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INTELLIGENT RECOGNITION OF PHYSICAL EDUCATION CURRICULUM RESOURCES BASED ON DEEP NEURAL NETWORK AND THE GAME MODEL STUDY

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Research Paper

Abstract: Nowadays, with more and more physical education curriculum resources, schools or teachers have more and more choices for physical education curriculum resources. However, because some teachers need a deep understanding of curriculum training programs and standards, the selected curriculum resources cannot promote their curriculum development. This paper puts forward the research on the intelligent recognition and game model of physical education curriculum resources based on neural networks. The specific research conclusions are as follows: The intelligent consciousness and movement model of physical education curriculum resources based entirely on the technical knowledge of the BP neural community and deep neural community are proposed. With the help of MATLAB7.1 neural network toolbox to implement the specific recommendation system, a three-layer BP network is established, and the NEWFF function is used to create the neural network. Useful resources in each direction generate a direction recognition vector according to the route guidance standard, calculate the course recommendation degree according to selection statistics and scoring, and input the course resource recognition vector and recommendation degree into the neural network. When the number of hidden layer nodes is 10, and the learning training algorithm selects the L-M optimization algorithm, the error between the actual output and the expected output of the network meets the requirements. It shows that the accuracy of the recommendation model meets the requirements; that is, the relationship between the recognition vector of physical

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education course resources and the recommendation degree of course resources reflected by the neural network basically reflects the functional relationship between them and the model can be used to make corresponding recommendations.

Keywords*: Deep learning; Physical education course; Course identification vector; Course recommendation; Neural network.*

1. Introduction

Young human beings are the future of the country, the hope of the nation, and a crucial pressure for the brilliant rejuvenation of the Chinese government. The bodily fitness of youngsters has continually been a warm topic. With the implementation of the countrywide method of "Healthy China" in recent years, the physical fitness of youngsters has attracted extra and extra interest from all walks of life. The survey of students' bodily fitness has been carried out in China for more than 30 years since 1985. Although the survey outcomes of some check gadgets exhibit that the declining fashion of students' bodily fitness has slowed down or even multiplied barely (Group, 2015), the average scenario is nevertheless not optimistic. The primary manifestations are the growing incidence of weight problems and myopia and the lowering fee of some take a look at symptoms (Group, 2015). Studies have proven that adolescents' bodily fitness is associated with the quantity of physical undertaking (González-Calvo, Otero-Saborido, & Hortigüela-Alcalá, 2022), and students' physical fitness issues are associated with inadequate bodily endeavors in each daily existence (Chao, Guo, & Wang, 2022). Lack of bodily pastime at some point in youth can motivate growth, development, and fitness troubles and, without delay, affect the stage of physical endeavor in maturity (Chen et al., 2023a). Low tiers of bodily exercise at some stage in youth imply a drastically accelerated possibility of low tiers of bodily drive in adulthood (Chen, Jagota, & Kumar, 2023b). In view of the physical fitness issues brought about by way of inadequate bodily recreation in adolescents, the World Health Organization (WHO) recommends that adolescents and youth have to have at least one hour of average to high-intensity physical endeavor each day (Gao et al., 2023). However, most kids in the world no longer meet this endorsed amount, and inadequate bodily drive has become a frequent phenomenon in all international locations (Guthold et al., 2020).

The Chinese authorities attach notable significance to the bodily fitness of teenagers and have brought a sequence of insurance policies to promote the organic endeavor of adolescents. The "Guidelines for Physical Activity of Chinese Children and Adolescents," launched in 2018, genuinely states that healthful youngsters and children in China must have at least one hour of moderate-high-intensity bodily endeavor each day. In 2010, the Ministry of Education performed a nationwide survey on students' physical fitness status, and the consequences confirmed that solely 22.7% of the most important and secondary college students' bodily undertaking degrees reached the endorsed stage of WHO (Survey, 2010). According to the effects of the National Survey on Physical Fitness of Children and Adolescents in 2016, the share of children who do bodily workouts for one hour a day is 13.1%, and with the boom of grades, this share suggests a downward fashion (Liu et al., 2019). According to the record on the bodily exercise stage of kids in Shanghai in 2016, only 19.7% of young people and young people reached the endorsed degree of physical undertaking (Liu et

al., 2016). Some students used accelerometers to take a look at essential and secondary faculty college students in eleven cities throughout the country, and the outcomes confirmed that solely 5.6% of college students might want to meet the endorsed amount, and there was once a distinction between male and girl college students (Wang, 2013). As can be viewed from the effects of the above survey report, whether or not in the shape of subjective or goal bodily endeavor exams for adolescents, the results exhibit that the quantity of physical undertaking of Chinese young people is insufficient and solely a small wide variety of college students meet the advocated amount of one hour of moderate-high depth bodily endeavor per day.

