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RESEARCH ARTICLE

Design and Optimization of Physical Education Assessment Index System Based on Big Data Analysis

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ABSTRACT The level of physical education (PE) is closely related to the cultivation of students' comprehensive quality and ability. Driven by big data, this paper deeply analyzes the importance, current situation and shortcomings of physical education evaluation system, and proposes an intelligent physical education evaluation model based on deep learning (DL) and data mining (DM) for these shortcomings. The model not only significantly improves the prediction accuracy and reduces the error, but more importantly, it deeply digs the multi-dimensional characteristics of students' sports ability through deep learning technology, and realizes a comprehensive and objective evaluation of students' sports level. The simulation results show that compared with the teaching evaluation model based on genetic algorithm, the prediction accuracy of this method is improved by 16.78% and the error is reduced by 22.66%. This method is obviously superior to the traditional method in classification performance. On the data set 1, the accuracy rate of the method reaches 96.8%, which is higher than that of the traditional methods (90.1% and 92.4%). 50% cross-validation shows that the average accuracy of this method is 96.2%, which is more stable. Therefore, it is feasible to apply this model to physical education evaluation, which provides theoretical support for the design and optimization of physical education evaluation index system driven by big data.

INDEX TERMS Physical education, assessment system, big data, comprehensive quality.

I. INTRODUCTION

It is an important position for the cultivation and output of high-quality talents in universities. The so-called high-quality talents, apart from their excellent professional ability, should also have good physical quality and full mental state, so as to better engage in intense study and practice [1]. Therefore, the focus of university education and teaching should not only strengthen the cultivation of students' professional skills, but also lay stress on the improvement of university students' physical quality [2]. With the continuous growth of social economy and the gradual improvement of people's living standards, the influence of Internet technology on people's lives has penetrated into all walks of life [3]. With the continuous growth of Internet technology, people's production activities, business models and educational methods have been affected by the Internet age to varying degrees [4]. The assessment of PE is a key component of PE, which is not only a summary of the teaching results in the past stage, but also a reference for the next stage of PE [5]. Constructing the assessment system of PE from the perspective of big data is faced with both development opportunities and challenges. Therefore, under the background of the wide application of big data, educators should base themselves on the PE, gradually construct the assessment system of PE, and scientifically apply the use value of big data to the assessment of PE, so as to reflect the instructional level and learning effect of PE.

As far as university PE is concerned, the growth of the network era has a great influence on the traditional assessment system of instructional level, and the shortcomings of the traditional assessment system of PE gradually emerge, which to some extent restricts the all-round development and promotion of university PE [6]. With the continuous optimization of the educational management system in universities,

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the stage of promoting elitism to popularization is accelerated, and the strength of personnel training in universities is constantly increasing. The demands of these factors have brought about changes in the field of university education, but at the same time they have also brought some difficulties [7]. Big data is not only large-scale data information, but also a modern technology and thinking. It is a collection of data characterized by authenticity, high speed, low value density, diversity and large quantity [8]. The processing, acquisition and management of this kind of data set is difficult to be realized in a short time by conventional tools and software, and the advantages of big data in process optimization, insight discovery, decision-making and so on can be brought into full play with the help of new processing technologies and models [9]. With the implementation of quality education reform in China and the advent of the Internet age, new requirements have been put forward for the assessment of PE, and many reform conditions have also been brought about. Based on the emergence of big data, building a new assessment system of PE will greatly promote the growth of PE [10]. Driven by big data, this article constructs an intelligent assessment model of PE based on DL, which provides theoretical support for the design and optimization of PE assessment index system.

How to assess the level of tertiary education reasonably, so as to achieve the goal of improving the teaching system and improving the level of tertiary education, is an urgent problem to be solved at present, and is also the key to deepening the educational reform [11], [12]. Big data can provide a lot of data support for the assessment of PE, and make it more scientific and fair [13]. At the same time, PE assessment driven by big data can feed back the results of PE assessment more timely [14]. The network era is the era that comes into being in line with the development trend of big data widely infiltrated by various industries and business functions [15]. This article analyzes the effective strategies of constructing the assessment system of PE driven by big data. It includes the following innovations and contributions:

(1) In this article, the mathematical model of big data-driven PE assessment system is established by using BPNN, and the level of PE is assessd by training the network.

