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CONSTRUCTION AND APPLICATION OF MOOC+FLIPPED CLASSROOM MIXED TEACHING MODEL IN VOLLEYBALL TEACHING IN COLLEGES AND UNIVERSITIES

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Abstract. "MOOC+Flipped Classroom" (MFC) is a new model that make the online learning and offline learning integrated. And it also shows a new way in developing the teaching reform. Based on MFC, a mixed teaching mode suitable for college volleyball was studied and established. And a reasonable evaluation index system was developed. It fosters educational fairness and improvements in volleyball learning performance. To be applicable to many kinds of problems, the support vector machine (SVM) is improved to obtain the DBT-SVM based quality evaluation model of college volleyball mixed teaching. The average score of students in the mixed teaching mode was higher than that in the traditional teaching mode. The comprehensive performance scores of the former and the latter after the experiment are 9.12 ± 0.75 and 7.63 ± 0.56 respectively. The mixed teaching mode results in higher student attendance. Among the prediction results of DBT-SVM, BT-SVM and SVM, DBT-SVM has higher accuracy, less training and testing time, and smaller error. This shows that DBT-SVM can accurately evaluate the teaching effect and quality.

Key words: MOOC; Flipped classroom; Mixed teaching; College volleyball teaching; Quality evaluation; DBT-SVM

1. Introduction. As the network develops rapidly, resource sharing concept in college education has been deepened and the awareness of informatization has been strengthened. This has facilitated the growth of Massive Open Online Course (MOOC) and flipped classroom [1]. MOOC's emerging has changed teaching methods and learning methods. This not only promotes educational fairness, but also improve the teaching method. Flipped classroom is a teaching method that emphasizes "people-oriented". It overlaps with the teaching methods of blended learning to some extent, aiming at making students learn more actively and flexibly. In the teaching process, flipped classroom has no preconditions. However, in the case of uneven students' foundation, the implementation of flipped classroom must have some basic prerequisites and use the appropriate teaching platform [2]. The combination of MFC can promote the smooth completion of teaching objectives and improve students' knowledge level. To a certain extent, it can improve students' motivation to learn and the classroom teaching quality (TQ) [3]. Volleyball, as one of the ball games, can improve people's physical coordination and is conducive to physical health. But at present, the problems of single teaching mode and low interest of students still exists in the volleyball teaching in higher education. This does not bode well for college volleyball education in the long run. It should make effective use of the network tools and platforms in the information age to build a new teaching model and enhance students' enthusiasm for volleyball courses. At the same time, the construction and implementation of the classroom TQ evaluation system will highly facilitate teaching theory development and ensure teachers' classroom TQ evaluation. After SVM is introduced into TQ evaluation, all school members will be evaluated. Not only can human errors be avoided, but the teacher's teaching process can also be fully demonstrated. In view of this, the research will build a mixed mode for volleyball teaching based on MFC. At the same time, reasonable indicators are selected to establish a TQ evaluation model to verify whether the mixed teaching mode is effective.

2. Related Works. In response to the impact of informatization on teaching models, many scholars studied online teaching models, including MOOC and flipped classroom, etc. The evaluation model based on BP neural network and SVM has been established for TQ, and many research results have been achieved.

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For more effective educational data mining, Qian Y and other scholars used MOOCs based flipped classroom and back-propagation neural network to predict students' grades and analyze the impact of teaching. Under the new model, students' performance had improved [4]. For more autonomous learning ability of college students' English, Chang H proposed a teaching model for flipped college English classes with big data and deep neural networks to investigate changes in student performance. This model provided a reference for cultivating college students' autonomous learning ability in English [5]. To overcome the low efficiency of college English evaluation, Zhang Y et al. proposed a method for evaluating inputs of distance education and determined a reasonable input evaluation index. The effectiveness of the keyboard rack results was more than 90%, and the students' English scores had improved [6]. In view of the vigorous development of online and offline teaching models, Wu X proposed a mixed teaching evaluation method of ideological and political education in college English teaching, and put forward suggestions on reforming the evaluation system for the two parts [7]. To improve BP neural network's low efficiency for evaluating the TQ, Jiang L et al. proposed a model based on AHP and particle swarm optimization BP neural network to evaluate TQ. The model parameters were adjusted and the results were verified by ANOVA. This method can effectively overcome the shortcomings of BP neural network and improve the evaluation accuracy [8].