Adolescents spend most of their day in school, which performs a critical function in merchandising students' bodily and intellectual health. Physical Education is the foremost shape of a college sports activities organization, which conducts a quintessential role in cultivating students' hobbies in sports, educating college students on sports activities skills, and advertising undertaking participation. The quantity of physical pastime in bodily Education is essential for the healthful improvement of students. At the same time, bodily Education is additionally an obligatory path stipulated by means of the Ministry of Education. In current years, with the gradual upward thrust in the reputation of Physical Education, the variety of type hours in one-of-a-kind college-age segments has multiplied accordingly, and bodily Education performs a more and more necessary position in faculty bodily Education. The curriculum necessities and challenging nature of PE suggest that it is a way required to put in force 60 minutes of exercising for college students each day (He et al., 2023). A giant range of overseas research has proven that teenagers' participation in medium-high-intensity bodily activities can correctly promote students' physical fitness (Zhou et al., 2023). In view of the modern-day scenario of students' bodily health, the United States and the United Kingdom proposed that at least 50% of the whole classification time must be spent on -high-intensity physical pastimes in bodily training training (Fan, Zi-xuan, & Ming-hu, 2023; Guo et al., 2016; Harris, 2015; Jin & Dong, 2016). The Chinese authorities additionally attach superb significance to the bodily fitness of younger people and put ahead in the Third Plenary Session of the 18th CPC Central Committee that "through the mixture of bodily training and extracurricular exercises, to reap the cause of bettering the bodily and intellectual fitness of younger people." Therefore, it is indispensable to enhance the bodily schooling curriculum similarly and provide full play to the tremendous function of Physical Education in growing the organic exercise of young adults and promoting the wholesome improvement of physique and mind.

The choice of PE curriculum resources plays an essential role in the quality of the PE curriculum. Based on the deep neural network, this paper puts forward the intelligent choice model of PE curriculum resources and verifies the model in order to provide a reference for the choice of PE curriculum resources.

2. Convolutional Neural Network Overview

2.1 Nerve cell

The neuron is the fundamental processing unit of the synthetic neural network; its structural mannequin is proven in Figure 1 (Abdel-Hamid et al., 2014; Sainath et al., 2015; Salakhutdinov & Hinton, 2012).

x_i indicates the input signal; n input signals are input to neuron j. w_{ij} at the same time, showing the weight value of the connection between input signal x_i and neuron j. b_j represents the internal state of the neuron, that is, the bias value, and y_j is the output of the divine element.

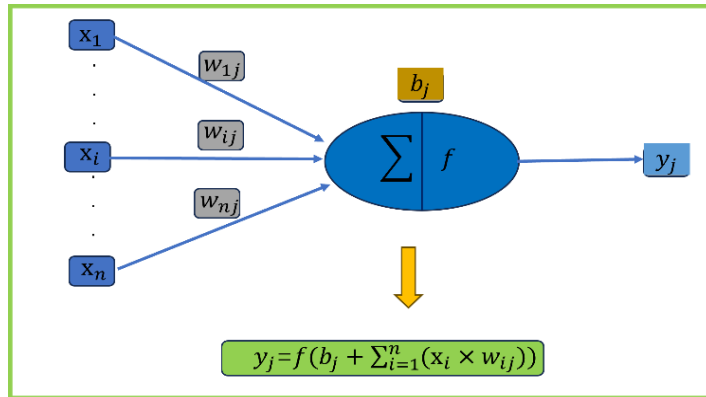$$y_j = f(b_j + \sum_{i=1}^{n}(x_i \times w_{ij}))$$

