Hindawi
Wireless Communications and Mobile Computing
Volume 2022, Article ID 3556136, 8 pages
https://doi.org/10.1155/2022/3556136

Research Article

Application of Decision Tree Algorithm in Teaching Quality Analysis of Physical Education

JiaJia Zhao

School of Physical Education, Central China Normal University, Wuhan, Hubei 430079, China

Correspondence should be addressed to JiaJia Zhao; zhaojiajia@mail.ccnu.edu.cn

Received 14 January 2022; Accepted 28 February 2022; Published 14 April 2022

Academic Editor: Kalidoss Rajakani

Physical education is not only an important part of national education, but also one of the important means to improve the physical quality of students and citizens. With the rapid innovation of information technology in China, the decision tree algorithm is introduced into the teaching quality analysis of physical education, which becomes the new reform thinking direction of PE teaching, and promotes the teaching method and the training way of coaches. Under the background of new era, in this paper, the basic principle and realization process of decision tree algorithm is analyzed, applying it to the data analysis of the teaching quality of physical education. The computer is used to excavate the factors that influence the teaching of physical education. And the results show that the method can classify the data well, and the acquired knowledge is of great significance to the teaching reform of the physical education class in the future. Through the rational evaluation of teachers' overall teaching quality, teachers can optimize the teaching process according to the evaluation results, find the weak links of students' learning in time, remind students to review and consolidate relevant knowledge, help students improve their study and examination scores, and further improve their impact on physical education teaching behavior.

1. Introduction

Teachers' teaching effect is an important factor that directly affects the quality of teaching. The teaching effect should be comprehensively measured from various teaching links (such as classroom teaching, exercise class, experimental class, classroom discussion, counseling and Q & A, and teaching and educating people). Teachers can choose reasonable assessment indicators from three aspects: (1) teachers' academic and professional level such as the familiarity with the contents of teaching materials, the accuracy of mastering key points and difficulties, the level of organizing classroom discussion, selecting and compiling teaching materials, and selecting exercises and test questions; (2) teachers' teaching methods, for example, whether the teaching method of highlighting the key points and dispersing the difficult points is appropriate, whether it is combined with the actual situation of students, whether it meets the requirements of the syllabus and whether it can properly organize all teaching links, how to use the past and the future and heuristic teaching methods, and whether the expression and blackboard writing are clear and organized; (3) teachers' teaching attitude such as whether to prepare lessons carefully, whether to implement teaching plans, whether to continuously improve teaching and update teaching contents, whether to teach and educate people, etc.

Education is the foundation of the future development of the country, school teaching is the most important thing in the education system, and it is the first way to cultivate the social talents, and only with excellent teaching quality can we ensure the cultivation of excellent talents to meet the needs of social development [1]. This requires schools to focus on teaching quality, strict compliance with teaching requirements, to ensure higher teaching quality [2]. Although there are many ways to improve the quality of teaching, but no matter which way, there is no teaching evaluation, and the results of teaching evaluation is accurate, scientific, will determine the whole development of teaching, and directly affect the quality of teaching promotion [3]. The results of teaching evaluation not only reflect the teaching level of teachers, but also analyze the students' learning quality, which has direct influence on the planning of teaching content [4]. Therefore, the teachers who participate in teaching evaluation can not only reflect on their teaching methods through the evaluation results but also make the next teaching plan through the teaching evaluation results and train the teachers in a targeted way to realize the utilization of the maximum efficiency of educational resources [5]. Therefore, the evaluation of teaching quality has a very important reference value both for improving the teaching quality of the school and for teaching management at ordinary times [6]. Therefore, it is necessary to analyze the evaluation of classroom teaching and the factors affecting the quality of PE teaching in order to improve the quality of PE teaching and improve the teaching level of PE class. Based on this, the decision tree algorithm is applied to the quality analysis of PE teaching, so that the scientific guidance can be put forward effectively.

Under the background of the new era, this paper analyzes the basic principle and implementation process of decision tree algorithm and applies it to the data analysis of physical education teaching quality. Its innovative contributions include the following: (1) Teachers can optimize the teaching process according to the evaluation results of the algorithm, find the weak links of students' learning in time, remind students to review and consolidate relevant knowledge, and help students improve their learning and examination scores. (2) Computer algorithms are becoming more and more mature and practical, which can reduce teachers' workload in many teaching aspects, which makes computer algorithms have been widely used in real life. (3) It has promoted the further reform and improvement of teaching methods and coaching training models and has provided reference value for creating a talent training mode that is more in line with the requirements of the new era.