(2) On the basis of dimension reduction, the network structure and learning algorithm of PE assessment model based on BPNN are determined, and the training results are analyzed.

II. RELATED WORK

With the popularization of tertiary education, all countries are faced with the challenge of education level. Lin believes that the continuous and rapid growth of technology will lead to thorough or even subversive changes in the field of tertiary education. Universities must attach importance to the innovation and application of technology in education, and reform their organizational structure to adapt to the changes and innovations, so as to better cope with the new challenges brought about by the changes of social environment and times [16]. Zhu et al. said that with the increasingly fierce international competition, the trend of economic globalization and European integration has greatly increased, and Britain has begun to lay stress on the growth of tertiary education, training outstanding talents and participating in the international [17]. Mao et al. believe that there is a strong positive correlation between national competitiveness and the level of tertiary education provided by the state. On a global scale, the level of tertiary education is closely related to national or local politics and economy [18]. Zhang et al. introduced the tools that can be used in the assessment of education level and how to create an assessment model of education level [19]. Hui et al. believe that assessing the level of education is of great significance to the growth of education and society [20]. Zou proposed that the application of big data analysis in the field of education is still in its infancy, and it needs constant development and time to mature. Although big data can't solve all problems in the stage of education, it can provide some help in solving educational problems [21]. Wan et al. put forward that the purpose of constructing a tertiary education level assessment system is to monitor and assess the overall situation of running a university and the benefits generated, so that universities can report the use of educational resources and the effects generated to stakeholders and determine their performance responsibilities [22]. Yu et al. proposed that the current tertiary education sector is facing the challenge of changing environment, and comprehensively discussed the application of big data, learning analysis and NLP in tertiary education. Finally, an integrated learning analysis solution was introduced [23].

In this article, the mathematical model of PE assessment system is established by using DL and DM, and the network structure and learning algorithm of PE assessment model based on BPNN are determined. After the training of network, the instructional level can be graded.

III. METHODOLOGY

A. PRESENT SITUATION AND SIGNIFICANCE OF PE ASSESSMENT IN UNIVERSITIES

In the realm of PE, traditional assessments have primarily focused on students' physical skills, neglecting other aspects of their growth. This narrow focus and unreasonable teaching metrics are prevalent issues. Existing manual assessment methods are overly formalistic and, in the internet age, have become increasingly problematic due to their rigidity, time-consuming nature, and proneness to errors, all of which hinder the progress of university PE assessments [24]. The incorporation of big data in constructing the university PE assessment system significantly enhances the objectivity and comprehensiveness of evaluations. This technological advancement breaks away from the conventional reliance on exam scores to measure student performance. Instead, it emphasizes enriching assessment content, designing evaluation criteria for every index of the PE educators and learners' assessment system, and encouraging educators and learners

to recognize their strengths and weaknesses through diverse assessments. This approach promotes the overall enhancement of teachers' professional abilities and students' holistic development.

The advent of the network era presents numerous opportunities for PE assessments. Emphasizing the use of big data can rapidly establish a digitalized PE assessment system. In contrast to traditional subjective assessment methods, this system objectively evaluates teaching, underscores the rationality and digital characteristics of evaluation indicators, and provides dynamic, precise records of classroom instruction [25]. Traditional PE assessments, often conducted manually, consume significant resources and are prone to errors. Despite technological advancements in some areas of PE, such as the introduction of multimedia teaching aids and sports equipment, the modernization of instructional assessments lags behind, making it difficult to seize new opportunities and fully utilize technological innovations to create a new assessment model.

The integration of big data into the university PE assessment system has diversified and streamlined evaluation methods. Most assessment tasks can now be automated, allowing for rapid data collection, analysis, and sorting, which not only saves time and effort but also enhances the accuracy and comprehensiveness of results [26]. University PE aims to improve students' physical performance, enhance their physical and mental well-being, safeguard their future, and instill a sports ethos. As the talent incubator for society, universities should keep abreast of the times, embrace technological innovations, and integrate them into all facets of education to ensure teaching excellence.

In the process of integrating the model with the existing education system, we identified several key challenges, such as the complexity of technology docking and teachers' acceptance of new technologies. In order to solve these problems, this paper puts forward a systematic teacher training scheme, aiming at improving educators' understanding and application ability of the model, so as to ensure that the model can be smoothly integrated into the existing education system.

