

Evaluation Method of Physical Education Students' Mental Health based on Multi-source and Heterogeneous Data

YongCheng WU

Anhui Technical College of Mechanical and Electrical Engineering, Anhui Wuhu, 241000, China

Abstract—To enhance the ability to evaluate the mental health status of physical education students, a method of evaluating the mental well-being state of physical education students based on multi-source heterogeneous data mining is proposed. A fuzzy information detection model of multi-source heterogeneous data on the mental health status of physical education students is constructed, with four factors as dependent variables: compulsion, interpersonal sensitivity, hostility, and depression. Combined with the hierarchical index parameter detection and analysis method, the statistical analysis of multi-source heterogeneous info is accomplished. Based on the factor extraction outcomes of multi-source heterogeneous info, combined with the subspace heterogeneous fusion method, an estimated parameter feature clustering model is established. Combining the results of characteristic distributed clustering and linear regression analysis, the psychological well-being state evaluation of physical education students is realized. The results of empirical analysis show that this method has higher accuracy and better feature resolution in the evaluation of the mental well-being state of physical education students, which improves the reliability and confidence level of the assessment of the mental well-being status of physical education students.

Keywords—Multi-source heterogeneous data; sports major; students; mental health; assess the situation; confidence level; linear regression analysis

I. INTRODUCTION

Based on the analysis of the rules of school physical education, the physical education major teaches the basic theory, knowledge, and skills of physical education major, and trains students who have talents and expertise in the field of education, can engage in physical education teaching, extracurricular sports activities, extracurricular sports training, and competitions, and can conduct scientific research, management, and guidance. There are obvious differences between physical education majors and other majors in the ways of attending classes, practicing after class, and conducting experiments and different training methods will develop students' different ways of thinking and attitudes toward life [1]. For example, "Research on Personality Differences between Physical Education Majors and Students of Science and Liberal Arts" indicates that there are great disparities in personality among physical education majors and students of other training methods. The research on the differences in personality and thinking mode between domestic liberal arts students and science students also shows that there are significant differences in personality and thinking mode

among students cultivated under different training modes. "Combined with the research, it is found that because of the different training methods, the mental well-being status of university students majoring in physical education will be different from that of other majors [2]–[4]. Therefore, knowing the mental health status of university students majoring in physical education and carrying out targeted mental health education are also beneficial to better professional talents who meet the training objectives of physical education [5].

Chinese scholars have summarized mental health. Broadly speaking, mental well-being implies an effective, satisfying and stable mental status. In a narrow sense, mental well-being implies the full and consonant procedure of individuals' primary mental actions, that is, the complete and coordinated knowledge, emotion, will, behavior, and personality that can adjust to the community and keep pace with the community. By studying the evaluation model of physical, intellectual, and emotional development of physical education students' mental health, combined with multi-source heterogeneous data fusion analysis of physical education learners' psychological wellness performance, the evaluation level of physical education learners' psychological wellness can be improved, and the study on related calculation methods of physical education students' mental health has attracted great attention [6].

In response to the above issues, this article proposes a method for evaluating the mental health status of sports major students based on multi-source heterogeneous data mining. This method utilizes a fuzzy information detection model and a hierarchical indicator parameter detection analysis method to evaluate four factors: compulsion, interpersonal sensitivity, hostility, and depression. Establish an estimation parameter feature clustering model through multi-source heterogeneous data feature extraction and subspace heterogeneous fusion methods. By combining the results of feature distributed clustering and linear regression analysis, the evaluation of the psychological health status of sports major students is achieved. Empirical analysis shows that this method has good performance in evaluating accuracy, feature resolution, and reliability.

II. RELATED WORKS

The study on the evaluation of physical education students' mental well-being is on the basis of the reliability fusion and cluster analysis detection of data. Joined with the correlation feature detection and extraction way, the evaluation and feature fusion of physical education students' mental health can

improve the balance of multi-source heterogeneous data output of physical education students' mental health [7]. In the traditional method, there are mainly fuzzy aggregation scheduling methods, PID scheduling methods and self-adaptive equilibrium scheduling methods for the evaluation of physical education learners' psychological wellness under the coordinated improvement of physical intelligence and emotion. The author in [8] used symptom checklist to test 15392 freshmen from 2013 to 2019, with P values <0.001 However, this method cannot fully consider the factors of gender, nationality, and professional category when carrying out psychological counselling. The author in [9] proposed an automatic evaluation method of College Students' mental health based on multimodal data fusion calculation Build a multimodal psychological assessment data set (ja-ipad) model to improve students' psychological files, accurately intervene in students' psychology, and optimize mental health services to provide decision-making basis and technical support, but this method has problems of poor anti-interference and weak feature resolution in the procedure of College Students' mental well-being assessment.

III. MULTI-SOURCE HETEROGENEOUS DATA MINING THEORY

In the procedure of informatization construction, because of the stage, technicality, and other economic and human features of the construction and implementation of data management systems of various business systems, a huge amount of business info with several storage ways has been accumulated in the development process, including different data management systems[10], [11]. From simple file databases to complex system databases, they constitute multi-source heterogeneous info. Multi-source data fusion is to combine several info data, capture the specification of distinct info origins, and then extracts unified, better and richer data than single info. Multi-source heterogeneous data comes from multiple data sources, including data sets collected by different database systems and different devices in their work. Heterogeneous data includes many types of structured data, semi-structured data, and unstructured data. There is no uniform standard in the formation of different types of data, which leads to the "heterogeneous" characteristics of data. According to the requirements, the data are calculated and the data model is automatically established, which effectively reduces the burden of statistical work and improves the efficiency of data analysis.