2. State of the Art

Data mining is one of the hottest branches in the research, development, and application of databases and artificial intelligence today, and many data mining systems have been successfully applied in the fields of retailing, marketing, and telecommunications [7]. The world's most influential companies, as well as its data mining system developed by SAS Company Enterprise Miner, are a common data mining tool that helps users find business trends and explain known facts by collecting statistical analysis and customer purchase patterns [8]. Therefore, it is the original intention to predict the key factors needed to accomplish the task in the future and finally realize the company's revenue increase and cost reduction. IBM's intelligent miner can automate data selection, data conversion, data mining, and results to demonstrate that this process is repeated when necessary [9]. The Clementine developed by Solution Company provides a visual modeling environment, including data collection, mining, collation, modeling and reporting, and other parts of the company [10]. The Knowledge seeker developed by Angoss Company is a fairly complete classification tree analysis program based on decision tree [11]. The national personnel engaged in data mining research are generally concentrated in universities, research institutions, and companies [12]. A great deal of work has been done in improving the efficiency of mining algorithms, such as Fudan University, Nanjing College, Xi'an Jiaotong University, Southeast University, and National Defense Department [13].

In order to improve the image processing performance of data mining system and improve the efficiency of image processing, some image processing algorithms running in hardware can be used. In practice, Liu and Li introduced some reconfigurable devices and more advanced programming languages to use FPGA for image processing [14]. People's interest in intelligent mobile learning system is growing explosively. More effective education and adaptive learning can be carried out according to each student's learning ability. Matzavela and Alepis further improve the personalization of students' academic performance, including dynamic testing using prediction models. One of the main objectives of the research is to create an adaptive dynamic test for evaluating students' academic performance and constantly compare the evaluation results showing students' personal situation with the results of the decision tree algorithm for developing students' knowledge level prediction model, according to the weight of the decision tree [15]. People's interest in intelligent mobile learning system is growing explosively. More effective education and adaptive learning can be carried out according to each student's learning ability. The goal of Guo and Cai is to further improve the personalization of students' academic performance, including dynamic testing using prediction models. One of the main objectives of the research is to create an adaptive dynamic test to evaluate students' academic performance and constantly compare the evaluation results showing students' personal situation with the results of the decision tree [16]. Shi et al. established a prediction model of whether the number of summer rainstorm days in Lianyungang area is large by using classic C5.0 decision tree algorithm. The results show that the prediction model of summer rainstorm days established by C5 is feasible [17].

3. Methodology

3.1. ID3 Algorithm. As early as in the 80s, the Quinlan first determined the ID3 algorithm, and specifically, it is through the data structure decision tree recursive process. It is based on information theory, which is a research direction in mathematics, which belongs to the theory of probability and mathematical statistics, usually to deal with such problems as entropy, communication system, and data transmission. According to the information gain degree based on the analysis, the data for detailed management classification, the process is in turn from the top down, and the structure is shown in Figure 1 [18]. The ID3 algorithm usually picks out an attribute as its root node, and its values all form branches. In this way, the data on the root node is branched, thus deriving all kinds of child nodes, thus forming a tree structure [19]. Using the computational information gain to help the decision tree to select its own attributes, all nodes can be detected to the maximum extent when they complete the test [20, 21]. The detailed steps are as follows: when you

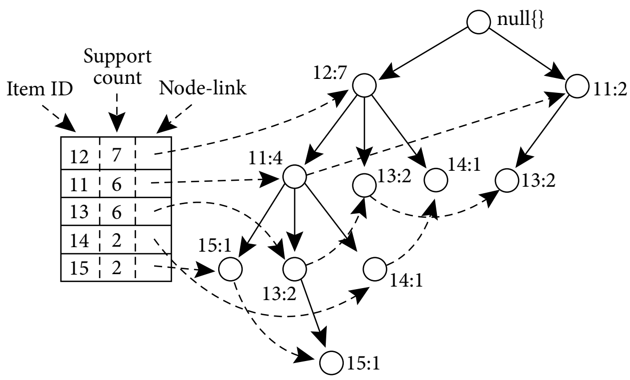

Figure 1: ID3 algorithm logic structure.

want to detect all the properties, select the point with the most class information, then complete the branch based on each of these values, and use this method again on each branch to complete its other branches, stopping after all the values of the subset have been detected [22]. In this way, the complete decision tree is analyzed, and it can be used to analyze and generalize other data [23].