Figure 1. Neuron model

2.2 Convolutional Neural Network

The primary shape of CNN is composed of an enter layer, quantity layer, pooling layer, utterly linked layer, and output layer. The convolution layer and pooling layer are commonly chosen several, and the convolution layer and pooling layer are alternately set. Since every neuron of the output function floor in the convolutional layer is regionally linked with its input, and the weighted sum of the corresponding connection weight and the neighborhood enter plus the offset fee are used to reap the enter price of the neuron, this procedure is equal to the convolutional process, subsequently the title CNN (Bai, Cao, & An, 2023; Barker et al., 2023; WANG et al., 2023a).

3. Sports curriculum resources

3.1 Physical education curriculum resource content

From the definition of curriculum resources, PE curriculum resources can be defined as shown in Table 1. The purpose of PE curriculum content mainly includes two aspects, as shown in Table 2: On the one hand Jess, Carse, and Keay (2022), believe that PE curriculum content should be determined according to PE curriculum objectives, and PE curriculum content should be processed before it can be incorporated into PE teaching. On the other hand, Wang Shuying (Wang et al., 2023b) believes that the content of the physical education curriculum is the sum of sports knowledge selected from practical experience and different sports-related understanding, and the content should be arranged in a logical order. (Lee, 2023) believes that physical education curriculum content resources belong to material physical education curriculum resources, which include sports knowledge, sports skills, sports practical experience, activity ways and methods, emotional attitudes, and values, and mainly involve skills and feelings.

To sum up, the content resources of the physical education curriculum in this study

are defined as the sources of biological education knowledge and sports knowledge selected from practical experience according to the objectives of the physical education curriculum, which mainly involve the technical and emotional components.

Table 1. Physical education curriculum resource definition

Name		Definition
Veson	broad sense	Covers a variety of content to achieve the goals of the physical education curriculum
	narrow sense	Covers only sources of direct factors for physical education courses
Zhao Jifeng		Include all content that will help students achieve their learning goals, as well as all physical activities they can participate in.
Li Lin Zhang Xue		It is helpful to form the material of the physical education curriculum and the conditions for implementing the physical education curriculum.

Table 2. Physical education curriculum content definition

Name	Definition
Mao Zhengning	According to the goal of the physical education curriculum, we should carry out processing before entering into physical education teaching.
Wang Shuying	The content is arranged in a logical order, depending on the sum of sports knowledge and other sports-related knowledge selected from practical experience.
Tian Jing	It includes sports knowledge, sports skills, sports practice experience, activity ways and methods, emotional attitude, and values.

3.2 The existing problems of Physical Education in colleges and universities

1)   Physical education teaching efficiency could be higher.

At present, most faculties and universities in our US have opened the campus community and have a positive basis of community statistics construction; however, the utilization of this current instructional science is enormously low, specifically for the sports activities schools and departments, the standard instructing mode, the educating strategies and skill are single, the educating tools and amenities are simple. For example, in sports activities, training is nevertheless solely a single teacher's oral explanation and demonstration, and students imitate exercises. In the teaching of theory courses, teachers only rely on a blackboard and a piece of chalk, the classroom lacks vividness, the amount of information conveyed is limited, and students can not quickly and accurately comprehend and master abstract technical action essentials and technical principles (Fan et al., 2023).

2)   Physical education teaching resources need to be more serious.

It is mainly reflected in the shortage of PE teachers; the number of PE teachers is not compatible with the school-running scale, and the level of PE teachers is uneven, especially in some comprehensive colleges and universities, due to the lack of teachers, students have little choice of PE courses; At the same time, it is difficult to update and expand all kinds of teaching materials, the version of teaching materials is not uniform; Sports teaching venues and facilities can not meet the needs of teaching.

3)   Students need better autonomy in learning.

At present, the dominant educating mode in the discipline of bodily training in schools and universities is nevertheless the usual collective educating mode of one-way indoctrination of information. As a cognitive subject, college students need more autonomy in teaching. In the face of college students with unique sports activities competencies and expertise levels, it is challenging for instructors to instruct college students in accordance with their aptitude, provide full play to their strengths, and spotlight their personalities (Kumar, 2023).