IV. DATA ANALYSIS AND STATISTICAL ANALYSIS ON EVALUATION OF PHYSICAL EDUCATION STUDENTS' MENTAL HEALTH

A. Spatial Cluster Distribution Structure of Evaluation Data of Physical Education Students' Mental Wellness

Aiming to conceive the assessment of physical education students' mental wellness under the coordinated development of physical intelligence and emotion, a fuzzy information detection model of multi-source heterogeneous data of physical education learners' psychological wellness under the

coordinated improvement of physical intelligence and emotion is constructed[12], [13]. According to the SCL-90 questionnaire, among various factors, if the score of a certain factor is more than or equal to 3, the subject may have a moderate degree of mental health problems, while the score of any one of the 10 symptom factors ≥ 2 indicates. If any factor scores 2.2 and < 3 , the subjects can be considered to be in a sub-health psychological state. Less than or equal to 2 has no mental health problems. According to the survey, the number of students with medium or above mental disorders accounted for 4.69% of the total number, which was 13. The amount of students in the sub-health state is 86, accounting for 31.05% of the whole. The amount of students in mental wellness is 178, accounting for 64.26% of the whole amount. The fuzzy correlation analysis of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is accomplished using the feature extraction algorithm of high-order statistics, and the fuzzy decision figure of mining multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is established. The fuzzy information cluster analysis of multi-source heterogeneous data of physical education learners' psychological wellness under the coordinated improvement of physical intelligence and emotion is carried out, and the distributed detection model of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is established[14]. The statistical spatial information category distribution of multi-source heterogeneous data of physical education trainees' psychological well-being under the coordinated improvement of physical intelligence and emotion is shown in Fig 1.

Based on the statistical spatial information category dispensation pattern of multi-source heterogeneous data of physical education trainees' psychological wellness under the coordinated improvement of physical intelligence and emotion shown in Fig 1, the attribute scheduling of multi-source heterogeneous data of physical education trainees' psychological well-being under the coordinated improvement of physical intelligence and emotion is accomplished using pointer fusion indicator way, and the spatial coordinate block distribution model of multi-source heterogeneous data of physical education trainees' psychological wellness under the coordinated improvement of physical intelligence and emotion is established[15]. Improve the statistical analysis and mining ability of multi-source heterogeneous data of physical education trainees' psychological well-being under the coordinated improvement of physical intelligence and emotion and build a pointer scheduling model of multi-source heterogeneous data of physical education trainees' psychological wellness under the coordinated improvement of physical intelligence and emotion as presented in Fig 2.

Based on the mental wellness state evaluation model of physical education students shown in Fig 2, the fuzzy correlation of the mental wellness state evaluation data of physical education students is analyzed.

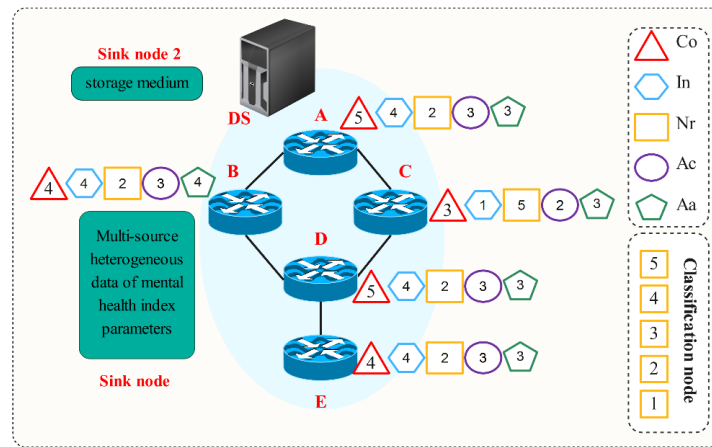


Fig. 1. Statistical spatial information category distribution of mental health evaluation data of physical education majors.

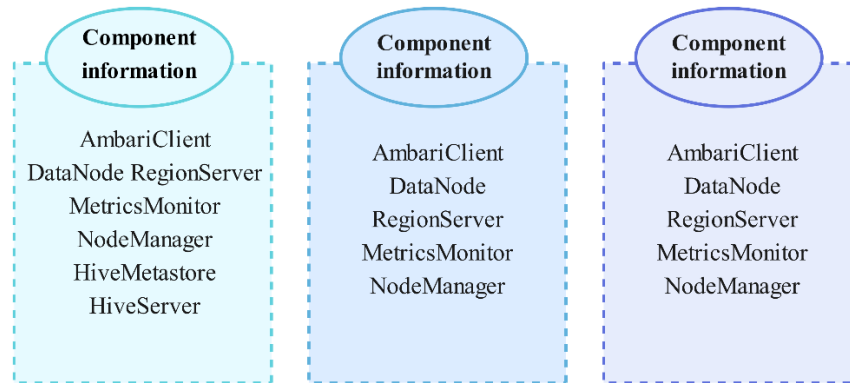


Fig. 2. Evaluation model of the mental wellness status of physical education majors under the coordinated improvement of physical intelligence and emotion.

