

Fuzzy Clustering Prediction and Improvement Path Analysis of University Students' Physique

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ABSTRACT

It is difficult for traditional methods to enter the fields of biology, psychology, medicine and social sciences because there are too many factors and complicated rules in these disciplines. Complexity and accuracy often exclude each other, but complexity is compatible with inaccuracy, namely fuzziness. Therefore, a new fuzzy clustering prediction method of university students' physique is proposed, and the path of improving university students' physique is analyzed. This paper introduces the five indicators of young students' physique recognized by all countries in the world at present, and obtains the data structure of young students' physique files. Data pre-processing is realized by calculating the average and standard deviation of sample data, standard deviation processing of sample data and normalization processing of sample data. The sample matrix and fuzzy compatibility matrix are established based on the fuzzy clustering of university students' physique samples, and the fuzzy relation is further transferred equivalently. The transfer closure is obtained by matrix auto-multiplication method, and the appropriate cut-off set value is obtained. The similarity coefficients between the samples to be measured and each sample to be measured are calculated. The maximum similarity coefficients are found out and the classes of the samples to be measured are judged. By calculating the average indicator of each fuzzy clustering model, the fuzzy prediction analysis of university students' physique can be realized in two stages. On the basis of the above analysis, universities should promote the physical health level of university students in an all-round way by improving the physical function of campus natural environment, improving the scientific nature of sports facilities, carrying out physical education reform, cultivating students' scientific sports concept and good behavior habits. The experimental results show that the proposed method can effectively make clustering, and the purity and accuracy of clustering are high.

Keywords: University Students, Physique, Fuzzy Clustering, Prediction, Promotion Path

1. INTRODUCTION

Physical health, especially students' physical health, has been the focus of international and domestic sports, education and health research for more than ten years. Internationally, the study of university students' physical health has also been highly valued by all countries in the world. The research goal is to improve students' physical fitness, health and quality of life.

How to achieve a reasonable clustering and forecasting of physical education teaching has become a very important task in the reform of physical education. It is difficult for classical mathematical methods to enter the fields of biology, psychology, medicine and social sciences because there are too many factors and complicated rules in these subjects. Complexity and accuracy often exclude each other, but complexity is incompatible with inaccuracy, namely fuzziness. Therefore, fuzzy mathematics clustering prediction method has been applied in a wide range of fields [1-3].

Firstly, the given sample is analyzed and preprocessed, and the classification is most practical

according to the theory of fuzzy clustering analysis. For the predicted sample, the principle of maximum similarity coefficient with the measured sample can be used to judge which classification it belongs to, and the prediction status of the sample's physical health can be obtained [4].

2. METHODS

2.1 Data Structure of Physical Archives

In the field of medical archives and human science archives, there are physical examination archives, medical records Archives and physique archives. Each of them has its own corresponding data structure system, which reflects the essential attributes of the object under discussion. The selection of relevant parameters will determine the direction of work and success or failure [5].

This study introduces the following five items about the physical health of young students (male/female) which are generally accepted in the world at present [6]:

Klein index: (body weight / height × 1000): an effective index reflecting the morphological development and symmetry of the human body.

vital capacity index: (vital capacity / weight): a simple and effective index of human body function.

50 meters running: reflecting the speed and dexterity of the human body.

pull- up (male) / sit up (female): reflecting the flexibility of human body.

1000 meters running (male) /800 meters running (female): reflecting human stamina.

The above 3~6 indexes reflect the overall development level of human motor function.

From the data structure of this group of indexes, one is the morphological index, one is the functional index, four are the quality indexes, which is basically reasonable and effective. Although all kinds of indexes are different and the quality indexes are more appropriate, they reflect a reasonable and positive evaluation concept. Because many studies have shown that physical health and exercise ability are most closely related to physical strength.