The ID3 basic principle is developed by the two-class classification problem, and its mathematical expression can be expressed as follows: $E = F_1 * F_2 * \cdots * F_n$ has a poor vector space of n dimension, in which F_j is a set of poor discrete symbols, and the elements $e = \langle V_1, V_2, \cdots, V_n \rangle$ in E are called instances. Sets P and N are two instances of E and F , respectively, of the positive and inverse sets, in which $V_j \in F_j, j = 1, 2, \cdots, n$. The size of the positive sets PE is P, and the size of inverse sets NE is N in the vector space E; suppose they are the same. ID3 is based on the following two hypotheses: (1) A correct decision tree on the vector space E is identical to the probability of both positive and inverse examples of the classification probability of any example. (2) The amount of information required for a decision tree to make the correct classification of an instance is as follows:

$$E(E) = -\frac{P}{P+N} \log \frac{P}{P+N} - \frac{N}{P+N} \log \frac{N}{P+N} .. \quad (1)$$

If the attribute A is the root of the decision tree, which has a value $(V_1, V_2 \cdots V_v)$, E will be divided into V subsets; assuming that there is P_i positive example and N_i counter example, the information entropy of E_i subset is $E(E_i)$:

$$E(E_i) = -\frac{P_i}{P_i+N_i} \log \frac{P_i}{P_i+N_i} - \frac{N_i}{P_i+N_i} \log \frac{N_i}{P_i+N_i} .. \quad (2)$$

The information entropy $E(A)$, sorted by attribute root A, is as follows:

$$E(A) = \sum_{r=1}^{v} \frac{P_i + N_i}{P+N} E(E_i). \quad (3)$$

Therefore, the information gain $I(A)$ based on attributes is as follows:

$$I(A) = E(E) - E(A). \quad (4)$$

ID3 selects the $I(A)_{\max}$ (that is, $E(A)_{\min}$) property as the root A node. V subsets E_i of E in the recursive invocation of the above process, the resulting child node of $A, B_1, B_2, \cdots, B_v$.

The basic principle of ID3 is based on two kinds of classification problems, but it is easy to extend too many classes. Set a sample set S of C common class samples, and each type of sample number is $P_i (i = 1, 2, 3, \cdots, c)$. If the attribute A is the root of the decision tree, has a value $V_1, V_2, \cdots, V_v$, it will be divided into V subsets $[E_1, E_2, \cdots, E_v]$, and assuming that the number of class samples in E is $P_{ij} = 1, 2, \cdots, c$, then the amount of E_i information in the subset is $E(E_i)$:

$$E(E_i) = -\sum_{j=1}^{c} \frac{P_{ij}}{|E_i|} \log \frac{P_{ij}}{E_i}. \quad (5)$$

The information entropy of the root A classification is as follows:

$$E(A) = \sum_{i=1}^{v} \frac{|E_i|}{E} E(E_i). \quad (6)$$

Selecting A properties makes the smallest $E(A)_{\min}$ of formula (7), and the information gain increases.

3.2. C4.5 Algorithm. The C4.5 algorithm is developed on the basis of ID3 and is also used for the numerical classification of decision trees. And ID3 does contrast, and specific improvements have a few points: (1) through the information gain rate to complete the property screening and through the subtree information gain to complete the ID3 attribute filter. Information can be defined in a variety of ways. ID3 is defined by the entropy, which is often said that the Di changes value, and C4.5 is through the information gain rate. (2) In the process of organizing the structure of the decision tree, considering that there are some elements of the nodes are scarce, the result of the decision tree has been adapted, so the nodes of the above situation are not included in the analysis scope. Considering that there are many imperfections in the ID3 algorithm, industry scholars have been improving the characteristics of the algorithm. After the improvement, the new algorithm can handle more data types, and its processing efficiency has been improved greatly. The mathematical model of the algorithm is shown in Figure 2.

Set is an S collection of s data samples. Suppose the class label $C_i(I = 1, \cdots, m)$ has m different value, and set s_i to the number of samples in the class C_i. The desired information required to classify a given sample is given by the following formula:

Set is a collection of data samples. It is assumed that the class label has a different value, which is the number of

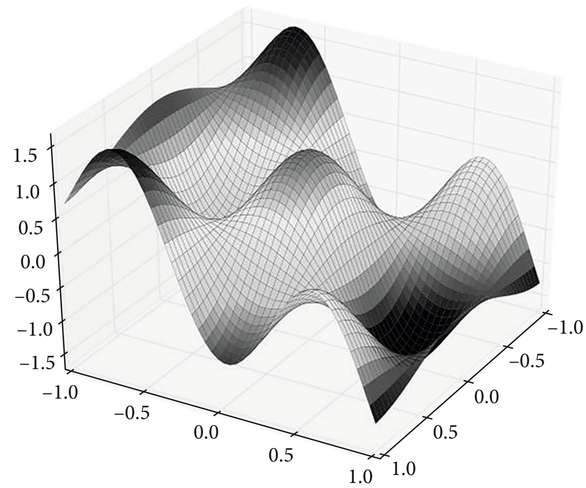

FIGURE 2: C4.5 mathematical model of algorithm.