B. Fuzzy Correlation Analysis of the Evaluation Data of Physical Education Students' Mental Health Under the Coordinated Development of Physical Intelligence and Emotion

The fuzzy correlation analysis of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is accomplished using the feature extraction way of high-order statistics[16]–[18]. The outcome autocorrelation factor accordant type of multi-source heterogeneous info of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is constructed, and the fuzzy clustering feature coefficient of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is calculated[19]–[21], which is defined as:

$$A_j(L + 1) = \frac{1}{n_j} \sum_{i=1}^k X_i^j \quad j = 1, 2, \dots, k \quad (1)$$

Wherein, n_j is a multi-source feature of the physical education students' mental health status, X_i^j is a multi-source heterogeneous spatial distribution set of physical education students' mental health status, and k is an embedded dimension. By analyzing the output difference features of multi-source heterogeneous data of physical education learners'

psychological well-being status under the coordinated improvement of physical intelligence and emotion, the fuzzy cluster analysis of multi-source heterogeneous data of physical education learners' psychological well-being status under the coordinated improvement of physical intelligence and emotion is carried out by using high-order statistical analysis method, and the discrete scheduling formula of multi-source heterogeneous data of physical education learners' psychological well-being status under the coordinated improvement of physical intelligence and emotion is defined as[22], [23]:

$$C(L) = \sum_{j=1}^k \sum_{k=1}^{n_j} (||x_k^j - A_j(L)||)^2 \quad (2)$$

Wherein $x(t)$ is the fuzziness of multi-source heterogeneous data sets of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion and $A_j(L)$ represents the similarity characteristic quantity. Fuzzy data clustering and distributed discrete scheduling ways are adopted to control the output reliability of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion. Establishing the attribute cluster distribution model of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion can realize the statistical detection of multi-source heterogeneous data sets of physical education learners' psychological well-being under the

coordinated improvement of physical intelligence and emotion[24], [25]. Combining with the similarity feature analysis method, the multi-source heterogeneous data mining feature quantity of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is established, and the residual distribution matrix of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is as follows:

$$D(x_i, A_j(L)) = \min\{D(x_i, A_j(L))\} \quad (3)$$

Wherein, $D(x_i, A_j(L))$ is the global weighted value of the evaluation of physical education students' mental health under the coordinated development of physical intelligence and emotion at the i point. A fuzzy information detection model of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is constructed. The fuzzy correlation analysis of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is accomplished using a high-order statistical detail mining way, and data mining and fuzzy clustering are carried out according to the feature extraction results.

V. EVALUATION AND OPTIMIZATION OF PHYSICAL EDUCATION STUDENTS' MENTAL HEALTH STATUS

A. Multi-source Heterogeneous Data Mining of Physical Education Students' Mental Health Under the Coordinated Development of Physical Intelligence and Emotion

Based on the fuzzy information detection model of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion, and the fuzzy correlation analysis of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion by using high-order statistical feature extraction method, the communication link data mining is carried out. This paper puts forward an evaluation method of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion according to multi-origin heterogeneous info mining. The outcome autocorrelation factor accordant type of multi-source heterogeneous info of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is formed, and the numerical evaluation of multi-source heterogeneous info of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is carried out by combining the hierarchical index parameter detection and analysis method. By adopting the multi-source heterogeneous data mining algorithm, the feature distribution set of data sampling node I at time T is expressed as $V = \{v_{ij} | i = 1, 2, \dots, c, j = 1, 2, \dots, s\}$, t is the offset characteristic quantity of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion, and S is the

weighting coefficient of evaluation of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion. Combining the semantic factor evaluation way with a fuzzy semantic factor rule set for evaluation of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is formed, and the adaptive weighting coefficient of multi-source heterogeneous data of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is as follows[26]:

$$H(t) = \hat{h}(t) * p(t) * p(-t) \\ = \left(\sum_{i=1}^M \hat{h}'_i(t) * h_i(-t) \right) * p(t) * p(-t) \quad (4)$$

Wherein, $\hat{h}(t)$ is the regression analysis value, $p(t)$ is the dynamic fitting parameter, $\hat{h}'_i(t)$ is the distribution function of transmission reliability, and $\max_i Freq_{i,j}$ is the residual specification amount of physical education students' mental wellness analysis and optimization under the coordinated development of physical intelligence and emotion among d_j . k_i is defined as the fuzziness of multi-source heterogeneous data mining of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion;

$$p_{ri}(t) = p(t) * h_i(t) + n_{pi}(t) \quad (5)$$

$$S_{ri}(t) = S(t) * h'_i(t) + n_{si}(t) \quad (6)$$

Wherein, $S(t)$ and $h'_i(t)$ are the fuzzy rule features of the physical education students' mental health evaluation under the coordinated development of physical intelligence and emotion and $n_{si}(t)$ is the interference item of multi-source heterogeneous data mining. The fuzzy clustering way is attained to optimize the shortest path of physical education students' mental wellness evaluation under the coordinated development of physical intelligence and emotion[27], and its calculation formula is:

$$r'_i(t) = S_{ri}(t) * p_{ri}(-t) \\ = S(t) * p(-t) * h'_i(t) * h_i(-t) + n_{1i}(t) \quad (7)$$