4) Low utilization of network facilities and insufficient construction of online courses

Although 70% of colleges and universities have set up campus networks and have realized the Internet connection, the utilization of network facilities could be higher, and the need for corresponding teaching management software to support the construction of network courses is still at the initial stage. In the field of physical Education in colleges and universities, intelligent network teaching and practice building are also in the initial stage; the primary forms of network teaching are still limited to multimedia classrooms. Multimedia courseware has just become a demonstration tool. Lack of interaction and communication can not become students' independent learning and exploration tools, let alone individualized teaching; therefore, it can not be called.

4. Intelligent recognition and game model of PE curriculum resources based on deep neural network.

In Education and teaching, each course has its training program, each training program has developed curriculum training standards, and each curriculum resource in the training program is associated with supporting curriculum training standards. The selection of curriculum resources should consider the completion of curriculum training objectives, and the choice of curriculum resources should be related to supporting curriculum training standards. If we can obtain the recommendation degree of each curriculum resource according to the curriculum training standards and then get good selection guidance through the recommendation degree, it is difficult to express the relationship between the curriculum training standards and the curriculum resources with appropriate mathematical analytic expression, which is a complex nonlinear classification problem (Choi, 2019; Mitchell & Walton-Fisette, 2022). This paper puts forward a recommendation model of physical education curriculum resources based on a neural network, which calculates the recommendation degree of curriculum resources to a particular course according to each curriculum training standard. The general function expression method can not solve these problems well, but an artificial neural network, as a new technology, opens up a new way for the research of PE curriculum resource recommendation with its essential characteristics, such as nonlinear mapping and real-time optimization. In this paper, according to the curriculum training standard, a physical education curriculum resource recommendation model based on a neural network is established, and the results of the model are verified by data testing (Zhai, Yin, & Lin, 2015).

4.1 Physical education curriculum training standards and curriculum identification vector
1) Curriculum training standards

When designing the teaching plan for each subject, the curriculum standards will be formulated, the curriculum training objectives will be detailed, the curriculum

syllabus will be developed, and the teaching links will be improved. Table 3 and Table 4 show the teaching objectives and contents of physical education courses, respectively.

Table 3. The teaching goal of physical education course

Criterion	Content
Criterion1	To help students experience the benefits of physical exercise and develop an active and healthy lifestyle
Criterion2	Train students to exercise their sense of autonomy and cooperation
Criterion3	Develop students' physical potential and cultivate students' sports skills
Criterion4	Develop students' physical potential and cultivate students' sports skills

Table 4. The teaching content of the physical education course

Aspect		Content
Aspect 1	Physical Training	Schools should provide students with purposeful and regular physical exercise. Students should do a proper amount of physical exercise every week to ensure good health.
Aspect 2	Basic sports skill	Students should master basic physical skills, including running, jumping, throwing, catching, hitting, etc. Schools should provide appropriate training and guidance to help students master these skills
Aspect 3	sporting events	Schools should guide students to participate in a range of sports, such as football and basketball. Students can choose their interest in the project for in-depth research and training.

2) Course identification vector

Physical education curriculum resources are the basic structural unit of the physical education curriculum, and relative to the curriculum, the curriculum resources are more fundamental entities. The curriculum and curriculum resources in the teaching program are mutually supportive and related. One or more curriculum resources support each curriculum training standard, and each curriculum resource is associated with one or several curriculum training standards. There is a many-to-many relationship between curriculum resources and curriculum training standards. Therefore, curriculum resources can be identified through curriculum training standards, and curriculum teaching objectives can be obtained. In the course selection, we can compare and select the course resources according to the curriculum training standards. Here, the set $b = \{b_1, b_2, …, b_n\}$ can describe all curriculum training standards ([Vittoria, 2023](#)). A curriculum resource can support multiple curriculum training standards, so the curriculum training standards can be described as follows:

Definition (curriculum resources) A curriculum resource is expressed as a vector composed of curriculum training criteria: $k = \{k_1, k_2, …, k_n\}$

In the above definition, k_i can be used to describe the course. Where $k_i = 0$, the course resources do not conform to $_n$; $k_i = 1$, the course resource works to b_n.

