Effectiveness Evaluation of Network Ideological and Political Education Method in Universities Based on MLP Neural Network

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Abstract: With the rapid development and wide spread of the Internet, network ideological and political education, as a new front of ideological and political education in universities, has become more and more important and necessary, and ideological and political workers in universities are also constantly carrying out in-depth research on the methods of network ideological and political education. This paper focuses on the effectiveness evaluation of university network ideological and political education methods, and obtains the effectiveness evaluation model of network ideological and political education methods in universities through PCA algorithm and MLP neural network; PCA algorithm is used to perform principal component analysis and dimensionality reduction on the data, and MLP neural network is used to train the data to obtain intuitive prediction and evaluation results. The experiment shows that the average error rate of the prediction model is 5.57%, and the calculation results have high accuracy and recognition ability.

Keywords: university, network, ideological and political education, MLP, effectiveness

1. Introduction

With the rapid development of Internet technology, the network is no longer a simple tool of use, but forms a deep fusion force, which gradually penetrates into various fields of production and life, bringing profound changes in the way people produce, live, learn, etc. "Internet + education" was born in this context, and universities have always been the forefront of Internet applications. Now university students have become the most active group on the network. The network is an important way for them to obtain knowledge and information, understand society and exchange ideas. However, their ideas are not mature enough, their ideals and beliefs are not firm enough, and their values are still in the formative stage. The interweaving and collision of multi-cultures in the network environment can easily impact their values. Therefore, strengthening the network ideological and political education of university students has become an important work for Chinese universities. In recent years, Chinese universities have gained some new experience and accumulated many effective methods in ideological and political work, but to create a set of network ideological and political education methods that adapt to the new situation, we still need to continue to explore and explore in practice, continue to summarize, and gradually improve and develop.

The network ideological and political education method is a method of network plus ideological and political education, where the network is both a method and a carrier. When the network is used as a method in the network ideological and political education method, it refers to the sum of the ways, methods or means used by the network platform to achieve the goals of ideological and political education, disseminate the content of ideological and political education, and complete the tasks of ideological and political education according to the characteristics and laws of people's ideological and behavior in the network virtual society[1]. The effectiveness of network ideological and political education methods in universities refers to the actual effect of the methods used by universities in the process of ideological and political education for university students through the network. This effect is an important standard to measure and test the effectiveness of network ideological and political education methods[2]. The research on the effectiveness of ideological and political education methods in universities will help enrich the teaching content, and provide a solid theoretical basis and theoretical

support for promoting the scientific teaching of ideological and political education in universities and for the research of teaching methodology of ideological and political education in universities. At the same time, it can accurately grasp the profound connotation of university students' ideological and political education, which has important academic significance for forming a relatively complete ideological and political education teaching system and expanding educational horizons, and can have a good guiding role in practice[3].