Wherein, $S_{ri}(t)$ is the joint matching coefficient, $S(t)$ is the similarity characteristic quantity, and $n_{1i}(t)$ is the dynamic interference component. Using the statistical information analysis method, this paper establishes the correlation distribution set of multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion. On this basis, the spherical test of KMO and Bartlett is carried out on the scale (the test results show whether the scale can be used for exploratory feature evaluation), and then the exploratory feature evaluation is accomplished. Generally speaking, when the KMO test value is above 0.8, it is suitable for exploratory factor analysis, and Bartlett's spherical test value needs to reach a significant level, that is $\text{Sig} < 0.05$, then exploratory factor analysis can be carried out on this scale. Therefore, the spherical test of KMO and Bartlett is required for the pre-test

psychological resilience scale, and the experiment outcomes are presented in [28], [29] (12 direction scoring questions have been preprocessed). The fuzzy data factor evaluation way is attained to perceive the outcome autocorrelation factor accordant of multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion and to improve the ability of mining multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion.

B. Evaluation of Mental Health Status of Students Majoring in Physical Education Under the Coordinated Development of Intelligence and Emotion

Based on the multi-source cluster analysis method of the split grid, a multi-source heterogeneous data mining model of the physical education students' mental health status under the coordinated development of physical intelligence and emotion is established. The feature extraction results are evaluated by the hierarchical index parameter detection method. The global variables are set, and the fuzzy partition coefficient of physical education students' mental health status evaluation under the coordinated development of physical intelligence and emotion is established as follows:

$$V_i = \frac{\sum_{k=1}^m (\mu_{ik})^m x_k}{\sum_{k=1}^m (\mu_{ik})^m} \quad (8)$$

Where, μ_{ik} represents the median of mental wellness evaluation of physical education students under the coordinated development of physical intelligence and emotion, m is the lower bound of mental wellness evaluation of physical education students under the coordinated development of physical intelligence and emotion, and it is the median of multi-source heterogeneous data of mental wellness of physical education students under the coordinated development of physical intelligence and emotion, and n represents the minimum statistical characteristic quantity of multi-source heterogeneous data of mental wellness of physical education students under the coordinated development of physical intelligence and emotion in all dimensions. Based on the detail mining outcomes of multi-source heterogeneous info of physical education students' mental health under the coordinated development of physical intelligence and emotion, the hierarchical index parameter detection method is adopted to evaluate the mental health of physical education students under the coordinated development of physical intelligence and emotion. The great info extraction model is shown below:

$$P_u = \frac{|\sum_1^{N_R} s(i,t)|}{V} = \frac{N_R}{V} \quad (9)$$

Wherein, $s(i,t)$ is a linear fitting parameter of multi-source heterogeneous data of physical education students' mental health status, N_R is a multi-source decision function, and V is KMO test value. Under the decision tree model of physical education students' mental health evaluation data distribution under the coordinated development of physical intelligence and emotion, this paper adopts a multi-source heterogeneous data mining algorithm to carry out self-adaptive optimization in the procedure of physical education students' mental wellness evaluation under the coordinated development of physical

intelligence and emotion, with four factors of compulsion, interpersonal sensitivity, hostility and depression as dependent variables. Combined with the hierarchical index parameter detection and analysis method, this paper makes a statistical analysis of multi-source heterogeneous data on physical education students' mental health under the coordinated development of physical intelligence and emotion. Based on the detail mining outcomes of multi-source heterogeneous data of physical education students' mental health, the analysis of physical education students' mental wellness is perceived.

VI. SIMULATION AND RESULT ANALYSIS

Aiming to confirm the applying performance of this way in the analysis of physical education students' mental wellness, a simulation examination evaluation was applied. In order to ensure the effectiveness of the experiment, the experimental parameters of this article are set as follows:

- 1) *Fuzzy information detection model*: clustering number 4.
- 2) *Detection and analysis method for hierarchical index parameters*: significance level 0.05.
- 3) *Feature extraction and subspace heterogeneous fusion methods*: Dimension 10 of principal component analysis (PCA), hyperparameter lambda=0.5 of subspace fusion methods.

Among them, the comparative method uses the corresponding parameters used in its experiment, and will not be introduced in detail here.

Matlab was used for the algorithm processing of the analysis of physical education students' mental wellness, and the number of nodes for multi-source heterogeneous data sampling of the physical education students' mental well-being was set to 400. The Sink root node of the physical education students' mental well-being evaluation is 35, the Sink source node number of the physical education students' mental well-being evaluation is 6, the length of multi-source heterogeneous data sampling of physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion is 3000, and the distribution characteristic resolution of association rules of physical education students' mental health evaluation is 34Bps/s, The sampling frequency of multi-source heterogeneous statistical features for the analysis of physical education students' mental well-being is 24Hz, and the sampling frequency of autocorrelation features is 46Hz. Based on the earlier principles, the evaluation of physical education students' mental wellness under the coordinated development of physical intelligence and emotion is carried out. Same to the exploratory factor analysis method used in the preliminary investigation, the test results of KMO and Bartlett are shown below. Cronbach's Alpha Reliability Analysis Table, a positive scale of psychological toughness, is constructed. The KMO value of this scale is 0.915, and Bartlett's test value is 0.000 (<0.05). This scale is very suitable for factor analysis. By using principal component analysis and tilt rotation method, 10 common factors were extracted, the maximum convergence iteration times were 25, and the cumulative contribution rate reached 60.00% for observation. Factor analysis one by one

eliminated KL3, KL10, KL29, KL47, KL17, KL18, KL51, KL57, KL6, KL15, KL34 and KL. After 15 times of factor extraction, the load value of each factor is above 0.4, and the cumulative variance is 60.00%, that is, the total explanation rate of the factors is 60.00%, which has a high explanation rate. The reliability of 60 items in 602 questionnaires of middle school students' mental health scale was analyzed, and Cronbach's Alpha coefficient was 0.929, $\alpha > 0.85$, which indicated that the reliability of the formal survey scale was good.