In this way, when k_i takes a definite value, the conformity of the curriculum

training standard of a course resource can be obtained.

4.2 Course recommendation model of BP neural network

When selecting course resources, if we can obtain the recommendation degree of each course resource identified according to course training standards, we can know the support degree of this course resource to our physical education course, make a decision whether to choose or not, and thus get good course selection guidance (Egert & Kreutz, 2023). However, the relationship between curriculum training standards and curriculum resource recommendation is complicated, with different weights for each curriculum training standard and many levels and contents of the bar, so it is difficult to obtain accurate and scientific recommendations. To recommend a curriculum resource, it is necessary to understand the degree of conformity of the curriculum resources to the curriculum training standards and the weight coefficient of each bar. A conformance function can be used to define the degree to which course resources meet specific criteria for course cultivation:

$$F = f(b_i)$$

F is defined as 0 or 1, where 0 is not a match, and 1 is a match.

The recommendation degree of each course resource identified according to the curriculum training standard is the result of the joint action of the curriculum training standard and the conformity vector of the curriculum resource training standard. The function is expressed as:

$$T = F * K$$

The above function is used to describe the course resource recommendation model, but it is challenging to express the relationship between course training standards and course resources with appropriate mathematical analytic expression. It is a complex nonlinear classification problem, and the functional relationship is very complex and difficult to directly and accurately obtain. Therefore, machine learning tools are used to simulate the course resource recommendation model.

1) Construction of BP neural network course recommendation model

BP neural network can realize any nonlinear mapping from input to output and has good generalization ability. According to the Kolmogorov theorem, this paper adopts a three-layer BP network, namely "input layer - hidden layer - output layer," to train the course resource recommendation model. The specific design of the model is that the curriculum training standard is taken as the input factor. The calculation result of the curriculum resource number and average grade function is taken as the output factor in the past. Then, the training and learning are carried out so as to obtain the recommendation relationship of the course resources to the course. For the course resources to be recommended, after identifying them according to the course training standards, the conformity vector of the course training standards is taken as the input, and the output of the course recommendation degree of the course resources can be obtained through the trained course resource recommendation model.

2) Data preprocessing

In this paper, 10 selected course resources are used to identify each course resource

in line with the curriculum training standards, and a set of recognition vectors for course resources is obtained, as shown in Table 5. At the same time, the course selection and score records of 10 course resources were extracted and calculated according to the following output function, and the recommended results were obtained, as shown in Table 6.

Table 5. Course identification vector partial sample data set

Course	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	Criterion 6	Criterion 7	Criterion 8	Criterion 9	Criterion 10
Course1	1	1	1	1	1	0	0	0	1	0
Course2	1	1	0	1	0	1	1	0	0	1
Course3	1	1	1	0	1	0	0	·1	0	0
Course4	1	1	1	1	1	1	1	1	0	1
Course5	0	1	1	1	1	1	1	1	1	0
Course6	0	0	1	1	1	1	1	1	0	0
Course7	0	0	0	1	1	1	1	0	0	0
Course8	1	1	1	1	0	1	1	1	1	1
Course9	1	1	1	0	0	1	0	1	1	1
Course10	0	0	0	1	1	1	1	0	0	1

Table 6. Data processing set of course recommendation results.

Course	Number of courses enrolled	Total number of students enrolled	average scores	T
Course1	80	120	78	0.52
Course2	87	100	82	0.71
Course3	55	100	70	0.39
Course4	72	120	68	0.41
Course5	123	150	90	0.74
Course6	94	100	74	0.7
Course7	88	120	71	0.52
Course8	115	120	80	0.77
Course9	106	120	69	0.61
Course10	33	150	82	0.18

4.3 Model training

In this paper, MATLAB7.1 neural community toolbox is used to recognize the precise advice system, a three-layer BP community is established, and NEWFF characteristic is used to create the neural network. There are 10 neurons in the input, 10 neurons in the center hidden layer, and one facts output, so the community is 10 × 10 × 1 structure. Neurons in the enter layer and a hidden layer of the neural community are set to the hyperbolic tangent S-type switch transit function. Since the output has been normalized to the interval [0,1], the switch characteristic of neurons in the output layer is set to the logs-type switch login function.