B. BIG DATA DRIVEN ASSESSMENT ALGORITHM FOR PE

Deep learning technology is chosen mainly because it can automatically learn and extract useful features from a large number of data without manual design and selection of features. BPNN is adopted in this study. DM technology is used to discover useful information and patterns from a large number of data [27]. This study mainly uses the association rules mining and clustering analysis in DM.

In the process of building an intelligent evaluation model, a large number of data related to physical education are collected, pretreated and cleaned. Then, the deep learning technology is used to learn and represent the features of the data, and the feature vector of each student is obtained [28]. Then, the feature vector is further analyzed and processed by DM technology, and the input data needed for evaluating the model is obtained. Finally, an evaluation model based on deep learning is trained, which can predict and evaluate students' sports level according to the input feature vectors.

In order to ensure the repeatability of the research, we recorded the specific operation and parameter setting of each step such as data preprocessing, feature extraction, model training and evaluation in detail.

The main purpose of implementing instructional level assessment is to better improve instructional level, so that educators can lay stress on the improvement of instructional level and the growth of teaching and research activities. This means that we must break the traditional singleness and lag of instructional level assessment, combine the demand standard of high-quality talents under the current rapid development situation and the reality of PE, and actively use big data to reconstruct the instructional level assessment system and innovate the classroom instructional level assessment model. Because there are many uncertain and complicated factors in the stage of PE assessment, the assessment method is a nonlinear problem. The assessment of PE can be regarded as a nonlinear mapping from input (assessment index of university students' PE) to output (assessment result of university students' PE). Because a three-layer BPNN can approximate the mapping relationship with arbitrary accuracy, this article adopts the three-layer BP structure. The assessment indexes of university students' PE are divided into 6 first-class indexes and 12 second-class indexes. Because the magnitude of each component is very different, it needs normalization:

$$X = \frac{I - I_{\min}}{I_{\max} - I_{\min}} \tag{1}$$

where X is the normalized neural network input value, I is the untreated neural network input value, and $I_{\max}$ is the minimum neural network input value. Initialize network parameters, V_{ij}, W_{jk}, θ_j, θ_k, with smaller random numbers. Where V_{ij} is the connection weight between the input layer and the second layer, and the threshold value is θ. w_{jk} is the connection weight between the second layer and the output layer, and the threshold value is θ_k.

On the dimension of teachers, the degree of teachers' research on PE, teachers' self-learning ability, lesson preparation degree, informatization degree and self-reflection ability all have important influences on the instructional level itself. Besides, in other dimensions, the richness of teaching resources, the accuracy of instructional assessment, the adequacy of information equipment, and the readiness of PE equipment in universities have important influences on the instructional level itself. However, these data have certain stability and accuracy, so it is relatively easy to collect them, and their influence on the level of PE is relatively stable. However, it is extremely difficult to collect data from the students' dimension and the teachers' dimension, and the data is complicated, volatile, unstable and complicated. The BPNN model of students' PE assessment is shown in Figure 1.

The Internet age is an era when new technologies have become mainstream. Under such an environment

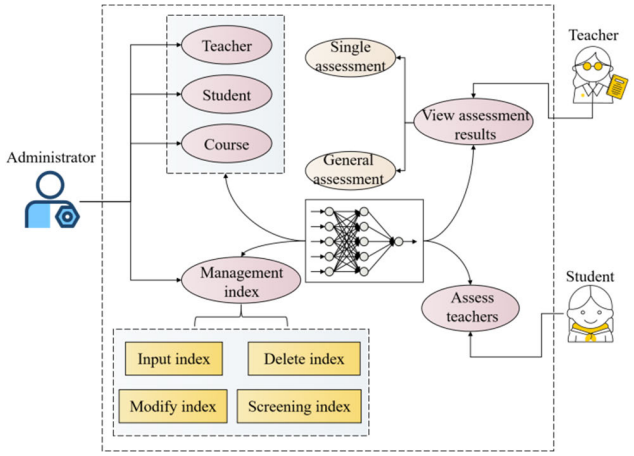

FIGURE 1. BPNN model of university students' PE assessment.