samples in the class. The expected information required for a given sample classification is given in the following form:

$$I(s_1,\cdots,s_m) = \sum_{i=1}^{m} p_i \log_2^{(P_i)}. \quad (7)$$

It is the probability that any sample p_i belongs c_i to, and s_i/s is used to estimate.

The set attribute A has v subset $s_1, \cdots, s_y, s_i$ including some of the samples in the S, which have a_i values on the set A. If the test attributes A are selected, the subsets correspond to the branches that are grown by the nodes that contain the set. The number of samples for subsets is set S. According to the entropy s_{ij} divided by the subsets s_j in classc_i, the entropy is given by the following formula divided by A:

$$E(A) = \sum_{i=1}^{v} \frac{s_{ij}+\cdots+s_{mj}}{s} I\left(s_{ij},\cdots,s_{mj}\right). \quad (8)$$

In this, the item $(s_{ij}+\cdots+s_{mj})/s$ acts as the right of a subset j, and for a given subset s_i,

$$I\left(S_{1j}, S_{2j},\cdots,S_{mj}\right) = \sum_{i=1}^{m} p_{ij} \log_2^{p_{ij}}. \quad (9)$$

Among them, $p_{ij} = s_{ij}/s_j$ is the probability that the samples s_j in the class c_j are classified.

The encoding information to be obtained on the previous branch A is as follows:

$$\text{Gain}(A) = I(s_1,\cdots,s_m) - E(A).. \quad (10)$$

In this case, information gain ratio should be used instead of information gain.

$$\text{SplitInfo}(S, A) = -\sum_{i=1}^{c} \frac{|s_i|}{|S|} \log_2^{|s_i|/|s|}. \quad (11)$$

s_1 to s_c subset of c samples is formed into A property partition S of c value.

The information gain ratio on the attribute A at this time is as follows:

$$\text{GainRatio}(S, A) = \frac{\text{Gain}(S, A)}{\text{SplitInfo}(S, A)}. \quad (12)$$

Use the highest information gain ratio as the test property for the collection. Create a node and mark it with this attribute so that all of its values are divided and the sample is recorded by this branch.

3.3. Fuzzy Comprehensive Evaluation Method. Fuzzy comprehensive evaluation method is a kind of evaluation method based on fuzzy mathematics. Based on the fuzzy mathematics comprehensive evaluation method of qualitative evaluation theory, the fuzzy mathematics is used to evaluate the various factors of things or objects quantitatively. Therefore, it is widely used to express the uncertainty of things. The principle of fuzzy comprehensive evaluation is as follows, and the hypothetical comprehensive evaluation model is shown in the following matrix:

$$\begin{pmatrix} a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\ a_{2,1} & a_{2,2} & \cdots & a_{2,n} \\ \cdot & \cdot & \cdot & \cdot \\ a_{n,1} & a_{n,1} & & a_{n,n} \end{pmatrix}. \quad (13)$$

In this formula, the relative weight of the index ai relative to the index aj is indicated ai, j.

The weight of the fuzzy comprehensive evaluation method has great influence on the overall accuracy of the result of the score calculation. Therefore, it is necessary to analyze the weight of fuzzy comprehensive evaluation method, it is understood that the maximum eigenvalue of the judgment matrix is analyzed, the most important method is the square root method, and the calculation steps are as follows:

Calculate the product of each line of the matrix R.

$$M_i = \prod_{j=1}^{n} B_{ij}, i = 1, 2, \cdots, n. \quad (14)$$

The quadratic root n of the computation M_i is

$$\overline{w_i} = (M_i)^{1/n}, i = 1, 2, \cdots, n. \quad (15)$$

The normalized treatment of $\overline{w_i}$ is

$$w_i - \frac{\overline{w_i}}{\sum_{i=1}^{n}\overline{w_i}}, i = 1, 2, \cdots, n. \quad (16)$$

The right vector is as follows:

$$w = [w_1, w_2, \cdots, w_4]^T. \quad (17)$$

Calculate the λ_{max} eigenvalue of a judgment matrix R.
In the formula, $[Rw]_i$ is the i element in the vector.