2. Literature review

In the process of social modernization and information development, the network plays a prominent role in the ideological and political moral level of university students, and the ideological and political education into the network is imminent. The research work of network ideological and political education methods in universities has achieved certain results[4]. Chinese scholars have studied from different angles. For example, Li Quanfang summarized the special ideological and political education methods generated in the network by means of the definition of ideological and political education methods in the article "Research on the Methods and Effective Operation of Network Ideological and Political Education for University Students". The general name of the ways and means used by the education subject to recognize and influence the thoughts and behaviors of university students through the network is the network ideological and political education method, which is the way to achieve the educational purpose[5]; Xiong Wei said in "The Problems and Countermeasures of the Application of Network Ideological and Political Education for University Students" that the methodology of ideological and political education for university students keeps pace with the times, and its network form presents prominent characteristics of the times,The interactive method of education subject and object, the method of seizing the 'microblog position', and the method of relying on 'campus cultural activities' are the existing education methods[6]; Xu Jianjun and Wang Fan introduced "network survey method, educational decision-making method and network education method" in their article "On the specific methods of network ideological and political education for university students"[7]; Song Yuanlin, in the article "The Construction of network Ideological and Political Education Method System", put forward five methods: "information database method, subject interaction method, information concealment method, virtual reality method, and the combination of online and offline education method"[8];Yang Zhifan and Hu Shuxiang, based on the problems encountered in the practice of using the network to carry out ideological and political education in universities and the new trend of the development of network technology, pointed out that the structure of the network ideological and political education methods in universities should be constructed from the three levels of "information acquisition, information transmission, and information reuse"[9];In "On the Methods of Network Ideological and Political Education for University Students", Hu Siheng believes that "reasonable mixed methods, demonstration and comparison methods, coordinated teaching methods, and self-education methods" are the main methods of network ideological and political education for university students[10].The method of network ideological and political education for university students keeps pace with The Times and develops constantly, Most scholars have directly discussed some specific methods. They think that the methods of university students' network ideological and political education are these specific methods. Some scholars have made a systematic discussion based on the whole. It is many specific methods that together constitute a methodology[11]. As far as ideological and political education is concerned, it is a concept with Chinese characteristics, but this does not mean that there is no ideological and political education abroad. In fact, countries all over the world, like China, pay close attention to their own ideological and political education work. The difference lies in its different manifestations under the influence of cultural differences. For example, Cheung Waiman and Huang Wanyne made a detailed survey and analysis of the application of the Internet in universities from the perspective of university students in the article "Proposing a Framework to Assess Internet Usage in University Education: an Empirical Investment From Students' Perspective", and put forward constructive suggestions on guiding university students' thinking and standardizing their behavior in the new media environment, It has laid the foundation for the effective development of ideological and political education activities for university students in the new media environment, so that universities can realize the important role of strengthening the correct ideological guidance for university students [12]. In the book "Active Networks and Active Network Management: a Proactive Management Framework" written by Stephen F. Bush and Amit B. Kulkarni, it is deeply analyzed that the new media supported by network technology will have a guiding effect on the thinking of media users due to its immediacy of information dissemination and the universality of the audience, so some problems will arise. Therefore, the network technology and network standard management have been advanced [13].

Throughout the research situation of network ideological and political education, the research results endow ideological and political education with distinctive epochal characteristics and enrich the ideological and political education work on the whole[14]. Most of the current research is related to the analysis from the overall perspective of the ideological and political education methods. The results of the effectiveness of the ideological and political education methods in universities still need to be in-depth, and there is no systematic and scientific theoretical construction of guiding role.The educational object of network ideological and political education is extremely special, the educational environment is extremely complex, the educational means are extremely diverse, and the evaluation of educational objectives is extremely difficult to quantify. These characteristics determine that the effectiveness evaluation of network ideological and political education methods is a multi-factor, multi-variable, fuzzy non-linear problem, and the different levels of factors also further increase the difficulty of evaluation[15]. Traditional evaluation methods are not suitable for the effectiveness evaluation of network ideological and political education methods due to the large randomness, strong subjectivity, difficulty in determining weights, lack of self-learning ability and other reasons in the evaluation process. In order to find a relatively accurate and simple evaluation method, this study is the first attempt to use MLP neural network modeling to evaluate the effectiveness of network ideological and political education methods in universities.

3. Research design

3.1. Research framework

First of all, a large number of collected student data are pretreated by preliminary cleaning, formatting, desensitization, and stored in the database; After data conversion and dimensionality reduction, these data are modeled and analyzed. The research framework is shown in Figure 1.
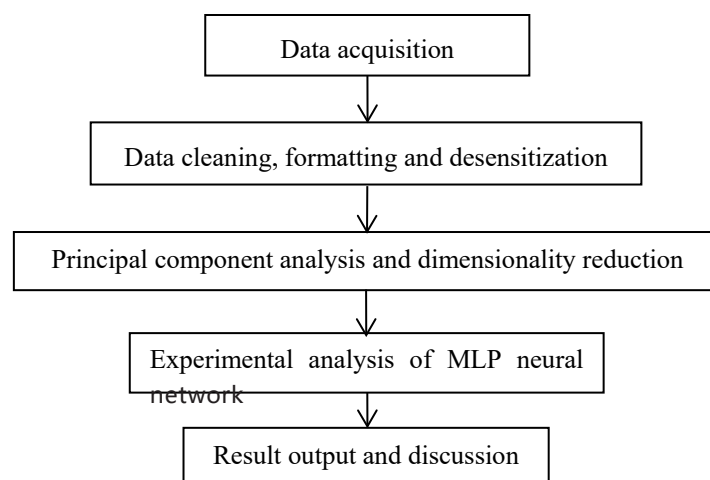

Figure 1: Research framework

3.2. Data source and preprocessing

3.2.1. Data acquisition

This study takes 6 universities in Zengcheng District, Guangzhou, Guangdong Province as the research object. Through a questionnaire survey of some college students, the whole collection period is about two months, and a total of 3103 valid data are obtained. The original data will be saved in EXCEL after standardization, data statistics and other processing.

