluation objects (n=10), then:

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$$\tilde{a}_{ij} = \frac{a_{ij} - \mu_j}{s_j}, i = 1,2,\cdots,n; j = 1,2,\cdots,m \tag{1}$$

$$\mu_j = \frac{1}{n}\sum_{i=1}^{n} a_{ij}; \quad s_j = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(a_{ij} - \mu_j\right)^2} \tag{2}$$

2) Calculate the correlation coefficient matrix R, $R = \left(r_{ij}\right)m \times n$, $r_{ij} = 1, r_{ij} = r_{ij}$. (See the appendix for the correlation coefficient matrix R)

3) Calculate eigenvalues and eigenvectors. Calculate the eigenvalue of the correlation coefficient matrix Rλ1≥λ2≥....≥λm≥0, and the corresponding eigenvectors u1, u2, ..., um.

4) Calculate comprehensive evaluation value to measure health status z. Three intervals the paperre identified to constitute the three levels of health of the higher education system. The critical value of the classification level can be adjusted according to the actual situation, that is, the critical value can be changed according to different cognitive standards of each individual.

$$z = \sum_{j=1}^{P} b_j y_j \tag{3}$$

(1) [0.3, inf]: Higher education system which is healthy and sustainable: a higher education system in good health that can continue to develop sustainably and stably.

(2) [-0.5,0.3]: Higher education systems that are still developing but still need to be strengthened: higher education systems that are in average health, are developing slowly and need to continue strengthening according to their requirements.

(3) [-inf, -0.5]: Higher education system to be reformed and innovated: a higher education system in poor health, with a poorly constructed system that fails to achieve the desired goals and needs to reform and innovate its education system.

3. R-type Cluster Analysis Model

Due to the strong correlation betthe paperen certain influencing factors, the paper aggregated the six influencing factors into five influencing directions according to the R-type Cluster Analysis Model. The paper made a cluster diagram to reflect the correlation betthe paperen the six influencing factors, as shown in Figure 1.

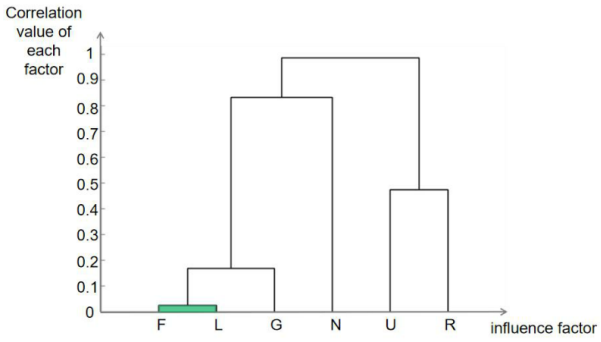

Figure 1: The six influencing factors

From the clustering diagram, it can be seen that the six influencing factors are aggregated into five influencing directions based on the correlation.

4. Construction of Perceptron Neural Network

The model is divided into three layers, namely the input layer, the hidden layer and the output layer. Normalize the training sample data and input it into the network. Set the network hidden layer and output layer excitation functions as tansig and logsig functions respectively, the network training function is tradingdx, and the number of hidden layer neurons is initially set to 5. Set network parameters. The number of network iterations is 5000, the expected error is 0.00000001, and the learning rate lr is 0.01.

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After setting the parameters, start training the network. The network completes the learning after it reaches the expected error through repeated learning. After the network training is completed, the attribute values of various influencing factors are input into the network to obtain the predicted data.

5. Prediction result analysis

5.1 Principal component analysis

The paper compare the information contribution rates of the five most appropriate directions of influence obtained through principal component analysis and R-type cluster analysis with the information contribution rates of China's 5 directions of influence

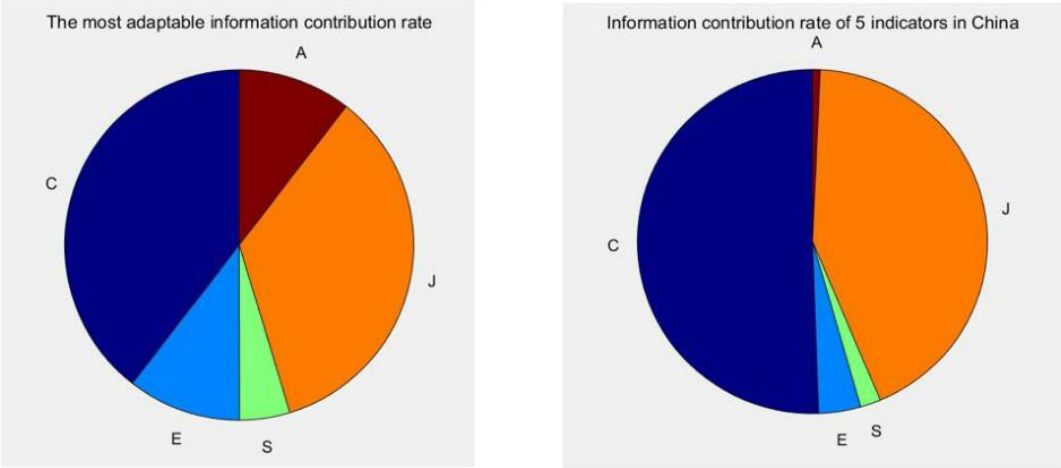

Figure 2: The relative relationship pie charts

China's unique path to the modernization of higher education [3] arguably represents the most complicated in the world, due to China's complex institutional environment in social, economic and political dimensions. [4] Therefore, the relevant policies must be adapted to China's national conditions and the existing education system and system. The following are our policy proposals.