Because of the comparison of the more complex things, there is no way to achieve very accurate quantization. There is always some error in comparison, so the matrix detection needs to be consistent. So as to ensure its accuracy. The algorithm for conformance checking is as follows:

$$CI = \frac{\lambda_{max} - n}{n - 1}. \quad (18)$$

In this formula, the variable n is equal to the dimension of the matrix, which is actually the number of the same matrix index; λ max is the maximum eigenvalue of the matrix. When the dimension of the matrix is large, the consistency index needs to be corrected. Its operators are as follows:

$$CR = \frac{CI}{RI}. \quad (19)$$

The above formula is the correction factor, which has different values for different dimensions, such as Table 1.

Because when the index dimension is less than 3 dimensions, the judgment matrix is very easy to be identical; therefore, it does not need to compute the consistency index. Normally, when $CR < 0.1$, the matrix was considered to satisfy the conformance requirements.

The weight vector of target criterion layer based on the above method is

$$W = (w_1, w_2, w_3, \cdots, w_k). \quad (20)$$

w_i is the relative weight of benchmark layer indicator I in the benchmark layer.

Set for the K criteria layer indicators, and the criteria below the measure layer are weighted to the following:

$$W_k = (w_{k1}, w_{k2}, w_{k3}, \cdots, w_{kp}).. \quad (21)$$

In the hierarchy, the synthetic weight calculation operator of measure j index under criterion i is

$$w_{i,j} = w_i \cdot w_j.. \quad (22)$$

Finally, the calculation results are obtained by sequencing each index. After obtaining the weights of each index, the evaluation score can be calculated by the product of the value. The calculated operator is as follows:

$$Ea = (w_{p,1}, w_{p,2}, \cdots, w_{p,n})(v_{p,1}, v_{p,2}, \cdots v_{p,n})^T.. \quad (23)$$

The overall weight $w_{p,i}$ of the lowest index i, for which the score, is evaluated.

TABLE 1: Correction factor different dimension values.

Dimension	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.96	1.12	1.24	1.32	1.41	1.45

4. Result Analysis and Discussion

With the advancement of education informationization, higher requirements are put forward for the behavior of PE teaching, as shown in Figure 3. Therefore, it is necessary to make a rational evaluation of the teaching behavior and to improve the quality of PE teaching according to the content of the evaluation. The selected physical education teaching quality evaluation is divided into four different evaluation subjects, namely, student evaluation, peer and expert evaluation, leadership evaluation, and teacher self-evaluation. Then, according to the weight of the final effective scoring interval of these different evaluation subjects, an effective interval of comprehensive evaluation is given, and the final evaluation grade is obtained according to the effective interval.

The object studied in the hypothesis model is P: its factor set $U = \{u_1, u_2, u_3, \cdots, u_m\}$ and the evaluation grade set $V = \{v_1, v_2, v_3, \cdots, v_m\}$. The evaluation matrix can be obtained by means of the centralized fuzzy evaluation of different factors in U:

$$X_0(2)R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix}, \quad (24)$$

where the degree r_{ij} of subordination u_i of v_j is expressed.

Set reference data column is often recorded as X_0, remember the 1th moment of the value $X_0(1)$, the 2nd moment is the value, and the K moment of the value is $X_0(k)$. Therefore, the reference sequence X can be expressed as follows:

$$X_0 = (X_0(1), X_0(2), \cdots, X_0(n)). \quad (25)$$

The comparison sequence in correlation analysis is often recorded as $X_1, X_2, \cdots X_k$, similar to the way X is represented, and it has

$$X_1 = (X_1(1), X_1(2), \cdots, X_1(n)), \quad (26)$$

$$X_k = (X_k(1), X_k(2), \cdots, X_k(n)). \quad (27)$$

FIGURE 3: Physical education class.

For a reference data column X_0, there are several comparison sequences $X_1, X_2, \cdots, Xn$. You can use the following relationship to indicate the difference between the comparison curve and the reference curve at each point.

$$\zeta_i(k) = \frac{\min_i(\Delta_i(\min)) + \rho \max_i(\Delta_i(\max))}{|x_0(k) - x_1(k)| + \rho \max_i(\Delta_i(\max))}. \quad (28)$$

In the formula, the relative difference between the curve X and the reference curve X is$\xi_i(k)$ at the k time, $0 < \rho < 1$, $\rho = 0.5$, which

$$\min_i(\Delta_i(\min)) = \min_i\left(\min_k |x_0(k) - x_i(k)|\right), \quad (29)$$

$$\max_i(\Delta_i(\max)) = \max_i\left(\max_k |x_0(k) - x_i(k)|\right) = 1. \quad (30)$$