The data set of the course identification vector is input into the input layer of the network. 10 training samples are used as the learning set for training, and the training times are set to a maximum of 3,000 times. L-M optimization algorithm, gradient descent method with momentum, gradient descent technique with variable studying price, and elastic gradient descent approach are respectively used to research and teach the network. After repeated trial and error, when the trial characteristic of the L-M optimization algorithm is chosen through the studying coaching algorithm, the prediction impact of the community is the most ideal. In authentic training, after three iterations, the

error between the actual output and the predicted outcome meets the requirements, and the community stops the movement, as shown in Figure 2.
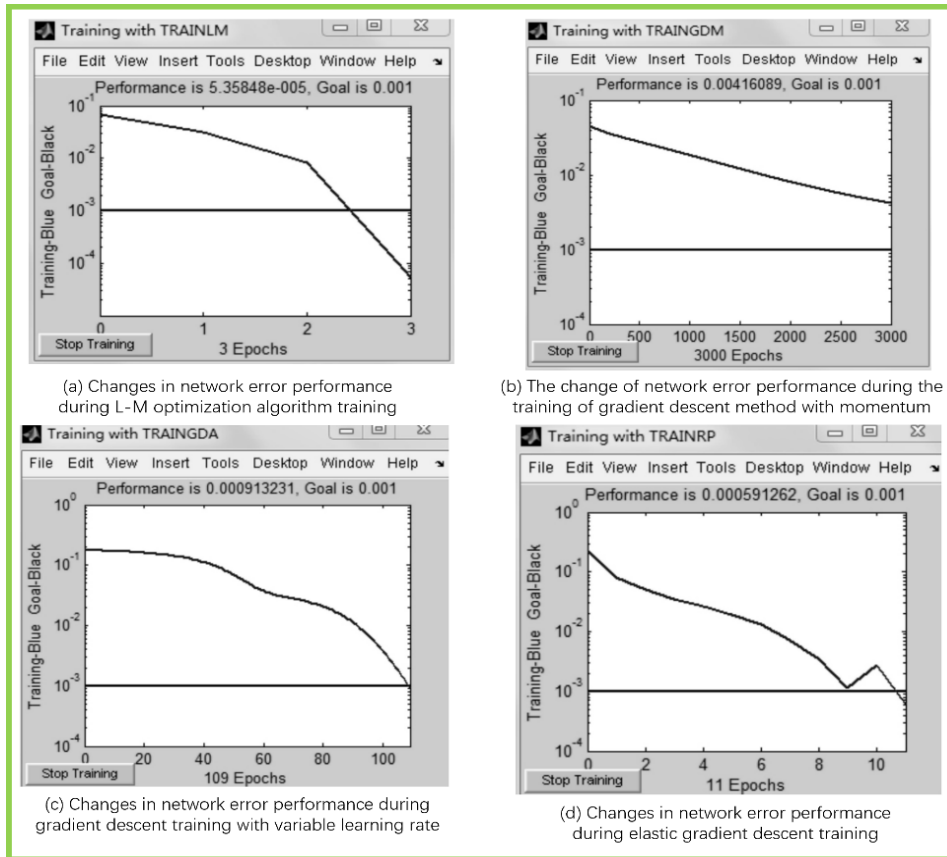

(a) Changes in network error performance during L-M optimization algorithm training

(b) The change of network error performance during the training of gradient descent method with momentum

(c) Changes in network error performance during gradient descent training with variable learning rate

(d) Changes in network error performance during elastic gradient descent training

Figure 2. Training process of artificial neural network

From the variation of error performance in Figure 4, we can see that (b) the gradient descent method with momentum still fails to reach the expected error after 3,000 iterations; (c) Gradient descent method with variable learning rate has achieved error performance, but after 109 iterations, the convergence speed is not fast; (d) Elastic gradient descent method, although the convergence speed is closed and the error expectation is reached, the network oscillation change performance is noticeable.