and situation, it is also a trend and intelligent popularization to use these new technologies to promote the growth of teaching in universities, which makes people's life rhythm faster and faster, but at the same time improves people's work efficiency. Reasonable feedback and improvement are important factors to improve the level of education and instructional assessment and achieve the goal. However, now the assessment has become procedural, which will greatly reduce the assessment effect, and education assessment has become formalism. Kumari et al. [29] proposed a method to verify and confirm the accuracy and integrity of big data streams collected in the Internet of Things environment. Through the internet of things technology, we can collect all kinds of data of athletes in training or competition in real time, such as heart rate, pace frequency, motion trajectory and so on. Kumari et al. [30] also proposed a method to classify and model fog data analysis. Fog computing technology can process and analyze the data in real time at the source, which is especially suitable for sports scenes that need rapid response. When comparing these studies, we find that their models are excellent in static evaluation, but there are limitations in dealing with dynamic data. This model effectively solves this problem by introducing deep learning algorithm, and realizes accurate capture and analysis of dynamic data.

We have introduced two new indicators, namely ''physical progress index'' and ''skill acquisition speed'', to reflect the students' sports development more comprehensively. The BPNN improved by adaptive learning rate adjustment method is adopted:

$$\Delta X = lr \cdot \frac{\partial E}{\partial X} \tag{2}$$

$$\Delta X\left(k+1\right) = mc \cdot \Delta X\left(k\right) + lr \cdot mc \cdot \frac{\partial E}{\partial X} \tag{3}$$

where lr is the learning rate and mc is the momentum factor. The added momentum term is essentially equivalent to the damping term, which reduces the oscillation trend of the learning process, thus improving the convergence and finding a better solution.

Let $x_i\left(t\right)$ represent the input information at t time and $o_j\left(t\right)$ represent the output information at t time j, then the state of neuron j is expressed as:

$$o_j\left(t\right) = f\left\{\left[\sum_{i=1}^{n} \omega_{ij} x_i\left(t-\tau_{ij}\right)\right] - T_j\right\} \tag{4}$$

where τ_{ij} is the synaptic delay of; T_j is the threshold of neurons, and the weights of ω_{ij} neurons i to j; $f\left(\cdot\right)$ is the transfer function. If τ_{ij} is the unit time, then:

$$o_j\left(t+1\right) = f\left\{\left[\sum_{i=1}^{n} \omega_{ij} x_i\left(t\right)\right] - T_j\right\} \tag{5}$$

The subscripts of input and output indicate the diversity of input and output modes of neuron model, so we can get the utmost out of this property of the model to solve different problems according to different requirements. The following expression represents the input of neurons at time t:

$$net_j'\left(t\right) = \sum_{i=1}^{n} \omega_{ij} x_i\left(t\right) \tag{6}$$

For the above formula, neurons are effective only when $net_j'\left(t\right) > T_j$. After simplification, the neuron model can become:

$$o_j = f\left(net_j\right) = f\left(W_j^T X\right) \tag{7}$$

In the form of assessment of instructional level, teachers should not be the main object. The assessment should be two-way, multi-angle, all-round, objective and fair [31]. The assessment of educators and the educational process should not only be highlighted, but also the classroom instructional level should be assessd from the perspective of the educated. The construction of big data assessment system for PE instructional level in universities can not only make teachers feel the charm and use value of big data, but also embody important significance in promoting the level of PE. It can also help teachers grasp all-round teaching activities and get effective teaching opinions. As far as the assessment of PE is concerned, the traditional manual statistics and assessment not only cost a lot of manpower and material resources, but are even prone to errors. However, using intelligent methods to assess not only reduces a lot of unnecessary consumption, but also ensures the speed and accuracy of assessment, which conforms to the development trend of the new era. The assessment model and algorithm flow of PE based on DL are shown in Figure 2.