It can be seen from the above formula that there are more related parameters involved in the calculation, so the results are easy to be distributed. Not to compare the results, therefore, the results of the calculation need to be treated with the mean value. Therefore, the general expression of the correlation degree is as follows:

$$r_i = \frac{1}{N}\sum_{k=1}^{N} \zeta_i(k). \quad (31)$$

By integrating the important indicators of different factors into a set $A = \{a_1, a_2, a_3, \cdots, a_m\}, \sum_{i=1}^{n} a_i = 1$, the following formula is derived:

$$\bar{B} = A \cdot R = \left(\overline{b_1}, \overline{b_2}, \cdots \overline{b_m}\right). \quad (32)$$

After normalization, we can get $B = \{b_1, b_2, \cdots, b_m\}$ and determine the evaluation level of the object.

The model directly divides PE teaching quality evaluation into four different evaluation subjects, which are student evaluation, peer and expert evaluation, leadership evaluation, and teacher self-evaluation. The algorithm will score statistics according to certain weights, then give an effective interval of comprehensive evaluation according to the weights of the final effective scoring interval of these different evaluation subjects, and obtain the final evaluation grade according to the effective interval. The algorithm implementation flowchart is shown in Figure 4.

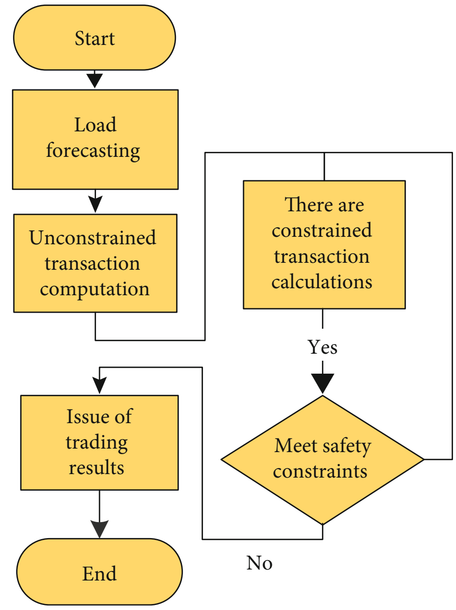

FIGURE 4: The algorithm realizes flow chart.

The main data studied in this paper are the results of some students in the course of physical education. These sports courses are the same but are taught by different teachers W_1, W_2, and W_3. After the collection of multiple database files collated, we randomly selected 18 students of the homework results, such as Table 2, a student data table, with student performance with A, B, C, D, and E scoring system.

At this time, $U = (u_1, \cdots u_n)$ as a set of evaluation index in teaching behavior evaluation table. Elements u_i in this collection should be considered as primary evaluation indicators. These first-level indicators represent the characteristics of teachers' own evaluation, such as teachers' own professional qualities and teachers' professional skills. The set $Q = (q_1, \cdots q_n)$ represents the weight corresponding to the level evaluation indicator. $U_i = \{u_{i1}, \cdots u_{\text{in}}\}$ as a set of two-level evaluation index in the teaching behavior evaluation table, the two-level index u_{ij} of the first-level index u_i in the set is the corresponding weight in the two-level evaluation index. Order as a set $Q_i(q_{i1}, \cdots q_{\text{in}})$ of three-level evaluation index in the teaching behavior evaluation table, the three-level evaluation index u_{ijk} of two-level evaluation index u_{ij} in the set, the collection $Q_{ij} = (q_{iji}, \cdots q_{ijn})$ represents the corresponding weights in the three-level evaluation index. In the process of realization, the algorithm first makes a reasonable score on the three-level index in the evaluation system of the teaching behavior in the evaluation subject, then directly statistics the frequency range of the scores

Table 2: Student performance data sheet.

Student ID	First time	Second time	Third time
201801022111	A	A	A
201801022112	B	C	B
201801022113	A	A	A
201801022114	B	A	A
201801022115	A	A	C
201801022116	A	A	A
201801022117	B	D	C
201801022118	A	A	A
201801022119	A	A	A

among different subjects, and uses the effective interval scoring formula to get the score of the original effective interval.

$$F_{ij} = \left\{ \begin{array}{c} \left[f_{ij1}^-, f_{ij1}^+\right] \\ \vdots \\ \left[f_{ijm}^-, f_{ijm}^+\right] \end{array} \right\}. \tag{33}$$

The variable m in the formula is the specific number of the three-level indicator represented as level two u_{ij}.