4.4 Model testing

After the training of the neural network, this paper uses a sim function to simulate and test the accuracy of the trained network. The sample course identification vector $k = \{k_1, k_2, ..., k_n\}$ is entered from the enter layer of the endorsed model, and the genuine output is obtained after the dummy runs, and the authentic production is in contrast with the predicted outcome, as proven in Table 7. It can be considered from the difference between the two units of records that though there are some variations between the actual output and the anticipated output, in general, the error necessities are met. The facts mirrored by using the two businesses are the same, and the accuracy

of the dummy is high. Therefore, this paper believes that this mannequin can be used for path shrewd advice (Huang et al., 2023).

Table 7. Comparison of neural network prediction model output and actual output values of test samples

Course	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
actual output	0.52	0.71	0.39	0.41	0.74	0.7	0.52	0.77	0.61	0.18
Model output	0.58	0.708	0.3855	0.4117	0.7378	0.7014	0.5286	0.7704	0.0.5996	0.1833

According to the above discussion, the course recommendation algorithm flow based on the course identification vector, as shown in Figure 3, is proposed.
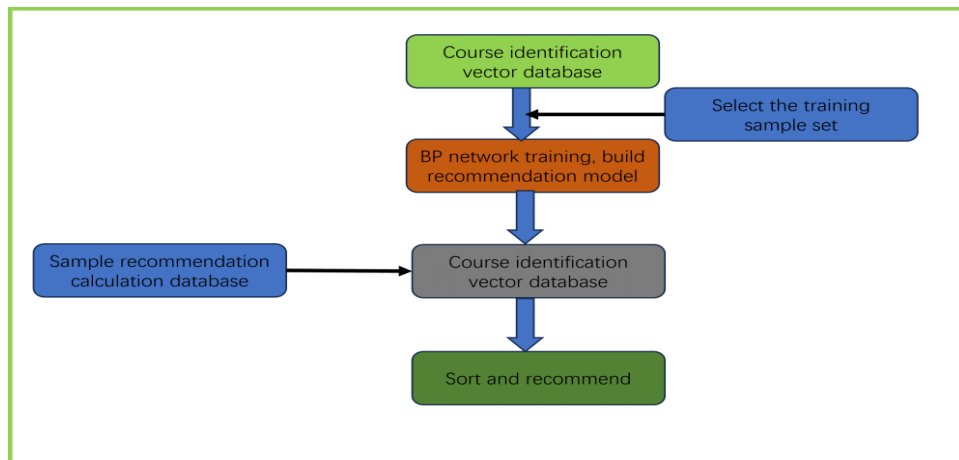

Figure 3. Course recommendation algorithm flow

5. Results and discussion

Nowadays, with more and more PE curriculum resources, schools or teachers are allowed to choose various curriculum resources according to their curriculum conditions. However, because some teachers need a deep understanding of curriculum training programs and standards, the selected curriculum resources cannot promote their curriculum development, resulting in a waste of personal time and energy, and school teaching resources. This paper puts forward the research on the intelligent recognition and game model of PE curriculum resources based on neural networks. Firstly, the conformity vector of curriculum training standards is taken as the input of the model, and then the result of function calculation based on course selection data and grades is taken as the output of the model. Finally, the data test verifies that the model conforms to the actual situation.

In this paper, the clever consciousness and sport mannequin of PE curriculum sources based totally on BP neural community technological know-how and deep neural community are proposed. Each direction valuable resource generates a direction identification vector in accordance with the route coaching standards calculates the helpful route resource advice diploma based totally on the choice statistics and grades, and inputs the route useful resource identification vector and

suggestion diploma into the neural network. When the quantity of hidden layer nodes is 10, and the L-M optimization algorithm is chosen through gaining knowledge of the education algorithm, the error between the actual output and the predicted outcome of the community meets the requirements. It indicates that the accuracy of the advice mannequin meets the requirements; that is, the relationship between the path aid identification vector and the path advice diploma mirrored with the aid of the neural community essentially displays the purposeful relationship between them, and the mannequin can be used to make corresponding preferences.

6. Shortage of research

This paper proposes to use BP neural network technology to study the intelligent recognition and game model of physical education curriculum resources based on deep neural networks. Although the corresponding calculation model and course recommendation algorithm flow are obtained, due to the limitations of the BP neural network, such as the steepest descent method for network training, the gradient value may be very small. The weights and deviations of each iteration lead to certain errors in the training and testing of the model, which is what this paper needs to continue to improve.

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