2.2 Fuzzy Clustering Analysis of Physical Sample Data

Cluster analysis is a kind of mathematical method which gathers the similar characters in the sample into a group. It belongs to a branch of multivariate analysis of mathematical statistics. If combined with data processing method of fuzzy mathematics, it is fuzzy clustering analysis.⁷ This section carries on the fuzzy clustering to the university student's physique sample, analyzes the main mentality and its mathematics expression of this method.

Establishing a sample matrix: let n samples be clustered, if each sample has five indexes, then as ample matrix with n rows and five columns is constructed. Every row of a matrix is the whole data of a sample. If the matrix is V , there are:

$$V = \begin{bmatrix} v_{11}, v_{12}, v_{13}, v_{14}, v_{15} \\ v_{21}, v_{22}, v_{23}, v_{24}, v_{25} \\ \dots\dots \\ v_{n1}, v_{n2}, v_{n3}, v_{n4}, v_{n5} \end{bmatrix} \quad (1)$$

Establishing a fuzzy compatibility matrix: Computing the similarity between the samples of the touch compatibility matrix, set to U , there are many ways to calculate the similarity between the samples of

many options. We will only introduce one of them: U is a square matrix, where each element is μ_y :

$$\mu_y = \begin{cases} 1, & \text{if } i = j \\ \sum_{k=1}^5 x_{ik} \cdot x_{kj}, & \text{if } i \neq j \end{cases} \quad (2)$$

$$U = \begin{bmatrix} \mu_{11}, \mu_{12}, \dots, \mu_{1j} \\ \mu_{21}, \mu_{22}, \dots, \mu_{2j} \\ \dots\dots \\ \mu_{i1}, \mu_{i2}, \dots, \mu_{ij} \end{bmatrix} \quad (3)$$

2.3 Fuzzy Clustering of University Students' Physique

Firstly, the transitive closure $t(\tilde{U})$ of \tilde{U} is obtained by the matrix self-multiplication method.

The confidence level $\lambda \in [0,1]$ is chosen appropriately, the λ -section matrix $t(\tilde{U})_\lambda$ of $t(\tilde{U})$ is obtained, and then classified according to $t(\tilde{U})_\lambda$.

The classification principle is as follows:

$$\text{If } t(\tilde{U}) = \left(\tilde{u}_{ij} \right)_{n \times n}, \quad t(\tilde{U})_\lambda = \left(\tilde{u}_{ij}(\lambda) \right)_{n \times n},$$

$$\tilde{u}_{ij}(\lambda) = \begin{cases} 1, & \tilde{u}_{ij} \geq \lambda \\ 0, & \tilde{u}_{ij} < \lambda \end{cases}$$

For $v_i, v_j \in V$, if $\tilde{u}_{ij}(\lambda) = 1$, it should classify objects v_i and v_j on the λ level into the same category. When λ selects different values in $[0,1]$, the classes will change accordingly.

According to the more practical classification, the appropriate AA value is acquired, and the similarity coefficient between the samples to be measured and each sample of the measured results is calculated, and then the maximum similarity coefficient is found out, so as to judge the class of the sample to be tested [7-8].

2.4 Path Analysis of Improving University Students' Physique

Based on the above analysis, universities must constantly innovate ways to promote the physical health of university students in an all-round way, such as improving the physical function of campus natural environment, improving the scientific nature of sports facilities, carrying out physical education reform, cultivating students' scientific sports concept and good behaviors.

Universities should make great efforts to improve the natural environment of campus, design roads and plan buildings according to the natural laws of university students' study and life, so as to provide good natural protection for university students' life, and at the same time, when designing roads and buildings, these objective physical training skills are enhanced. For example, some roads can be designed as jogging paths, and some green spaces can be seamlessly docked with the stadium [9]

University students' physical exercise cannot be confined to physical education class, it should pay attention to open up organized, multi-form extracurricular sports activities, expand the scope of physical education curriculum, so that students learn and master sports knowledge and skills through multiple channels, and students not only enhance their physique, but also lay a foundation for lifelong sports. It is suggested that the teaching mode of sports club be realized. According to their physical conditions, interests and hobbies, students can choose their own courses, teachers and classes, and study and exercise in different sports clubs. the integrated teaching mode of sports clubs in and out of class is constructed, to improve the teaching effect and promot the healthy growth of students, which is conducive to the cultivation of students' lifelong sports habits and campus sports cultural activities, and is conducive to the cultivation of students' professional ability [10].