3.2.2. Data preprocessing

First, clean the original data. The main task is to fill in the missing values and remove the noise in the data. First, clean the original data. The main task is to fill in the missing values and remove the noise in the data. Second, for unstructured data in the original data, the data structure method and quantitative method are used for format processing. Third, desensitize the data, replace, filter or delete the personal sensitive data in the original data without affecting the accuracy of the data analysis results, to reduce the risk of personal privacy disclosure.

3.3. Construct the effectiveness evaluation system of network ideological and political education methods

The implementation of network ideological and political education needs the joint participation of universities, teachers and university students to complete the education in the cooperation and interaction between each other, so as to have a benign guidance for university students' online public opinion. Therefore, the effectiveness evaluation system of network ideological and political education methods in universities needs to be student-oriented[16]. This study finally determined the effectiveness evaluation system of network ideological and political education methods in universities by studying relevant documents and the guidance of consulting experts, and using the data collected by the questionnaire of university students to conduct principal component analysis and dimensionality reduction[17]. The evaluation system reflects three aspects of the network ideological and political education method with educational means, educational methods and educational skills as the secondary indicators, and the subordinate items have 15 indicators at the third level, as shown in Table 1.

Table 1: Evaluation System

First-level indicators	Secondary indicators	Tertiary indicators
Evaluation system of effectiveness of network ideological and political education methods	Educational means	New media technology
		Network information platform
		Network resource sharing
		Network office
		Network humanistic environment
	educational methods	Network communication mode
		Network information release
		Network communication frequency
		Online Q&A and live broadcast
		Network class communication
	Educational skills	Online and offline linkage
		Multi-dimensional interaction
		Network communication language
		Network teaching skills
		Inspirational guidance

3.4. Research methods

3.4.1. PCA algorithm for principal component analysis and dimensionality reduction

The method of PCA (Principal Component Analysis) can reduce the dimension of high-dimensional data sets with multiple observed variables, so that people can find out some main aspects from the complex relationship between things, so as to make more effective use of a large number of statistical data for quantitative analysis, and better perform visualization, regression and other subsequent processing[18]. The specific implementation steps are shown in Figure 2.
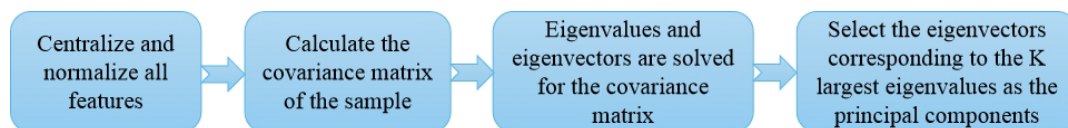

Figure 2: Implementation steps of PCA algorithm

3.4.2. MLP neural network

MLP (Multi-layer perceptron)Belongs to the neural network model of multilayer forward feedback. Its input is a group of vectors and its output is another group of vectors[19]. MLP is composed of input layer, hidden layer and output layer. The hidden layer can contain multiple layers. Figure 3 shows the network structure of MLP. The neuron operation mode of each hidden layer or output layer of the MLP neural network is to calculate the output function signal first, and then estimate and calculate the gradient vector through the reverse neural network. The input layer is an n-dimensional vector, that is, with n neurons. Neurons in the hidden layer need to be calculated by the activation function.First, it is fully connected with the input layer. Assuming that the input layer is represented by vector X, the output of the hidden layer is $y(x) = f(W_1^T X + b_1)$, of which W_1 is the weight (also called connection coefficient), b_1 is offset, function f it can be a common sigmoid function: $f(a) = 1/(1 + e^{-a})$, or

tanh function: $f(a) = (e^a - e^{-a})/(e^a + e^{-a})$. The hidden layer to the output layer can be seen as a multi-class logical regression, namely softmax regression, so the output of the output layer is $f(a) = e^a/\sum_{k=1}^{N} e^{a_k}$ where N is the number of nodes in the output layer[20].
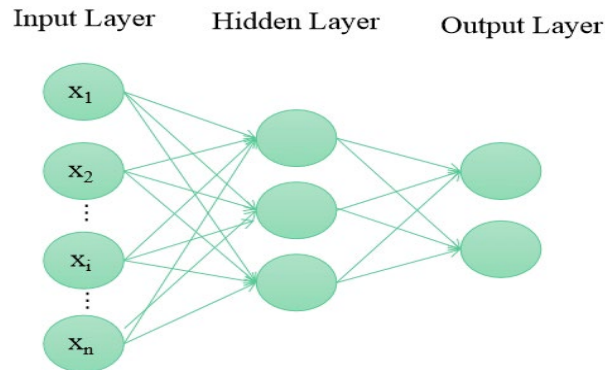