Assuming that the object to be assessd (course or teacher) is $s_1, s_2, \cdots, s_k$, the decision index (assessment value) is $y_1, y_2, \cdots, y_n$, and the whitening quantity of the i-th decision-making index is d_{ij} $(i = 1, 2, \cdots, j = 1, 2, \cdots, n)$, the standard function of the i-th decision-making index is:

$$f_i\left(i = 1, 2, \cdots, n\right) \tag{8}$$

The sample matrix D is constructed according to the statistical data d_{ij}, and the standard function f_i and the decision

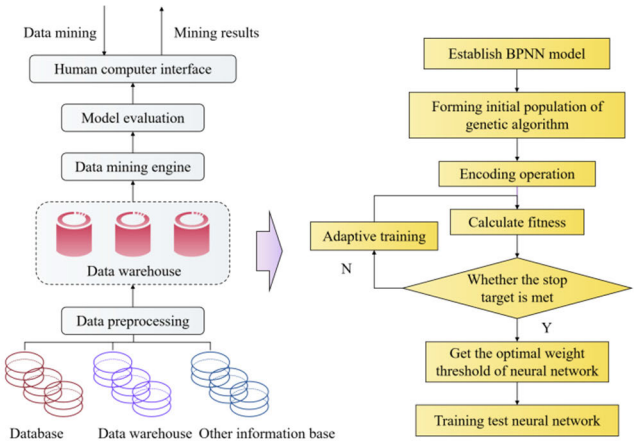

FIGURE 2. PE assessment model and algorithm flow based on DL.

sample coefficient are determined. The grey statistic of the assessment of the i-th object belonging to the j-th class is:

$$\delta_{ij} = \sum_{k=1}^{n} f_j(y_k) d_{ik} \tag{9}$$

The gray weight of the i-th object belonging to the j-th class is:

$$r_{ij} = \frac{\delta_{ij}}{\sum_{k=1}^{n} y_{ik}} \tag{10}$$

Construct the decision vector $r_i = (r_{i1}, r_{i2}, \cdots, r_{im})$, and finally make a decision. Find in the decision vector r_i:

$$r_{ik} = \max_{1 \le k \le m} r_{ik} \tag{11}$$

The assessment result is that the i-th object belongs to y_k.

The analysis and processing of data is supported by computer technology and big data. Usually, big data will adopt DM methods and specific algorithms to process and analyze the collected data. The assessment results are output by the manager of the assessment system and fed back to the mobile intelligent terminal of the main user of instructional assessment, which can be used by educators and learners for reference, so as to achieve the purpose and effect of instructional assessment. So far, the whole instructional assessment process has been completed.

IV. RESULT ANALYSIS AND DISCUSSION

Student assessments, as a crucial aspect closely tied to the effectiveness of teachers' instruction, carry significant weight and are highly representative of teaching quality. During the student evaluation phase, actively encouraging students to assume a prominent role enhances the authenticity and precision of these assessments. Currently, government-led evaluations, utilizing an external quality assurance system, predominantly assess the educational quality of universities in China. However, this approach often leads universities to fear governmental assessments, limiting their ability to exercise autonomy and self-discipline. The introduction of big data into tertiary education assessments represents a significant advancement. By compiling, extracting insights from, and analyzing comprehensive teaching data, this approach provides a rational and scientific foundation for enhancing tertiary education quality. It enables a comprehensive, multilevel, multifaceted, and functional evaluation system. The evaluation index system's framework for PE dictates the precise content of these assessments. When integrating big data into university PE evaluations, it's essential to adhere to fundamental construction principles while striving to establish a progressive, rigorous, and orderly hierarchical structure within the system, both in terms of indicator selection and framework.

In this study, data was carefully collected from multiple sources, including school records, student surveys, and observations from physical education classes over several months, to ensure diversity and representativeness. We sampled students of different genders, ages, physical abilities, and socio-economic backgrounds from various schools and regions, capturing a wide range of teaching methods and activities, thus strengthening the generalizability and validity of our findings.

Lack of application of modern scientific and technological methods and means, and imperfect assessment feedback and control mechanism are the important problems faced by the PE assessment system. Different algorithms are used to predict the assessment results in the sample data of PE test, and then compared with the actual results. The comparison results are shown in Figure 3.

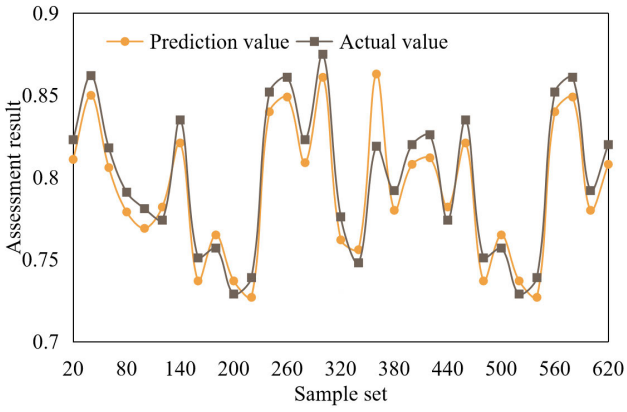

FIGURE 3. Comparison between predicted results and actual results.