To improve the evaluation efficiency of classroom TQ, Yuan T proposed a modified model to evaluate mixed TQ with Markov chain and designed a comparative experiment to select reasonable evaluation indicators. This model could improve the efficiency of evaluating the classroom TQ [9]. Addressing the inefficiency of traditional English TQ evaluation, Huang W proposed an improved Gaussian algorithm evaluation model, and combined with machine learning technology, improved the correlation vector machine model. The model had good quality evaluation effect and can be applied to English intelligent teaching [10]. To make reasonable efficiency use of the results to evaluate TQ, Yu H improved the Apriori Tid algorithm and proposed a model for evaluating online TQ on the basis of teaching needs. TQ evaluation using data mining proved that the model had good performance [11]. For addressing that online education evaluation model is inefficient, Hou J proposed a deep neural network-based online education quality evaluation model. The current BP neural network was improved by adaptive learning rate. This model could process large-scale data sets and improve the efficiency of the evaluation for TQ [12].

The above is the research of different researchers on the mixed teaching model and quality evaluation model. The mixed teaching model based on MFC can enhance the learning performance of students with certain effectiveness in evaluating. Therefore, this study will build a college volleyball mixed teaching mode based on MFC, and evaluate its TQ to promote college volleyball teaching.

3. Construction of mixed teaching mode and quality evaluation model of college volleyball based on MFC.

3.1. Mixed teaching mode of college volleyball based on MFC. MOOC is an online course with a large number of participants and no access conditions. In short, MOOC is to transform "teaching" into a new and open learning mode. Teachers use the Internet for teaching, students learn online, and conduct a higher level of knowledge exchange during this period. The "online+offline" teaching mode can be realized by MOOC, which is mixed with teachers' teaching, students' independent learning, quality curriculum of foreign and domestic schools [13]. During the teaching process, students can learn at their own pace based on their preferences and use various technologies to change the traditional way of teaching and learning in the classroom. Figure 3.1 shows MOOC teaching model.

The MOOC teaching model in Figure 3.1 mainly includes student activities and teacher activities. Learning and assessment are carried out through platforms and announcements, and teachers mainly play the role of supervision and assistance. In this process, we will achieve a higher level of knowledge exchange. Before the teaching activities are carried out, the teacher will issue a notice in the class group to guide students to complete the registration on the MOOC platform, and publish the selected textbooks, grading standards, and other requirements in the form of a notice to remind students to read. Then, the teacher fulfills the leading responsibility of supervising students' autonomous learning, while students control their dominant position and solve problems encountered during the learning process through independent research or communication and discussion. The teacher only needs to assist from the sidelines. Finally, the assessment is organized by teachers, with students actively participating in the assessment and actively verifying learning outcomes.

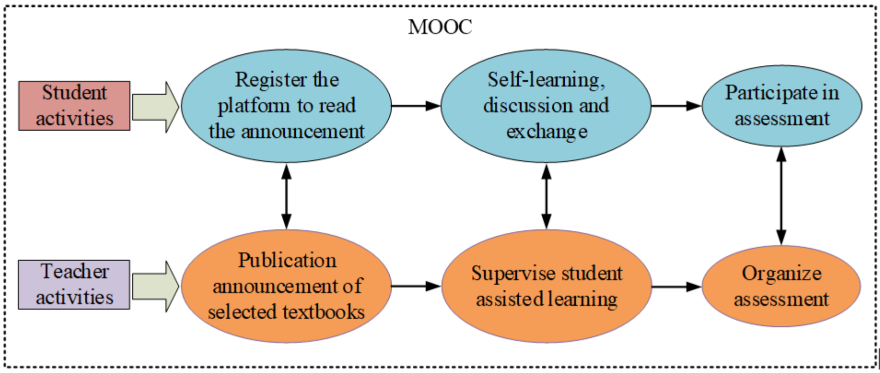


Fig. 3.1: MOOC teaching model

Flipped classroom (FCM), also known as "Flipped Class", refers to readjusting the time inside and outside the classroom, transferring the decision-making power of learning from teachers to students. It is a teaching method of reverse innovation through classroom discussion, practice, internalization and strengthening knowledge. In this teaching mode, the valuable time in the classroom allows students to focus more on proactive project-based learning, work together to research and solve problems, and thus gain a deeper level of understanding. Also reallocate time both inside and outside the classroom, transferring the learning power of teachers to students. Flipped classroom means that the physical classroom of "teachers' teaching and students' listening" has become a way to stimulate students' active and active learning. In this teaching mode, students can use their valuable spare time to engage in theme based learning, explore problem-solving together, and deepen their understanding of the problem. Teachers no longer occupy classroom time to impart information, which requires students to complete self-learning before class. They can watch video lectures, listen to podcasts, read enhanced e-books, and discuss with other classmates online. They can access the necessary materials at any time. Teachers can also have more time to communicate with everyone. After class, students independently plan their learning content, pace, style, and presentation of knowledge, while teachers use teaching and collaborative methods to meet students' needs and facilitate personalized learning. The goal is to enable students to achieve more authentic learning through practice. The Flipped classroom model is a part of the big education movement. It overlaps with blended learning, inquiry learning, and other teaching methods and tools in meaning, all of which are designed to make learning more flexible, active, and enable students to participate more. In the The Internet Age, students learn rich online courses through the Internet, and do not have to go to schools to receive teachers' lectures. The Internet, especially the mobile Internet, gave birth to the "Flipped classroom" teaching model. "Flipped classroom" is a complete subversion of the traditional classroom teaching structure and teaching process based on printing, which will lead to a series of changes in teacher roles, curriculum models, management models, etc.