Figure 3: Structure diagram of MLP neural network

4. Statistical analysis and results

4.1. Principal component analysis and dimensionality reduction results

The principal component analysis and dimensionality reduction are realized by SPSS software. The results show that the KMO（Kaiser-Meyer-Olkin）value is 0.961, and the Bartlett spherical test P value is 0.000***, indicating that there is correlation between the variables, and the factor analysis is effective and appropriate. According to the factor load factor (as shown in Table 2), some common factor variances are less than 0.5, indicating that these variables have little correlation with independent variables. All these factors are removed, and the remaining 15 factors form the evaluation system.

Table 2: Factor load factor table

	Factored load factor after rotation	Common degree (common factor variance)
	Factor 1	
Network information platform	0.742	0.551
Network resource sharing	0.871	0.758
New media technology	0.806	0.649
Campus network resources	0.355	0.253
Network speed	0.423	0.401
Network office	0.855	0.731
Network humanistic environment	0.848	0.719
Network communication mode	0.812	0.659
Network information release	0.842	0.709
Participate in online activities	0.466	0.423
Network communication frequency	0.705	0.497
Online Q&A and live broadcast	0.777	0.604
Network class communication	0.762	0.58
Online and offline linkage	0.823	0.677
Multi-dimensional interaction	0.873	0.763
Online duration	0.458	0.414
Network communication language	0.868	0.753
Network teaching skills	0.836	0.699
Inspirational guidance	0.798	0.636
Use APP to learn	0.379	0.265

4.2. Create partition

Use SPSS software to realize multi-layer perceptron neural network, set random distribution scheme, create partition variables, input partition values, set parameters for training samples, test samples and

retention samples to 50%, 30% and 20% respectively. The summary of case processing is shown in Table 3, including 1539 cases allocated to training samples, 904 cases allocated to test samples, and 660 cases allocated to retention samples.

Table 3: Sample partition processing results

		N	percentage
sample	train	1539	49.6%
	test	904	29.1%
	keep	660	21.3%
Valid		3103	100%
exclude		0	
total		3103	

4.3. Specified architecture of neural network

The basic information of the specified architecture of the neural network is shown in Table 4. There are 15 units in the input layer, and the covariates are standardized by the rescaling method; The number of hidden layers is 1, and there are 8 units; In the output layer, there is only one "evaluation level" as the dependent variable, and there are four units, namely "excellent", "good", "pass" and "fail".

Table 4: Neural network information

Input layer	Covariant	1	Network information platform
		2	Network resource sharing
		3	New media technology
		4	Network office
		5	Network humanistic environment
		6	Network communication mode
		7	Network information release
		8	Network communication frequency
		9	Online Q&A and live broadcast
		10	Network class communication
		11	Online and offline linkage
		12	Multi-dimensional interaction
		13	Network communication language
		14	Network teaching skills
		15	Inspirational guidance
	Number of units a		15
	Rescaling method of covariates		Standardization
Hide Layer	Number of hidden layers		1
	Number of cells in hidden layer 1,a		8
	Activation function		Hyperbolic tangent
Output layer	dependent variable	1	Evaluation grade
	Number of units		4
	Activation function		Softmax
	error function		Cross entropy

4.4. Classification results

The classification results of the samples are shown in Table 5. The overall correct percentage of the neural network training samples is 95.5%; The overall correct percentage of the test sample is 93.9%; Figure 4 shows the cluster boxplot of the predicted quasi-probability of the training samples as well as the test samples. The X axis is the dependent variable of the evaluation grade, and the Y axis is the predicted quasi-probability. As can be seen from the boxplot, for the samples of evaluation grade, the prediction probability is above 90%.Figure 5 shows the ROC (receiver operating characteristic) curve. In machine learning, the most important parameter is ROC.The ROC parameter can be between-1 and+1, and the closer to 1, the higher the accuracy of the model. AUC (area under curve)is between 0 and 1. The closer the AUC is to 1, the better the diagnostic effect is; From Table 6, we can know the AUC value of each evaluation level, of which "excellent" is 0.989; "Good" is 0.99; "Pass" is 0.994; "Fail" is 0.999.