Combined with the results of the exploratory factor analysis of the formal psychological resilience scale, the confirmatory feature evaluation was applied with statistical software AMOS 20.0, the path significance was estimated by maximum likelihood estimation, and the fitting degree of the structural equation model was tested. The model was modified by combining factor load and model fitting index, and four factors, compulsion, interpersonal sensitivity, hostility, and depression, were taken as dependent variables. The distribution of multi-source heterogeneous data on physical education learners' psychological well-being under the coordinated improvement of physical intelligence and emotion was obtained as shown in Fig. 3.

The analysis shows that the factor loads of C15, C16, and C17 are negative, and the factor loads of C19 and C22 are less than 0.4. The load of the C18 factor in interpersonal assistance is negative, so there is only one factor in the dimension of positive cognition, so the dimension of positive cognition is deleted.

Fig. 3 shows that there are three impulse response waves in the obsessive-compulsive mental health state, two impulse waves in the interpersonal sensitive state and hostile state, and two shock waves in the depression state. The pattern in this article is able to precisely detect the multi-source heterogeneous data feature points of physical education majors' mental health state. At the same time, it is found that the fitting degree of the first model is not good in the absolute fitting index and relative fitting index of the model fitness test.

According to the correction index given by AMOS software, the model is modified by the residual correction method, with four factors of compulsion, interpersonal sensitivity, hostility, and depression as dependent variables. The final verification path correction result of the psychological resilience scale is shown in Fig. 4.

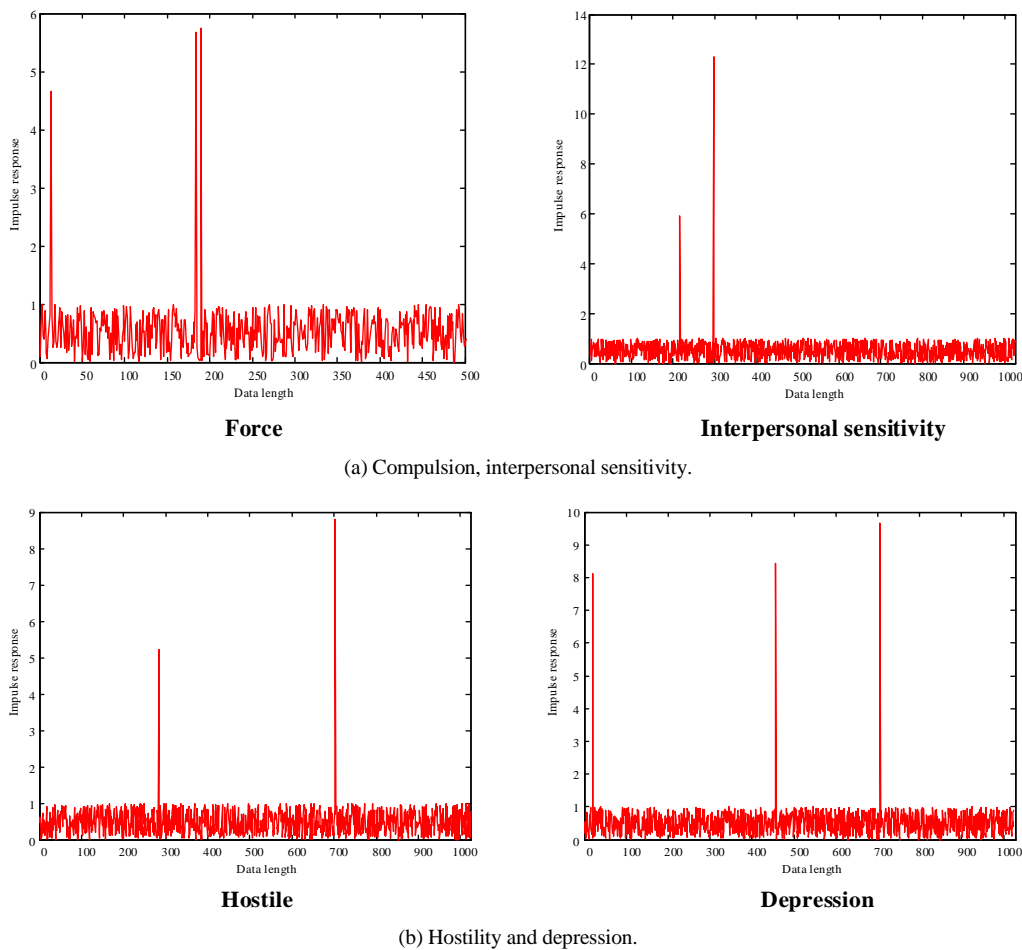


Fig. 3. Multi-source heterogeneous data distribution of physical education students' mental health status.