According to its weight, using matrix multiplication can be

$$R_{ij} = \left[r_{ij}^-, r_{ij}^+\right] = q_{ij} \times F_{ij} = \sum_{k=1}^{m} q_{ijk}\left[f_{ijk}^-, f_{ijk}^+\right] = \left[\sum_{k=1}^{m} q_{ijk}f_{ijk}^-, \sum_{k=1}^{m} q_{ijk}f_{ijk}^-\right]. \tag{34}$$

The variable R_{ij} in the formula is the effective interval score of the teacher in the two-grade index u_{ij}.

The effective interval score of the first level index can be obtained by the same

$$R_i = [r_i^-, r_i^+] = \left[\sum_{j=1}^{m} q_{ij}r_{ij}^-, \sum_{j=1}^{m} q_{ij}r_{ij}^+\right]. \tag{35}$$

The variables m in the formula are the number of level two indicators in the first-level u_i. Final effective interval score

$$R = [r^-, r^+] = \left[\sum_{i=1}^{m} q_i r_i^-, \sum_{i=1}^{m} q_i r_i^+\right]. \tag{36}$$

The number m is the first-level index in the evaluation system of teaching behavior in the formula.

The correlation calculation method in the above formula can be concluded that the effective interval between the four kinds of evaluation subjects is divided into

$$Z = [z^-, z^+] = \left[\sum_{i=1}^{4} W_i z_i^-, \sum_{i=1}^{4} W_i z_i^+\right]. \tag{37}$$

The main expression $[z_i^-, z_i^+]$ in this formula is the last effective interval of the evaluation subject in the first part and the comprehensive evaluation score W_i of the i evaluation subject in the formula. Then, the relative variables in this interval are then put into the hierarchical membership function $y_1(t) \sim y_4(t)$, in order to get the subordinate degree in each rank. Its rank is calculated by the degree of membership it obtains. If the ranked rank of the calculation is consistent, the ranking of all teachers in the evaluation of PE teaching behavior can be obtained directly through the ranking of the maximum membership degree in the same class.

Substituting the input in Table 1 to formula (26), the algorithm can be computed by using the MATLAB GUI to obtain the scoring matrix of the W_1, W_2, and W_3 three different teachers.

$$W_1 = \begin{bmatrix} 0.2 \\ 0.6 \\ 0.2 \end{bmatrix}, \tag{38}$$

$$W_2 = \begin{bmatrix} 0.14 \\ 0.65 \\ 0.21 \end{bmatrix}, \tag{39}$$

$$W_3 = \begin{bmatrix} 0.230 \\ 0.648 \\ 0.122 \end{bmatrix}. \tag{40}$$

It is not hard to see from the results that W_2 teachers have higher quality teaching effect than W_1 and W_3 teachers in the same course of teaching. Through the rationalization evaluation of teachers' overall teaching quality, teachers can optimize their teaching process according to the result of evaluation, so as to find out the weak point of students' learning in time, remind them to review and consolidate relevant knowledge, help students to improve their learning test scores, and further improve their influence on PE teaching behavior.

5. Conclusion

Due to the progress of algorithms and the increasing computing power of computers, computer algorithms are becoming more and more mature and practical, which can reduce people's workload in many aspects, which makes computer algorithms have been widely used in real life. This paper analyzes the basic principle and implementation process of decision tree algorithm and applies it to the data analysis of physical education teaching quality. Teachers can optimize the teaching process according to the evaluation results of the algorithm, timely find the weak links of students' learning, remind students to review and consolidate relevant knowledge, and help students improve their learning and examination results. It promotes the further reform and improvement of teaching methods and coach training mode and provides reference value for creating a talent training mode more in line with the requirements of the new era. Therefore, this paper proposes to apply the decision tree algorithm to the analysis of physical education teaching quality in order to reasonably evaluate the impact of computer on physical education teaching quality.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declared no conflicts of interest regarding this work.

References

[1] Y. Han, "Application of multimedia CAI technology in physical education," *Open Cybernetics & Systemics Journal*, vol. 9, no. 1, pp. 1814–1819, 2015.

[2] J. Chen, "PE teaching activities in colleges and universities based on decision tree," *International Journal of Emerging Technologies in Learning*, vol. 13, no. 8, pp. 38–50, 2018.

[3] S. Xu, L. Liang, and C. Ji, "College public sports culture practice based on decision tree algorithm," *Personal and Ubiquitous Computing*, vol. 24, no. 2, pp. 207–221, 2020.