Teaching in a mixed way is proposed before. Narrowly speaking, mixed teaching is a teaching context in which there is both online and offline teaching. Broadly speaking, mixed teaching is a combination of traditional teaching and digital teaching under the condition of information technology. The broad mixed teaching is applied in this study. Hybrid teaching is to organically combine the advantages of network and physical classroom teaching based on teacher-led and student-centered. Improvement for the teaching effect can be achieved by integrating seven links including teaching objectives, teaching environment, resources, content, time, assessment standards and teaching evaluation. Figure 3.2 shows the mixed teaching mode of "MFC".

The mixed teaching mode is mainly composed of classroom online activities and classroom offline activities, the two parts are conducted separately in the classroom and outside the classroom. In implementing "MFC" mixed teaching mode construction, teaching design and activity implementation, the teacher-led and student-centered principle should be strictly followed. At the same time, based on the needs of college sports volleyball students and teachers, it can grasp the support of its mixed teaching activities. Then, a rigorous and detailed

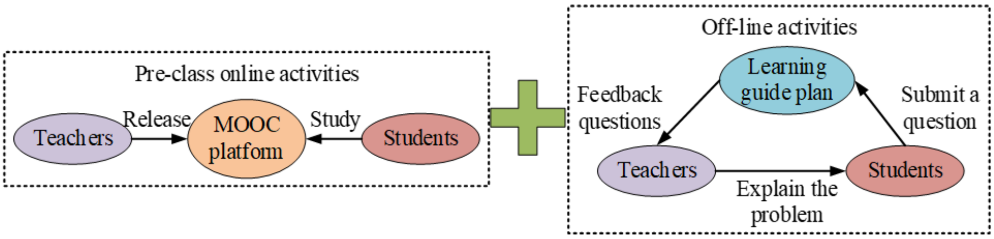


Fig. 3.2: Mixed teaching mode of "MFC"

teaching design is carried out in accordance with the characteristics of college mixed volleyball teaching. The "MFC"-based mixed teaching activities are adjusted in a timely and flexible manner to meet the actual teaching situation of the school for continuous efficiency improvement. Among them, in online activities, learning guidance plans assign tasks, manage platforms, and collect information into the course. Students also watch videos, provide feedback, and discuss online during the course. Teachers are mainly responsible for supervising and guiding. In classroom activities, the learning guidance plan involves teaching design practice for students. Students and teachers respectively provide feedback on teaching issues and guide teaching activities into the learning guidance plan. Teachers are also responsible for teaching and consolidating knowledge for students.

At the same time, in the theory and practice of the "MFC" mixed teaching mode of college volleyball, we must always adhere to the guidance of constructivism learning and relevance. Constructivist learning theory believes that learning is the process in which learners actively construct internal psychological representations in the process of interacting with the environment. Related scholars believe that the practical significance of constructivism refers to the connections between things, their properties, and laws. During the learning process, it helps learners understand the properties, laws, and connections between current things and other things. Due to the fact that current learners are in a certain background environment, with the help of other help, such as teachers, peers, etc., by establishing interaction with each other The process of actively constructing knowledge meaning through collaborative activities. Therefore, in the "mixed" teaching mode of "MFC", we will organically combine relevant teaching theories with practice, realize the "mixed" teaching mode of "MFC", and maximize the organizational activities of college volleyball. And the constructed model basically conforms to the principles of feasibility, systematicness and subjectivity. In the development of college volleyball mixed teaching based on "MFC", the process evaluation and the final evaluation are combined. This overcomes the disadvantages of the single evaluation information obtained only by the final score in the past, and makes its conclusions more authentic and credible.

3.2. Improved binary tree SVM multi-class classification algorithm. The evaluation of classroom TQ is important for college classroom teaching activities. Traditional evaluation methods include analytic hierarchy process and BP neural network evaluation. In a sense, both evaluation methods have yielded some results. However, some problems stay remained. The former accounts for a large proportion of the subjective factors, which leads to the objective and reliability of the final evaluation result is not ideal. There is a huge amount of data in training BP neural network model. There are problems such as learning and memory instability in the network, which leads to the failure of the model [14]. SVM can effectively solve the shortcomings of the above two methods, and analyze them on this basis to obtain the relevant dependencies, so as to correctly evaluate them.