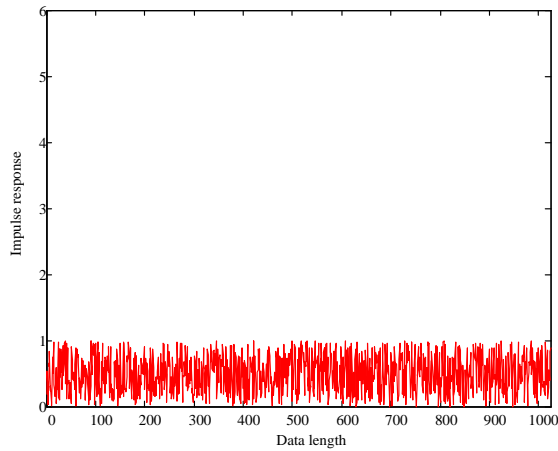


Fig. 4. Validation path correction results of the psychological resilience scale.

According to the analysis of Fig. 4, the multi-source heterogeneous mining is realized by this method, which reduces the risk of university students' mental well-being, suppresses the impulse wave of mental wellness risk state, establishes the regression analysis model of multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion, and extracts the statistical characteristic quantity of multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion. Based on the factor mining outcomes of multi-source heterogeneous info of physical education students' mental health, the health assessment is realized. It is concluded that all fitting indexes of the psychological resilience scale have reached an acceptable or good level. It proves that the structure of the revised psychological resilience scale has reached a stable state and is suitable for later research and analysis. The path coefficients of D12 and D23 in the obsessive-compulsive dimension, D4, D45, and D59 in the interpersonal tension and sensitivity dimension, D36 in the learning stress dimension, and D1 and D9 in the maladjustment dimension are all less than 0.4. Therefore, these items are deleted and combined with the model fitting index, it is found that the first Chinese middle school students' mental health scale model is not good. This way is able to effectively perceive the multi-source heterogeneous data mining of physical education students' mental health, improve the clustering ability and output balance of the info, and test the accuracy of several ways in evaluating physical education students' mental health. The comparison results are shown in Table I. From the analysis of Table I, it is known that the accuracy of this method in evaluating physical education students' mental health is high.

This algorithm is for analyzing the abnormal risk probability of mental wellness of physical education students in the 2019 academic year. The statistical results are shown in Fig. 5.

Through the simulation results in Fig. 5, it can be seen that the obtained probability coefficient is highly compatible with the actual probability coefficient. Using this algorithm can effectively evaluate the normal probability and abnormal

probability of mental health of sports students in the 2019 academic year, which shows that this algorithm can effectively evaluate the mental health status of sports students.

On this basis, by comparing the methods of [5] and [7], the calculation complexity of the proposed algorithm is counted (Table I). The shorter the time of the algorithm, the lower is the calculation complexity. Therefore, the experiment is carried out with the evaluation time as the test index, and the experimental results are shown in Fig. 6.

As shown in Fig. 6, under the same conditions, the proposed method takes the shortest time, indicating that the proposed method has the lowest computational complexity, the strongest operability, and high practical applicability.

TABLE I. COMPARISON OF EVALUATION ACCURACY OF THE MENTAL HEALTH STATUS OF STUDENTS MAJORING IN PHYSICAL EDUCATION UNDER THE COORDINATED DEVELOPMENT OF PHYSICAL INTELLIGENCE AND EMOTION

Iterations	Methods of this paper	Reference [5]	Reference [7]
20	0.976	0.854	0.887
40	0.978	0.877	0.892
60	0.999	0.924	0.925
80	1	0.946	0.943

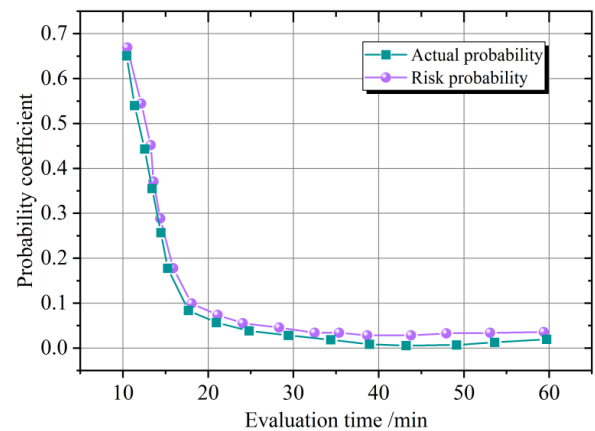


Fig. 5. Probability assessment results of abnormal mental health risk.

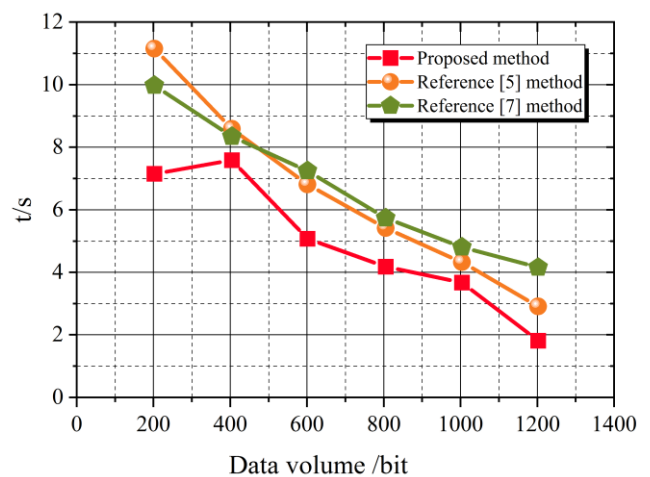


Fig. 6. Comparison of evaluation time of different methods.