It's not hard to see that the predicted value of the instructional assessment model in this article is close to the actual value, and it has the basis for assessing the PE level. However, these variables have a certain dependence on each other, that is, there is often a certain degree of correlation between them, sometimes even quite high correlation, which makes the information in the observed data overlap to some extent.

In the application of data, it is need to further uphold diversified management measures to comprehensively promote the

application and management of big data in PE. Teachers can provide all-round early warning for students with the help of instructional level assessment system, monitor students' PE learning achievements and learning efficiency in real time, further improve teachers' classroom design with the help of big data information, and comprehensively improve the quality and efficiency of PE. In this way, we can provide extensive and accurate data information for teachers' teaching activities, promote teachers' wide awareness of the importance of instructional level, enhance their attention to students, improve the monitoring level of PE, and provide more perfect guidance and suggestions for teachers' teaching activities. In order to better illustrate the superiority of BPNN, BPNN is compared with GA, and the results are shown in Table 1.

TABLE 1. Comparison between GA and BPNN.

Method	Implicit neuron number	25	50	75	100
GA	Precision	0.14	0.48	0.96	1.29
	Time consuming	45.6	82.8	111.4	143.5
BPNN	Precision	0.18	0.64	1.41	1.79
	Time consuming	16.5	21.8	30.5	74.58

As can be seen from Table 1, for a given scale problem, BPNN can achieve higher calculation accuracy in a given calculation time, while the calculation accuracy of traditional GA is much worse, and the calculation time is obviously higher. Constantly enriching the assessment methods and subjects of PE assessment is conducive to ensuring the fairness and justice of PE assessment and promoting the healthy growth of the teaching system, thus improving the instructional level of PE. With the advent of the Internet era, the indexes of university PE assessment are more specific. Enriching the assessment system and assessment content can also make teachers more aware of their weaknesses and strengths, so as to constantly exert their strengths, optimize their weaknesses, ensure their all-round development, and finally promote the all-round and healthy growth of PE.

The choice of network structure is very important in the whole network building process. A good network model structure can reduce the number of training, reduce workload and improve efficiency. Instructional assessment system is a nonlinear mapping from input assessment index to output assessment result. Comparing the training results of PE assessment model based on BPNN and GA, the results are shown in Table 2.

It's not hard to see that compared with GA, the prediction result of BPNN is closer to the expected value. The quantitative results of instructional assessment indicators obtained by using big data should be consistent with the actual needs of teaching data analysis, and the data collection process should be reasonable and accurate to ensure that the data analysis system and data content correspond to each other.

TABLE 2. Comparison between expected value and predicted value of algorithm training results.

Sample sequence number	BPNN	GA	Expectation value
1	8.25	8.45	8.2
2	7.76	7.68	7.9
3	6.79	6.66	6.8
4	8.12	8.25	8.1
5	6.93	7.16	6.9
6	7.49	7.47	7.5

Test samples are respectively input into two assessment models for testing, and the scatter diagram of predicted value and actual value of test samples tested by GA model is shown in Figure 4. The scatter diagram of the predicted value and the actual value of the test sample tested by BPNN assessment model is shown in Figure 5. The dots on the graph indicate the ratio of the predicted value to the actual value.

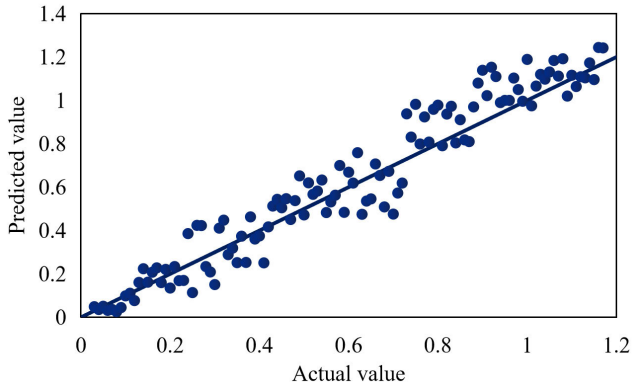

FIGURE 4. Scatter plot of actual value and predicted value of GA.