SVM is a supervised learning method by learning statistically. Its main feature is that the network's generalization rate can be effectively increased with minimal structural risk. This method has obvious advantages in solving nonlinear and small sample recognition problems, and has obtained good application prospects in pattern recognition and data mining.

SVM should first be solved from the linearly separable classification surface, assuming the linearly separable training sample set $S = [(x_1, y_1), (x_2, y_2), ..., (x_l, y_l)] \in (X \times Y)^l$. Among them, $i = 1, 2, ..., l$, $x_i \in R^n$, $y_i\ in 1, -1$.

SVM is to construct a classifier through the information provided by training samples, as shown in equation 3.1.

$$f : R^n \to \pm 1 \tag{3.1}$$

Among them, the optimal classification surface can be converted into an optimization problem, and equation 3.2 is the expression.

$$\begin{cases} \min\limits_{w,b} & \frac{1}{2}\|w\|^2 \\ \text{s.t} \quad y_i\left((w \cdot x) + b\right) - 1 \geq 0, & \text{for } i = 1, 2, ..., l \end{cases} \tag{3.2}$$

(w, b) is a parameter pair in equation 3.2. In the process of solving, the optimal solutions w and b of parameter pair (w, b) can be obtained. In equation 3.3, the decision function expression is constructed.

$$f(x) = \text{sign}(w \cdot x + b) \tag{3.3}$$

The Lagrange function can be used to solve it, and equation 3.4 is the expression of Lagrange function.

$$L(w, b, \alpha) = \frac{1}{2}\|w\|^2 - \sum_{i=1}^{l} \alpha_i [y_i(w \cdot x_i + b) - 1] \tag{3.4}$$

In equation 3.4, $\alpha = (\alpha_i \ldots, \alpha_l)$. The solution of the quadratic optimization problem can be obtained through the Lagrange function, and the decision function can also be deformed in equation 3.5.

$$f(x) = \text{sgn}\left(\sum_{i=1}^{l} y_i \alpha_i'(x \cdot x_i) + b'\right) \tag{3.5}$$

But because many problems in practice are nonlinear problems, it is necessary to introduce relaxation variables to soften the constraints, or use the idea of kernel function. In the case of nonlinearity, equation 3.6 shows the expression of final optimization problem.

$$\textbf{Maximize } F(\alpha) = \sum_{i=1}^{l} \alpha_i - \frac{1}{2} \sum_{i,j=1}^{l} \alpha_i \alpha_j y_i y_j \left[\phi(x_i) \cdot \phi(x_j)\right] \tag{3.6}$$

In equation 3.6, $\phi(x)$ is used to describe the training samples mapped to the samples in the high-dimensional space. Assume $K(x_i, x_j) = \phi(x_i) \cdot \phi(x_j)$, then equation 3.6 can be transformed to equation 3.7.

$$\textbf{Maximize } F(\alpha) = \sum_{i=1}^{l} \alpha_i - \frac{1}{2} \sum_{i,j=1}^{l} \alpha_i \alpha_j y_i y_j K(x_i, x_j) \tag{3.7}$$

$K(x_i, x_j)$ is the kernel function in equation 3.7. At present, there are mainly four kinds of kernel functions in common use. Equation 3.8 is the first linear kernel function.

$$K(x_i, x_j) = x_i^T x_j \tag{3.8}$$

The second kernel function is Gaussian kernel function, also called radial basis RBF kernel function. The expression is shown in equation 3.9.

$$K(x_i, x_j) = \exp(-\gamma \|x_i - x_j\|^2), \quad \gamma > 0 \tag{3.9}$$

The third kernel function is polynomial kernel function, and the expression is shown in equation 3.10.