VII. DISCUSSION

Based on the above research results, it can be concluded that this method provides a more comprehensive perspective for the evaluation of the mental health status of sports majors by integrating data from different sources and types.

In reality, the mental health issues of sports major students are of great concern. Using multi-source heterogeneous data for evaluation can better capture multidimensional information of individuals and identify potential mental health risk factors. In addition, the introduction of fuzzy information detection models, hierarchical index parameter detection and analysis methods, feature extraction, and subspace heterogeneous fusion techniques make the evaluation indicators more accurate and reliable.

However, there are still some challenges and room for improvement in further applications. The effective integration and processing of different types of data is a complex task that requires further optimization and exploration of methods and models suitable for different data types. In future research, it is recommended to further expand the scope of multi-source heterogeneous data evaluation and strengthen research on data preprocessing, feature selection, and model optimization.

VIII. CONCLUSIONS

In this article, an evaluation method of physical education students' mental health based on multi-source heterogeneous data mining is proposed. The output autocorrelation characteristic matching model of multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion is constructed, and the statistical analysis of multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion is carried out by combining the hierarchical index parameter detection and analysis method, and the fuzzy segmentation model of evaluation of physical education students' mental health under the coordinated development of physical intelligence and emotion is established. Multi-source heterogeneous data mining algorithm is used to self-adaptively optimize the evaluation process of physical education students' mental health under the coordinated development of physical intelligence and emotion, so as to realize the evaluation of physical education students' mental health under the coordinated development of physical intelligence and emotion. The analysis shows that this method has good balance and high accuracy in scheduling multi-source heterogeneous data of physical education students' mental health under the coordinated development of physical intelligence and emotion. Through empirical analysis, the following conclusions are also drawn:

First, the overall situation of physical exercise of students majoring in physical education is good. The overall average of psychological resilience is high, and the overall average of mental health is high.

Secondly, the physical exercise behavior of students majoring in physical education shows significant gender and grade differences at the overall level; there are significant grade differences in its sub-dimensions, and there are

significant gender differences in the intensity and time of physical exercise.

Thirdly, there are significant grade differences in the overall level of physical education major students' psychological resilience and its sub-dimensions; there are significant gender differences in their sub-dimension goal concentration and emotional control.

Fourthly, there are significant gender and grade differences in physical education students' mental health as a whole and its sub-dimensions; there are significant differences in their sub-dimension maladjustment in the only child.

Although this study has achieved good research results, there may be biases in the selection of samples in the study, resulting in inaccurate evaluation results or lack of widespread applicability. Therefore, further consideration will be given to the randomness and representativeness of sample selection in the next step of research.

DATA AVAILABILITY

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

CONFLICTS OF INTEREST

The authors declared that they have no conflicts of interest regarding this work.

FUNDING

This work supported by Quality Engineering Curriculum Ideological and political Construction Research project in Anhui Province in 2020, Study on Ideological and Political Construction of Wushu Course in Higher Vocational Colleges in Anhui Province (2020kcszyjxm054).

REFERENCES

- [1] L. H. Gunn, E. Ter Horst, T. Markossian, and G. Molina, "Associations between majors of graduating seniors and average SATs of incoming students within higher education in the US," *Heliyon*, vol. 6, no. 5, 2020.
- [2] D. H. Lu, J. A. Dopheide, D. Wang, J. K. Jeffrey, and S. Chen, "Collaboration between child and adolescent psychiatrists and mental health pharmacists to improve treatment outcomes," *Child and Adolescent Psychiatric Clinics*, vol. 30, no. 4, pp. 797–808, 2021.
- [3] C. Sun, C. K. H. Hon, K. A. Way, N. L. Jimmieson, and B. Xia, "The relationship between psychosocial hazards and mental health in the construction industry: A meta-analysis," *Saf Sci*, vol. 145, p. 105485, 2022.
- [4] J. Tabler, R. M. Schmitz, J. M. Nagata, and C. Geist, "Self-perceived gender expression, discrimination, and mental health disparities in adulthood," *SSM-Mental Health*, vol. 1, p. 100020, 2021.
- [5] Z. Guo and Y. Zhang, "Study on the interactive factors between physical exercise and mental health promotion of teenagers," *J Healthc Eng*, vol. 2022, 2022.
- [6] C. Fossati et al., "Physical exercise and mental health: The routes of a reciprocal relation," *Int J Environ Res Public Health*, vol. 18, no. 23, p. 12364, 2021.
- [7] Y. Nie et al., "Association between physical exercise and mental health during the COVID-19 outbreak in China: a nationwide cross-sectional study," *Front Psychiatry*, vol. 12, p. 722448, 2021.
- [8] P. Zhao, "Investigation and Analysis on the Mental Health Status of College Students," in *2022 3rd International Conference on Big Data and Informatization Education (ICBDIE 2022)*, Atlantis Press, 2022, pp. 966–973.