[4] A. Casey, B. Dyson, and A. Campbell, "Action research in physical education: focusing beyond myself through cooperative learning," *Educational Action Research*, vol. 17, no. 3, pp. 407–423, 2009.

[5] A. Casey and B. Dyson, "The implementation of models-based practice in physical education through action research," *European Physical Education Review*, vol. 15, no. 2, pp. 175–199, 2009.

[6] M. Kovač, S. Sloan, and G. Starc, "Competencies in physical education teaching: Slovenian teachers' views and future perspectives," *European Physical Education Review*, vol. 14, no. 3, pp. 299–323, 2008.

[7] Y. Le, "Building model of physical education teaching value under IT context," *IJACT: International Journal of Advancements in Computing Technology*, vol. 5, no. 2, pp. 443–450, 2013.

[8] G. E. J. Faulkner, J. J. M. Dwyer, H. Irving, K. R. Allison, E. M. Adlaf, and J. Goodman, "Specialist or nonspecialist physical education teachers in Ontario elementary schools: examining differences in opportunities for physical activity," *Alberta Journal of Educational Research*, vol. 54, no. 4, pp. 407–419, 2008.

[9] Y. Lili and L. Guocheng, "Research on the construction of human resources audit management platform based on big data," *Economic Problem*, vol. 3, pp. 114–121, 2019.

[10] S. Zhou and W. Song, "Crack segmentation through deep convolutional neural networks and heterogeneous image fusion," *Automation in Construction*, vol. 125, no. 3, article 103605, 2021.

[11] A. Yağci and M. Çevik, "Prediction of Academic Achievements of Vocational and Technical High School (VTS) Students in Science Courses through Artificial Neural Networks," *Education and Information Technologies*, vol. 24, no. 5, pp. 2741–2761, 2019.

[12] Y. Wu and H. Zhang, "Image style recognition and intelligent design of oiled paper bamboo umbrella based on deep learning," *Computer-Aided Design and Applications*, vol. 19, no. 1, pp. 76–90, 2021.

[13] Z. Zhang, Z. Zhao, and D. S. Yeom, "Decision tree algorithm-based model and computer simulation for evaluating the effectiveness of physical education in universities," *Complexity*, vol. 2020, 11 pages, 2020.

[14] T. Liu and X. Li, "Design of english video learning platform based on FPGA system and sobel algorithm," *Microprocessors and Microsystems*, vol. 83, article 103992, 2021.

[15] V. Matzavela and E. Alepis, "Decision tree learning through a predictive model for student academic performance in intelligent m-learning environments," *Computers and Education: Artificial Intelligence*, vol. 2, article 100035, 2021.

[16] G. Peng and C. Cheng, "Student achievement mining and analysis based on clustering and association algorithm," *Computer Engineering and Applications*, vol. 55, no. 17, article 169179, 2019.

[17] Y. Shi, W. Chen, and Y. Zhu, "Study on prediction model of number of rainstorm days in summer based on C5.0 decision tree algorithm," *Meteorological & Environmental Research*, vol. 10, no. 2, pp. 60–64, 2019.

[18] G. B. Chen, Z. Sun, and L. Zhang, "Road identification algorithm for remote sensing images based on wavelet transform and recursive operator," *IEEE Access*, vol. 8, pp. 141824–141837, 2020.

[19] Z. Shuhua, "Design of college student achievement data mining and physical fitness analysis system based on ID3 algorithm," *Modern Electronics Technique*, vol. 42, no. 5, pp. 104–106, 2019.

[20] R. V. Varade and B. Thankanchan, "Academic performance prediction of undergraduate students using decision tree algorithm[J]. SAMRIDDHI A Journal of Physical Sciences," *Engineering and Technology*, vol. 13, no. SUP 1, p. 97, 2021.

[21] G. Chen, L. Wang, and M. M. Kamruzzaman, "Spectral classification of ecological spatial polarization SAR image based on target decomposition algorithm and machine learning," *Neural Computing and Applications*, vol. 32, no. 10, pp. 5449–5460, 2020.

[22] S. Yimin, C. Weiwei, and Z. Yunfeng, "Study on prediction model of number of rainstorm days in summer based on C5. 0 decision tree algorithm," *Meteorological & Environmental Research*, vol. 10, no. 2, pp. 56–60, 2019.

[23] G. Chen, Q. Pei, and M. M. Kamruzzaman, "Remote sensing image quality evaluation based on deep support value learning networks," *Signal Processing Image Communication*, vol. 83, p. 115783, 2020.