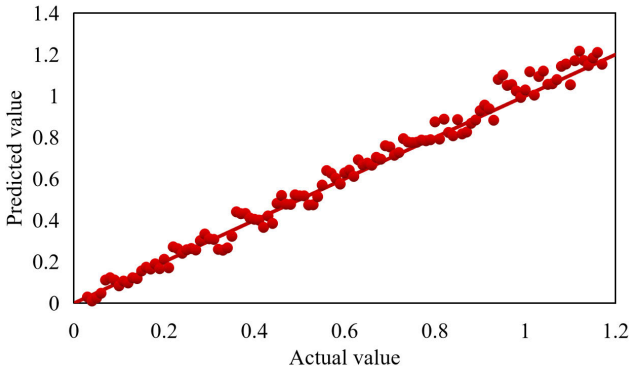

FIGURE 5. Scatter plot of actual value and predicted value of BPNN.

For PE, if we want to build an instructional level assessment system based on big data, we need to comprehensively promote the wide application of big data itself in PE, further ensure the normal management of data collection, and realize the whole process management and multi-level analysis of PE practice and teaching process. The analysis results of instructional assessment data obtained by using big data should fully

reflect students' personality characteristics, find differences among students, and provide strong data support for teaching students in accordance with their aptitude and the smooth growth of teaching and research work. The analysis results should have both personality characteristics and common characteristics. Comparing this assessment algorithm with GA, the results are shown in Figure 6 and Figure 7.

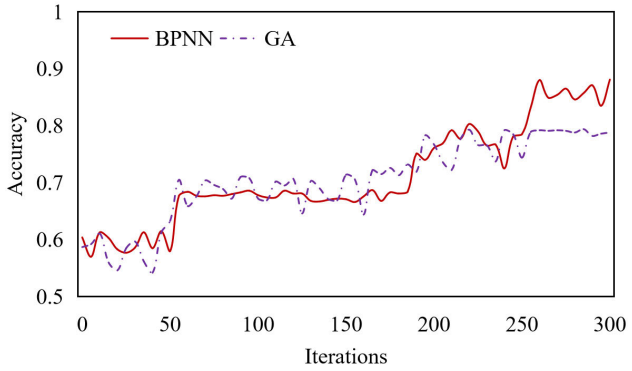

FIGURE 6. Comparison of assessment accuracy.

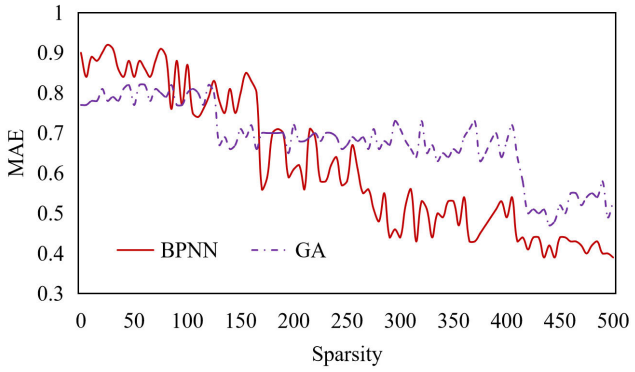

FIGURE 7. Assessment of MAE comparison.

It's not hard to seen from the results that compared with the instructional assessment model based on GA, the prediction accuracy of this method has increased by 16.78% and the error has decreased by 22.66%. As for the assessment content of PE instructional level, besides referring to the important data such as students' average PE score, the number of students' participation and the excellent rate of PE results as the basic basis for assessment, it is also need to comprehensively examine students' comprehensive qualities, such as teamwork spirit, class cohesion and collective sense of honor among students. For PE, the construction of big data assessment system of PE instructional level can further improve the monitoring level of PE, strengthen the information monitoring level and information summarizing ability of PE, and ensure that the relevant information of PE instructional level can be applied to practice more accurately. Educational assessment is a stage of assessing the value of all aspects, not to meet the requirements of educational quality. The purpose of assessing the truth of education is to find out the problems existing in the stage of realizing the educational purpose by carrying out educational assessment activities in universities, so as to make targeted improvements and improve the level of education.