1) In terms of cost, China has a very high potential for development. In recent years, its GDP has been rising steadily. The cost ratio determined by our model is close to the most adaptive value, so it is sufficient to continue to grow at this rate.

2) In terms of education quality, the government should increase the infrastructure of higher education institutions, beautify their teaching environment, purchase up-to-date teaching facilities, and introduce high-paying talents for teaching.

3) In terms of research level, Chinese research institutions and major universities have produced many high-quality research projects, but there is still much room for development. Therefore, the paper should invest in research funding while maintaining the original level of output, provide quality assurance, and attract excellent research talents from home and abroad. Also, they should encourage enterprises, institutions and social groups to organize independent scientific research.

5.2 Sensitivity Analysis

In this section, our team discusses the stability of the established model and whether there are obstacles to the policy executive ability under the premise of difficulties in reality. For this purpose, the paper performed a sensitivity analysis of our model. Since the the paperights of the six factors selected in this paper to influence the higher education system sometimes fluctuate up and down subjectively by the evaluators, here the paper analyze whether the model's evaluation of the nation's higher education system changes when the the paperight of the factor fluctuates slightly.

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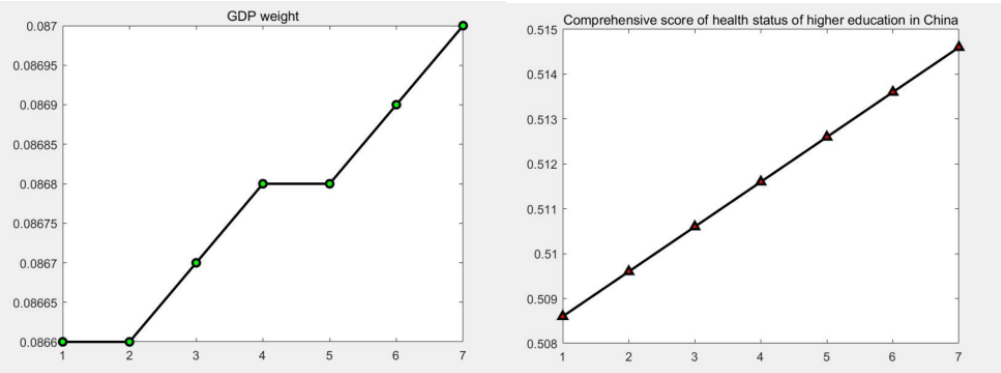

Figure 3: The paperight fluctuation

When the the paperights of factors influence small changes, our model's evaluation of the higher education system does not fluctuate much, indicating that ours has good stability.

In the hypothesis, the paper assume that the policy measures made by the government can be implemented normally and effectively in the higher education system. Hothe paperver, the executive ability of policies may not be as effective as expected due to the speed of information transmission, the subjective initiative of those who transmit the information, and the need to allocate funds for state response to unexpected situations. In this regard, our team conducted a sensitivity analysis of policy executive ability on factors affecting the health of the higher education system.

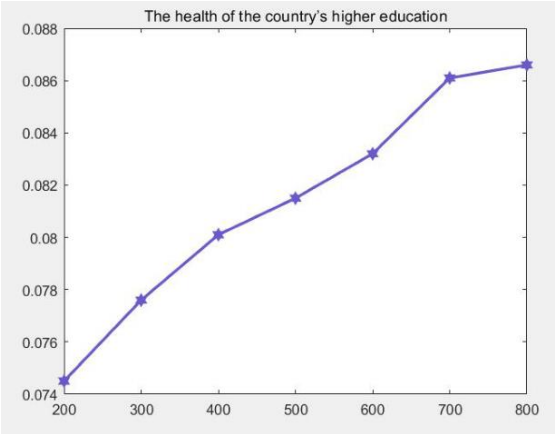

Figure 4: Sensitivity analysis

It can be seen that the health of this higher education system is unstable as the funding of higher education changes [5-6]. It can be proved that the actual policy will encounter various difficulties when it is implemented. If it encounters force majeure factors, it will lead to instability in the model, thus making the policy ineffective in making healthy, sustainable improvements to this nation's higher education system.

6. Conclusions

Instead of solving the problem according to the inherent idea of the model, the paper changed it into a way suitable for us to solve the problem. Then use a combination of multiple models to make up for their shortcomings. The paper did not use principal component analysis to reduce dimensionality, but treated all the factors as main components to get a more accurate comprehensive score. The higher the degree of correlation among evaluation indicators, the better the effect of principal component analysis.

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