Table 5: Classification results

sample	Measured	forecast				
		excellent	good	pass	fail	Correct percentage
train	excellent	100	17	0	0	85.5%
	good	7	651	17	0	96.4%
	pass	0	14	451	8	95.3%
	fail	0	0	6	268	97.8%
	Overall percentage	7.0%	44.3%	30.8%	17.9%	95.5%
test	excellent	54	20	0	0	73.0%
	good	5	385	16	0	94.8%
	pass	0	6	252	3	96.6%
	fail,	0	0	5	158	96.9%
	Overall percentage	6.5%	45.5%	30.2%	17.8%	93.9%
keep	excellent	44	5	0	0	89.8%
	good	5	261	10	0	94.6%
	pass	0	11	201	6	92.2%
	fail	0	0	3	114	97.4%
	Overall percentage	7.4%	42.0%	32.4%	18.2%	93.9%
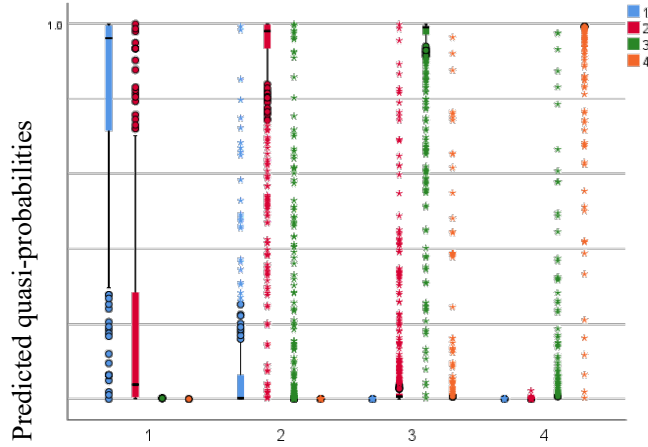
Figure 4: Prediction Chart
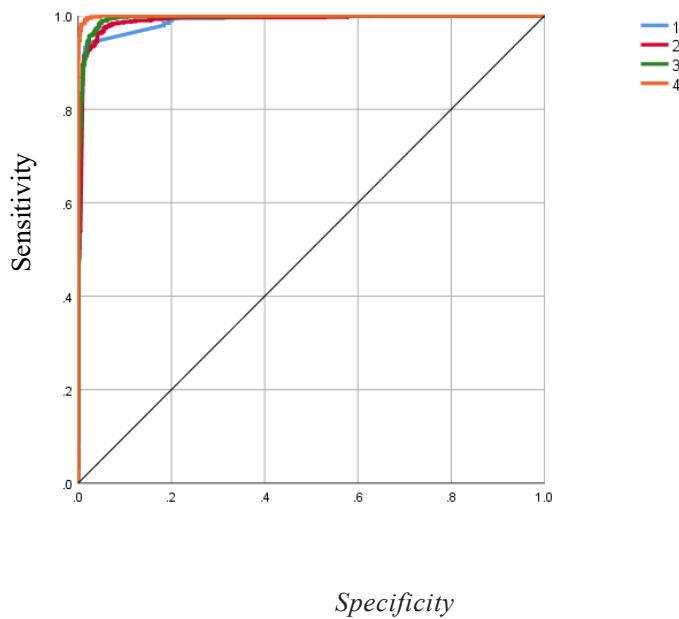
Figure 5: ROC curve