$$K(x_i, x_j) = (\gamma x_i^T x_j + r)^d, \quad \gamma > 0 \tag{3.10}$$

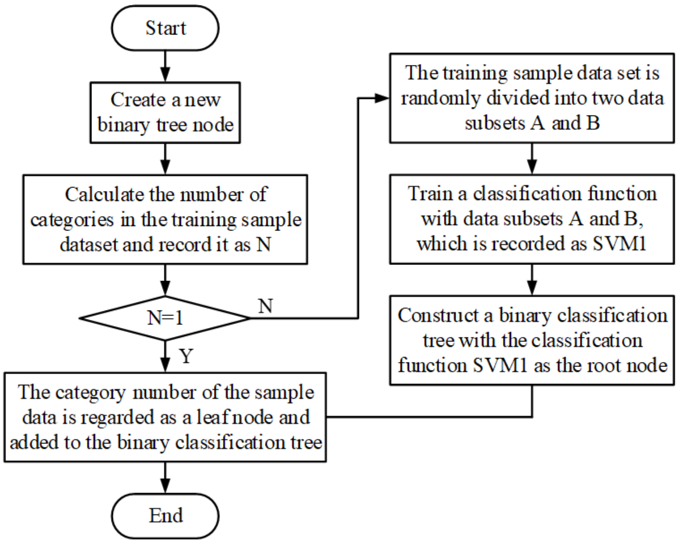


Fig. 3.3: Steps in BT-SVM algorithm training stage

The fourth kernel function is a two-layer neural network kernel function, which is also called sigmoid kernel function. The expression is shown in equation 3.11.

$$K(x_i, x_j) = \tanh(\gamma x_i^T x_j + r) \tag{3.11}$$

For the nonlinear separable problem, SVM can use RBF to avoid the complex calculation process, and most armies use RBF kernel function to solve [15]. At the same time, the main goal of SVM algorithm is to solve the second class classification problem. But in real life, most problems are multi-class problems. For multi-class problems, it is to decompose the multi-class problems into two classes, and then use the two-class classification function to solve them. Among them, Binary Tree SVM (BT-SVM) is a very popular multi-class classification algorithm. BT-SVM algorithm generally consists of training phase and test phase, and the steps of training phase are shown in Figure 3.3.

In the training phase, if the output category number is consistent with the category number when the data to be tested enters the node, the training is successfully completed in Figure 3.3. After that, it can test the data. In Figure 3.4, the steps in the BT-SVM algorithm test phase are shown.

The test phase is mainly to input the data to be tested into the root node in the training phase in Figure 3.4. Similarly, when the category label of the leaf node is the same as the category of the input test data, it also means that the test phase is successfully completed. However, BT-SVM will spend more time and economic costs in the process of training and testing, so it needs to be improved.

The Euclidean-based distance binary tree SVM (DBT-SVM) is improved. Assume that X is a sample set including k categories, and X_i is the training sample set of class i. In equation 3.12, the Euclidean distance of the nearest sample between class i and j is defined.

$$d_{i,j} = \min\{\|x_i - x_j\|\} \tag{3.12}$$

In equation 3.12, $i = 1, 2, \ldots, k$ means $d - i, j = 0$ and $d_{i,j} = d_{j,i}$. At the same time, the sample center expression of class i is shown as follows.

$$c_i = \frac{1}{n} \sum_{x \in x_i} x \tag{3.13}$$

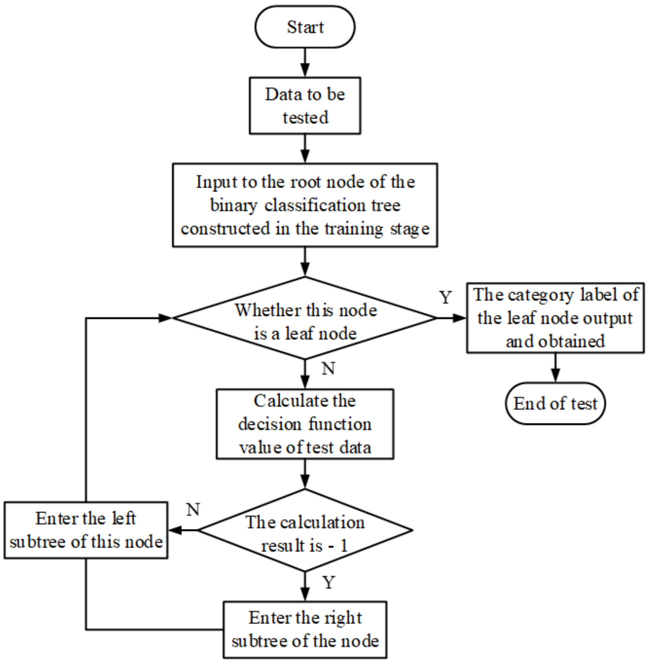


Fig. 3.4: Steps in the BT-SVM algorithm test phase

n represents samples number of class i in equation 3.13. If C_i is the sample centers of Class i, c_j is the sample centers of Class j, equation 3.14 shows the Euclidean distance between the centers of Class i and Class j.

$$d'_{i,j} = \|c_i - c_j\| \tag{3.14}$$

Like BT-SVM, DBT-SVM also includes training stage and test stage. First, all the existing category numbers are sorted from small to large in the experiment, and placed in set C. If a classification problem has k categories, equation 3.15 is the matrix D expression of Euclidean distance between category i and category j .

$$D = \begin{bmatrix} d_{1,2} & d'_{1,2} \\ d_{1,3} & d'_{1,3} \\ \vdots & \vdots \\ d_{k,(k-1)} & d'_{k,(k-1)} \end{bmatrix} \tag{3.15}$$

Then, in set C from matrix D, it should find out class i and j with the largest distance between samples. According to the order from small to large, it should put them in C_1 and C_2. An SVM classifier is also created at the corresponding node of the binomial tree. When each subtree has only one category, it can end the training. Similarly, when the node contains only one category, the test can also be ended.