3. RESULTS

In the physical health test database of a college in 2014, 100 boys and 100 girls of grade 2014 are selected for clustering and forecasting analysis. The physical health indexes of university students in this database include Ketolai index, vital capacity index, endurance score, flexibility strength score and speed dexterity score. The five indices are extracted as the features of fuzzy clustering, and each student's five physical health indexes forms a sample point. Thus, 200 clustering

sample points can be obtained. Through the effective fuzzy clustering and forecasting of samples, the students can be classified and predicted according to the similarity of five physical health indexes, such as body mass index, vital capacity, endurance, flexibility and dexterity of speed, so as to achieve more accurate and better grouping according to different physiques and formulate corresponding teaching methods. Effective measures are taken to meet the teaching requirements of students in accordance with their aptitude.

The membership matrix U is obtained by clustering 200 samples, and then the samples are classified according to the criterion of maximum membership. The membership classes of each sample are determined, and the optimal clustering results are obtained, which is described in Figure 1.

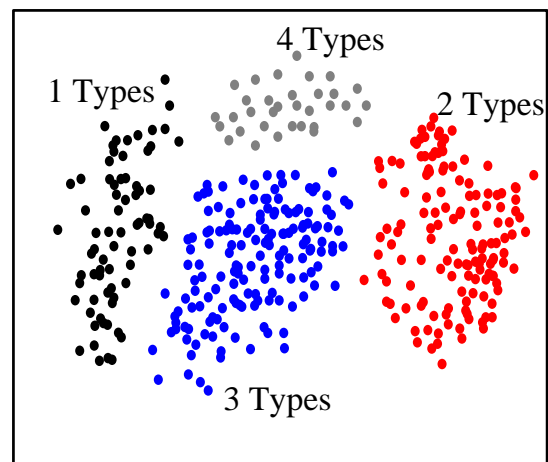


Fig 1. Results of fuzzy clustering

In Figure 1, Class 1 represents the students with excellent physical quality, Class 2 represents the students with good physical quality, Class 3 represents the students with general physical quality, and Class 4 represents the students with poor physical quality. In order to compare the results of various physical health indices of the four kinds of university students, the comparison charts of Ketolai index, vital capacity, endurance, flexibility and dexterity are drawn, as shown in Figure 2.

As can be seen from Figure 2, the average Klein index of the students in Class 1 is about 0.52, with a uniform figure, and they are not fat or thin, while the scores of vital capacity, endurance, flexibility and dexterity are relatively higher than those of other students; the average Klein index of the students in Class 4 is about 0.32, with a slim body. The results of vital capacity, endurance, flexibility and dexterity are lower than those of other students.