Table 6: AUC

		region
Evaluation grade	excellent	0.989
	good	0.990
	pass	0.994
	fail	0.999

4.5. Evaluation of the importance of classification variables

The importance evaluation of classification variables is an important indicator to consider the impact of each variable on the classification results. The normalized importance value is calculated by normalizing the gain value of each classification variable. Figure 6 shows the bar chart corresponding to the importance of each classification variable. The most important indicator is at the top, and the indicators are arranged in descending order. We can see that online and offline linkage, online humanistic environment, online defense and live broadcast, multi-dimensional interaction and network resource sharing are relatively important variables.
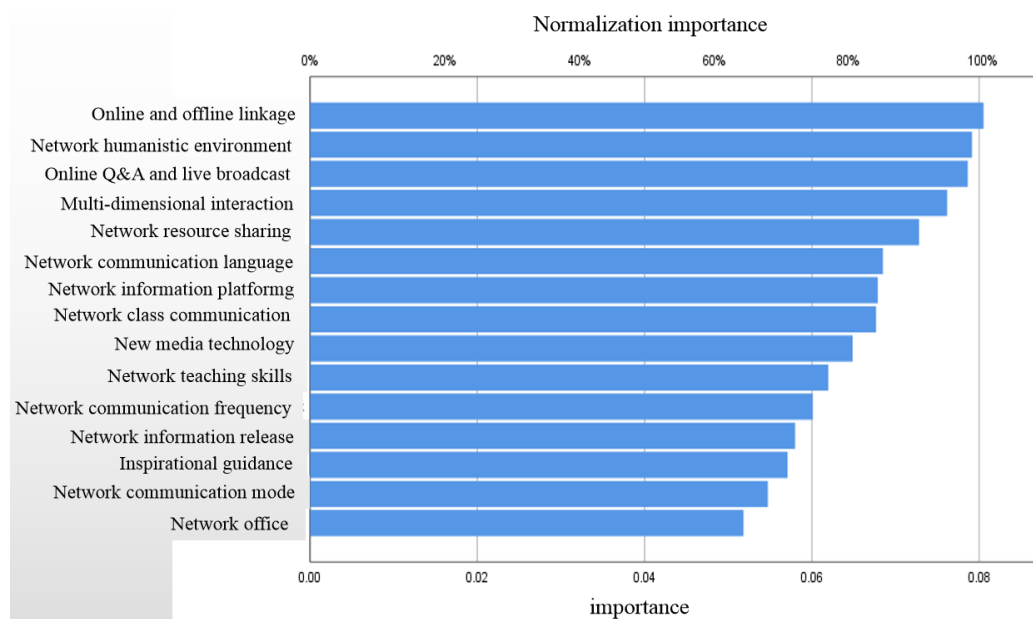

Figure 6: Importance of classification variables

5. Research discussion

This study proposes a research framework for the effectiveness evaluation of universities network ideological and political education methods based on MLP neural network, and validates the model with the data of six universities as an example. Through PCA algorithm, principal component analysis and data dimensionality reduction, the influential factors of college network ideological and political education methods with clear and clear influence are obtained, and the multi-layer perceptron neural network is used for training, The model of evaluation grade classification of network ideological and political education methods in colleges and universities is established, and the following main research conclusions are drawn.

First, the evaluation level of network ideological and political education methods in universities is comprehensively affected by multi-dimensional and different influencing factors such as educational means, educational methods and educational skills. In terms of educational means, the network humanistic environment and network resource sharing are the main variables that affect the evaluation level of educational methods, while the network office has a small impact on the evaluation level of educational methods. In terms of education methods, online Q&A, live broadcast and online class communication have an important impact on the evaluation level of education methods. In terms of educational skills, online and offline linkage, multi-dimensional interaction and online communication language are the main factors affecting the evaluation level of educational methods. The influencing

factors of the evaluation factors of the network ideological and political education methods in universities are complex. Therefore, we should be more aware of the complexity of the network ideological and political education in universities, and more aware of the importance of constructing the effectiveness evaluation system of the network ideological and political education methods in universities, and promoting the personalized development of students.

Second, from the classification results of the model, the results of the MLP neural network are ideal, and the correct percentage of training samples, test samples and adherence samples are higher than 90%.The average error rate was 5.57%. In the cluster box graph classification, the prediction probability of training samples and test samples is above 90%. In the ROC curve, The AUC values are all higher than 0.98. The prediction results of the effectiveness evaluation model of the network ideological and political education methods in universities based on the MLP neural network are basically consistent with the real situation, and the evaluation accuracy is high, which has been better than the accuracy of some relevant research at home and abroad, indicating that the model has certain effectiveness and application value. According to the design idea of the model, universities can expand to the field of teaching or management application in universities, excavate the value of university education data through data mining and analysis methods, and Promoting the improvement of university governance ability.

6. Conclusion

This study is based on the data analysis results of six universities and the classification model established. Whether it can be directly applied in other universities is still worth exploring. This study assumes that the six universities environments have the same impact on all individuals, but even the same school environment may have different impacts on different individuals. How much this affects the effectiveness of the classification model established can also be improved continuously.

Acknowledgments

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