3.3. Model for evaluating the DBT-SVM based college volleyball mixed TQ . Based on the principles of guidance, objectivity, fairness, conciseness and efficiency, this paper selects the evaluation indicators of the college volleyball mixed TQ. And combining the actual situation of teaching, it should formulate a reasonable index evaluation system to improve the accuracy and effectiveness of teaching evaluation. The evaluation index system adopts tower structure, and the appropriate first-level index is selected first. Then it is decomposed into second or third level indicators. Each indicator is given a score for evaluation and calculation [15]. In Table 3.1, the index system established by the study for evaluating volleyball mixed TQ is shown. The generation strategy of nearly complete binary tree and the related definition of class distance in clustering are

Table 3.1: Mixed TQ Evaluation Index System

First-level evaluation index	**Index No**	**Secondary evaluation index**
Learning attitude	X_1	Take classes on time, don't be late and leave early
	X_2	Actively participate in training
	X_3	Teamwork ability
Technological achievements	X_4	Serve
	X_5	Catch the ball
	X_6	Spike
	X_7	Learning duration
Network resource learning	X_8	Homework after class
	X_9	Online discussion

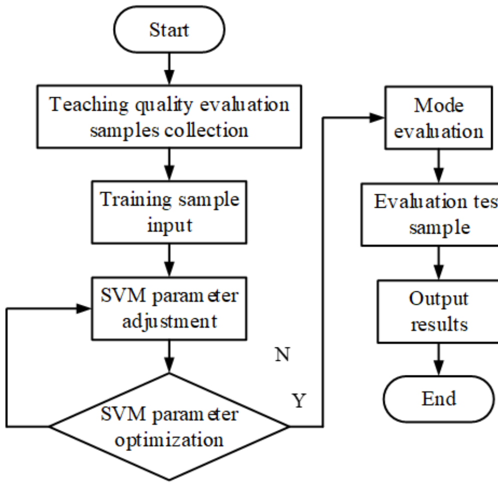


Fig. 3.5: Flow chart of university DBT-SVM based volleyball model for evaluating mixed TQ

used. Then, multiple binary tree SVM are combined to build a model for evaluating the DBT-SVM based college volleyball mixed TQ. Figure 3.5 shows the model flow chart.

The TQ evaluation samples need to be collected first, the samples preprocessed, the training samples input, and the SVM parameters adjusted in Figure 5. When the SVM parameters are in the optimal state, the mode can be evaluated, and the test samples can be evaluated to obtain the output results. On the contrary, if the SVM parameters do not reach the optimal state, it needs to continue to be adjusted until the parameters reach the optimal state before evaluation.

4. Analysis of colleges volleyball mixed teaching effect and quality evaluation results.

4.1. Analysis on teaching effect. The mixed teaching mode of university volleyball based on MOOC+ Flipped classroom and the evaluation model of university volleyball mixed teaching quality based on DBT-SVM will be handed over to experts for quality evaluation. The results show that the mixed teaching mode and teaching model are scientific and comprehensive. Since the focus of this research is the construction and application of the mixed teaching mode of MOOC+Flipped classroom in college volleyball teaching, the results will not be repeated. 50 students in the volleyball class selected by the 2020 level of a university are set as the experimental subjects. They are divided into two groups for observation and experiment, with 25 students in each group. Before the experiment, the scores of all subjects were recorded, including serving, receiving,

Table 4.1: Average score of the two groups of students

Group	Stage	Serve	Catch the ball	Spike	Comprehensive performance
Experimental group	Before experiment	5.29	6.11	4.99	5.41 ± 0.78
	After experiment	9.36	9.85	9.01	9.12 ± 0.75
Observation group	Before experiment	5.29	6.11	5.13	5.45 ± 0.71
	After experiment	6.77	8.65	7.59	7.63 ± 0.56