- [9] X. Zhou, L. Liu, Y. Chen, J. Hong, and L. U. Xiao, "Research on design and application of an automatic assessment model for college students' mental health based on multimodal data fusion," *E-education Research*, vol. 42, no. 8, pp. 72–78, 2021.
- [10] D. Kleszczewska, J. Mazur, and J. Siedlecka, "Family, school and neighborhood factors moderating the relationship between physical activity and some aspects of mental health in adolescents," *Int J Occup Med Environ Health*, vol. 32, no. 4, 2019.
- [11] W. Zhang et al., "A landing impact simulation test method for lunar lander," in *Journal of Physics: Conference Series*, IOP Publishing, 2021, p. 012017.
- [12] X. Chen et al., "Visual analysis of multi-source college students' mental health questionnaire data," *Journal of Computer Aided Design and Graphics*, vol. 32, no. 2, pp. 12–24, 2020.
- [13] D. Sánchez-Oliva, J. J. Pulido-González, F. M. Leo, I. González-Ponce, and T. García-Calvo, "Effects of an intervention with teachers in the physical education context: A Self-Determination Theory approach," *PLoS One*, vol. 12, no. 12, p. e0189986, 2017.
- [14] W. Xinbo, Y. A. O. Li, Z. Xiaojie, S. Xiaosong, S. H. U. Meiling, and L. I. U. Shuang, "Comprehensive grading of psychological crisis in children and adolescents," *北京师范大学学报 (自然科学版)*, vol. 57, no. 4, pp. 458–465, 2021.
- [15] Q. He, H.-W. Hao, and X.-C. Yin, "Keyword extraction based on multi-feature fusion for Chinese web pages," in *Proceedings of the 2011 2nd International Congress on Computer Applications and Computational Science: Volume 1*, Springer, 2012, pp. 119–124.
- [16] D. Kristomo, R. Hidayat, I. Soesanti, and A. Kusjani, "Heart sound feature extraction and classification using autoregressive power spectral density (AR-PSD) and statistics features," in *AIP conference proceedings*, AIP Publishing, 2016.
- [17] S. Zhang, Y. Wang, S. He, and Z. Jiang, "Bearing fault diagnosis based on variational mode decomposition and total variation denoising," *Meas Sci Technol*, vol. 27, no. 7, p. 075101, 2016.
- [18] Q. Zhao, C. F. Caiafa, A. Cichocki, L. Zhang, and A. H. Phan, "Slice oriented tensor decomposition of EEG data for feature extraction in space, frequency and time domains," in *Neural Information Processing: 16th International Conference, ICONIP 2009, Bangkok, Thailand, December 1-5, 2009, Proceedings, Part I 16*, Springer, 2009, pp. 221–228.
- [19] C. Pan, X. Jia, J. Li, and X. Gao, "Adaptive edge preserving maps in Markov random fields for hyperspectral image classification," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 59, no. 10, pp. 8568–8583, 2020.
- [20] M. XIAO, L. ZHANG, X. ZHANG, and Y. HU, "An improved fuzzy clustering method for interval uncertain data," *电子与信息学报*, vol. 42, no. 8, pp. 1968–1974, 2020.
- [21] R.-Z. Zhao and Z.-J. Sun, "Method of fault identification based on fusion of CEEMD_MPE and GK fuzzy clustering," 2020.
- [22] Y. Deng, "Finite difference numerical simulations of acoustic fields with MPI and GPUS," in *Proceedings of the 2014 Symposium on Piezoelectricity, Acoustic Waves, and Device Applications*, IEEE, 2014, pp. 302–305.
- [23] H. Wang, W. Mao, and L. Eriksson, "Benchmark study of five optimization algorithms for weather routing," in *International Conference on Offshore Mechanics and Arctic Engineering*, American Society of Mechanical Engineers, 2017, p. V07BT06A023.
- [24] S. Rye and E. Aktas, "A Multi-Attribute Decision Support System for Allocation of Humanitarian Cluster Resources Based on Decision Makers' Perspective," *Sustainability*, vol. 14, no. 20, p. 13423, 2022.
- [25] Y. Shaobo, W. Qinghe, W. Xiao-chun, and X. L. De, "Cloud Information Storage Encryption Based on Fuzzy Clustering Algorithm [J]," *Computer simulation*, vol. 37, no. 3, pp. 449–452, 2020.
- [26] F. Yihao, W. Jun, X. Shengjuan, L. Zhipeng, F. Xu, and Z. Jinlin, "A new life prediction method of Intelligent meters based on adaptive weighting coefficients," in *Journal of Physics: Conference Series*, IOP Publishing, 2020, p. 012085.
- [27] I. A. Platt, C. Kannangara, M. Tytherleigh, and J. Carson, "The hummingbird project: a positive psychology intervention for secondary school students," *Front Psychol*, vol. 11, p. 2012, 2020.
- [28] J. Bousquet et al., "Operational definition of active and healthy aging (AHA): the European innovation partnership (EIP) on AHA reference site questionnaire: Montpellier October 20–21, 2014, Lisbon July 2, 2015," *J Am Med Dir Assoc*, vol. 16, no. 12, pp. 1020–1026, 2015.
- [29] E. Wouters et al., "The development and piloting of parallel scales measuring external and internal HIV and tuberculosis stigma among healthcare workers in the Free State Province, South Africa," *Clinical Infectious Diseases*, vol. 62, no. suppl_3, pp. S244–S254, 2016.