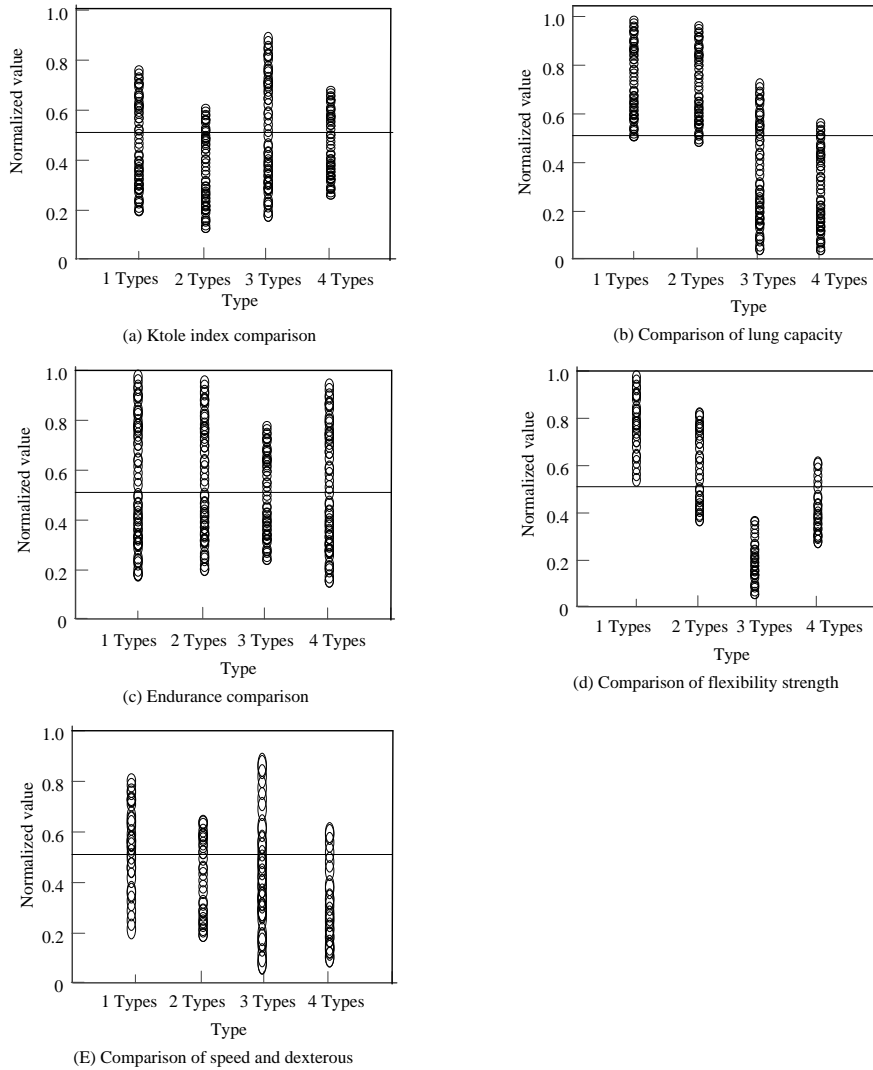


Fig 2. Comparison of four classes of university students' physique indexes

4. DISCUSSION

The study of physique level should include the comprehensive evaluation of shape and function index. The single factor analysis method cannot fully reflect the physique condition. It is of practical significance to establish the comprehensive grade standard and evaluation method of shape and function index.

In this study, the fuzzy recognition method of university students' physique level is evaluated comprehensively, and 200 samples are clustered to get the membership matrix U. Then the samples are classified according to the evaluation criterion of maximum membership degree. The subordinate categories of each sample are determined to get the best clustering results. The comparison diagrams of the four types of students' Ketolai index, vital capacity, endurance, flexibility and dexterity are drawn. The results show that the clustering method of university Students' physical health classifies the students with relatively good grades into one category and the students

with relatively poor grades into another category, which is more reasonable. In teaching, teachers should select different teaching materials and methods according to the actual conditions of each kind of students' physique, and focus on cultivating the weak links of all kinds of students, so that students' physique can be developed in an all-round and balanced way.

5. CONCLUSIONS

It is a very important task in the reform of physical education to teach students in groups according to their physical qualities, to teach them in accordance with their aptitude and to treat them differently. There are many shortcomings in traditional methods, so it is not suitable to be popularized. In this study, fuzzy clustering method is introduced into university students' physique clustering and forecasting, and a method of university students' physique clustering and forecasting based on fuzzy method is proposed. By comparing the physical condition of different types of university students, the rationality of the method is verified. Practice shows that

the proposed method can effectively realize the clustering of university students' physique, and the clustering and forecasting results are reliable, which is convenient for application and popularization.

This study presents a more convenient fuzzy clustering analysis method for predicting university students' physique. Although it is simple and operable, it is impossible to find a λ value to make the classification conform to reality in more complex classification applications. It can also use the BP algorithm in the iterative self-organizing analysis technology (ISODATA) or neural network for classification.

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