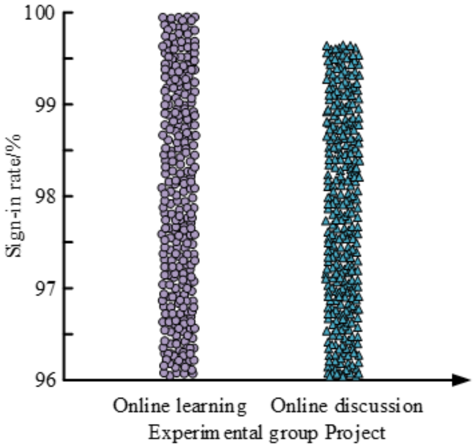
spiking and comprehensive performance. And the average value of each item of the two groups of students was calculated. After that, a semester was selected for the experiment, which lasted for 4 months, 4 weeks each month, 2 classes a week, and 90 minutes each time. The experimental group adopted the volleyball mixed teaching mode of "MFC", while the observation group adopted the traditional volleyball teaching mode with other conditions remained unchanged. The results were statistically analyzed. In Table 4.1, to facilitate the analysis, a ten-point system was adopted.

The results shown above are very close before the experiment in Table 4.1. After a semester of different teaching modes, the experimental group have greatly improved in serving, receiving, spiking and comprehensive performance. And the average score was significantly higher than that of the observation group. The comprehensive performance scores of the experimental group and the observation group before the experiment were 5.41 ± 0.78 and 5.45 ± 0.71 respectively. The two groups' comprehensive performance scores after the experiment are 9.12 ± 0.75 and 7.63 ± 0.56 respectively. In the volleyball mixed teaching mode of "MFC", the experimental group also have an online learning class than observation group. To further investigate students' learning attitudes under different teaching modes, in Figure 4.1, comparative analysis is made on students' attendance and learning duration.

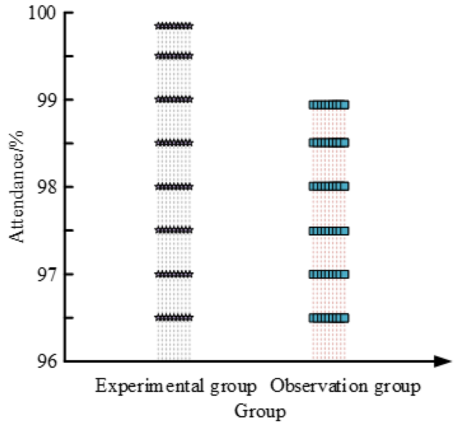
In Figure 4.1, sub-figure (a) shows the attendance rate of online learning and online discussion of the experimental group. Subfigure (b) shows the attendance rate of two groups. Subfigure (c) shows the average network course learning time of the experimental group every week. Subfigure (d) shows the network resources value evaluation by the students in the experimental group. Students in the experimental group have an ideal check-in situation for online resources, and the attendance rate of the experimental group performs better than that in the observation group. Students are more interested in volleyball courses under the mixed teaching mode of "MFC". From an online resource learning perspective, most students' weekly learning time of online resources is controlled within 1-3 hours. A small number of students study within 1 hour and 3-5 hours. No student's study time is more than 5 hours. In evaluating the students' network resources value, the higher the score, the higher the value that students think network resources have. From sub-graph (d), most students believe that network resources have certain value for volleyball teaching. In volleyball learning and improve students' performance, "MFC" can be used to build a mixed teaching mode of volleyball to enhance students' interest.

4.2. Evaluation of TQ. The research uses the volleyball teaching data of a university as the experimental data, and uses the evaluation scale filled by teachers and students as the data source. Finally, it selects three suitable data sets and divide them into data1, data2 and data3. In Figure 4.2, it uses SVM, BT-SVM and DBT-SVM to classify the data, and calculates the accuracy of the three algorithms. On different data sets, the three algorithms' accuracy is DBT-SVM, BT-SVM and SVM from high to low, that is, DBT-SVM has higher prediction accuracy in Figure 4.2. In dataset data1, the accuracy rates of DBT-SVM, BT-SVM and SVM are 97.01%, 96.67% and 94.56% respectively. In dataset data2, the accuracy rates of DBT-SVM, BT-SVM and SVM are 98.03%, 97.33% and 93.87% respectively. In dataset data3, the accuracy of DBT-SVM, BT-SVM and SVM are 97.34%, 96.78% and 93.96% respectively. After that, eight experiments were conducted on the dataset using three algorithms. The average time consumption of the three algorithms in Figure 8 is obtained by statistics of the time consumption during the experiment.

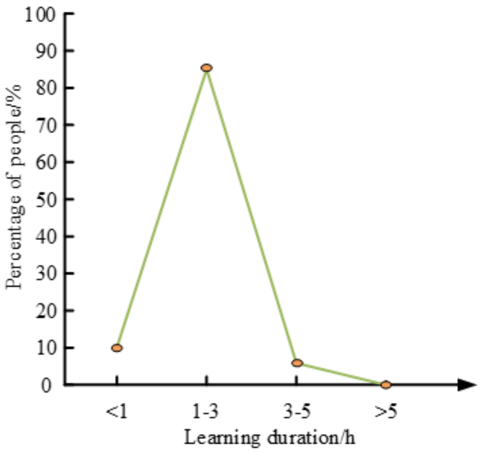
Sub-graph (a) shows the average training time and sub-graph (b) shows the average test time in Figure 4.3.