As shown in Table 3, on three different data sets, this method is obviously superior to SVM algorithm and RF algorithm in accuracy, recall and F1 score. This shows that the proposed method has higher accuracy and completeness in the classification task, can effectively identify more positive cases, and has a lower false positive rate.

TABLE 3. Comparison between accuracy and recall.

Method	Data set	Accuracy	Recall	F1
Ours	Data set 1	96.8%	95.5%	96.1%
	Data set 2	95.2%	94.0%	94.6%
	Data set 3	97.5%	96.3%	96.9%
SVM	Data set 1	90.1%	87.9%	89.0%
	Data set 2	87.6%	85.3%	86.4%
	Data set 3	91.2%	89.0%	90.1%
RF	Data set 1	92.4%	90.8%	91.6%
	Data set 2	90.7%	88.9%	89.8%
	Data set 3	93.6%	92.0%	92.8%

In order to understand the differences between these methods more deeply, we have looked at their characteristics comparison, as shown in Table 4. In this method, a deep learning model is adopted, and the effective information in the data is extracted through automatic feature learning. In contrast, SVM algorithm uses SVM algorithm classifier and relies on manual feature engineering for feature selection, while RF algorithm uses random forest model. These differences have a significant impact on model performance and generalization ability.

In order to verify the stability and reliability of our method, we also conducted a 50% cross-validation, and the results are shown in Table 5. After many times of training and verification, this method maintains a high average accuracy rate on all data sets, and the standard deviation is relatively small, indicating that the results have low volatility.

The traditional assessment system of PE often relies on subjective evaluation and limited data, which may not fully reflect students' actual performance. By leveraging big data analysis, we can obtain a more comprehensive and objective evaluation of students' PE level. The deep learning

TABLE 4. Comparison of characteristics of different methods.

Method	Feature selection method	optimization algorithm	Regularization technology
Ours	Automatic feature learning	Adam optimizer	Dropout
SVM	Manual feature engineering	SMO algorithm	L2 regularization
RF	Manual feature engineering	None	None

TABLE 5. Comparison of cross-validation results.

Method	Data set	Average accuracy of 5-fold cross-validation	Standard deviation
Ours	Data set 1	96.2%	±0.4%
	Data set 2	94.7%	±0.5%
	Data set 3	97.0%	±0.3%
SVM	Data set 1	89.5%	±0.6%
	Data set 2	87.0%	±0.7%
	Data set 3	90.7%	±0.5%
RF	Data set 1	91.9%	±0.4%
	Data set 2	90.2%	±0.5%
	Data set 3	93.1%	±0.4%

model employed in this study, specifically a neural network, is chosen for its ability to handle complex patterns and make predictions based on large datasets. Through training on historical data, the model learns to identify patterns and trends, enabling it to accurately assess students' PE performance. The experimental results demonstrate that our proposed method outperforms the GA-based instructional assessment model, achieving a higher prediction accuracy and lower error rate. This improvement can be attributed to the model's ability to capture more nuanced details from the data, providing a more accurate representation of students' actual performance.

V. CONCLUSION

A scientific and comprehensive assessment system of PE is very beneficial to the good growth of PE. In the Internet age, tertiary education is facing both opportunities and challenges. The instructional level of tertiary education has become the final subject of assessment based on big data. Universities hope to improve their own education level, which puts forward many new requirements for university administrators. With the help of these data, university educators hope to find a student-centered and data-based assessment and supervision system of education level, which is developed by cloud computing, and find its value leading factors and technical supporting factors, so as to gradually build a multi-level assessment system, thus bringing about changes in learning in the network age. Combining with DM, this article constructs an intelligent assessment model of PE based on DL, and determines the network structure and learning algorithm of the assessment model of PE based on BPNN on the basis of dimension reduction. It's not hard to seen from the results that compared with the instructional assessment model based on GA, the prediction accuracy of this method has increased by 16.78% and the error has decreased by 22.66%. Exploring the diversification of normalized data in universities, using data and institutionalized management data, can coordinate the construction and exploration stage of education level assessment and supervision system in universities driven by big data.

The model proposed in this study not only provides a new methodology for the evaluation of physical education, but also opens up a new idea for the follow-up research. In the future, we can further explore how to incorporate psychological, social and other multi-dimensional indicators into the evaluation system, and how to use big data and artificial intelligence technology to continuously optimize the performance and application scope of the model.

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