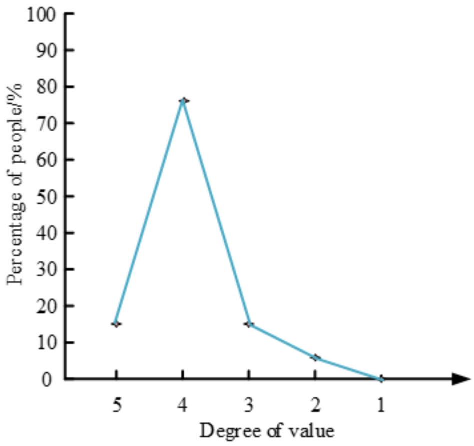
(a) Sign-in rate



(b) Attendance



(c) Learning duration



(d) Value evaluation of network resources

Fig. 4.1: Learning situation analysis

The training and testing time of SVM is significantly more than that of BT-SVM and DBT-SVM. The latter two both take less time, and the gap is not very large. This is because the amount of data and categories in this experiment is small, so the amount of calculation is small, making the gap not obvious. However, the training time and test time of DBT-SVM are less than that of BT-SVM, that is to say, it is effective to use DBT-SVM for mixed college volleyball TQ evaluation. At the same time, DBT-SVM, BT-SVM and SVM can also be used to predict the results, and 15 groups of test data sets can be selected for prediction. The results are shown in Figure 4.4.

Sub-graph (a), sub-graph (b) and sub-graph (c) respectively show the prediction of DBT-SVM, BT-SVM and SVM on performance in Figure 4.4. The predicted results of DBT-SVM are closer to the original results, and the predicted results are significantly better than those of BT-SVM and SVM. To better reflect the evaluation effect of DBT-SVM, the prediction result error is compared to obtain the evaluation results and error comparison under the three algorithms, as shown in Figure 4.5.

Among the three algorithms, the error of prediction results is DBT-SVM, BT-SVM and SVM from small

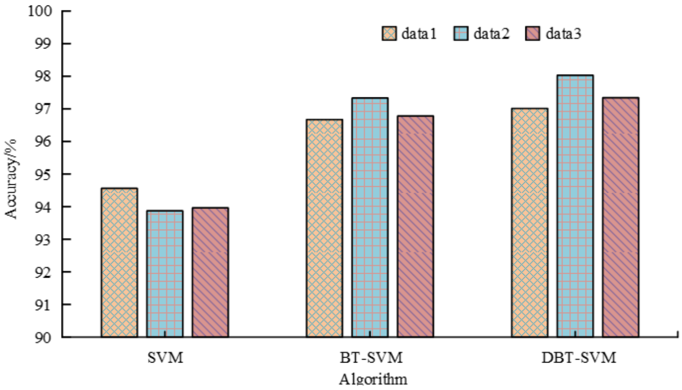
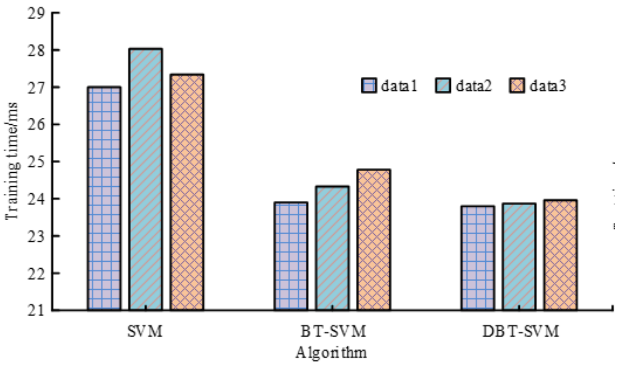
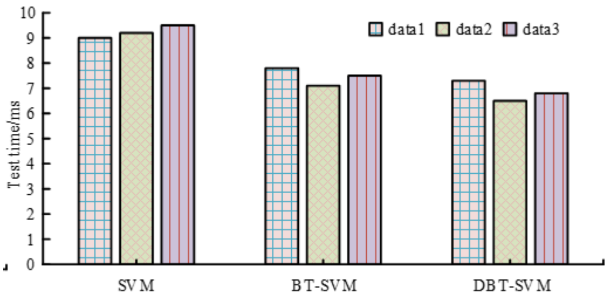


Fig. 4.2: Accuracy of three algorithms



(a) Training time

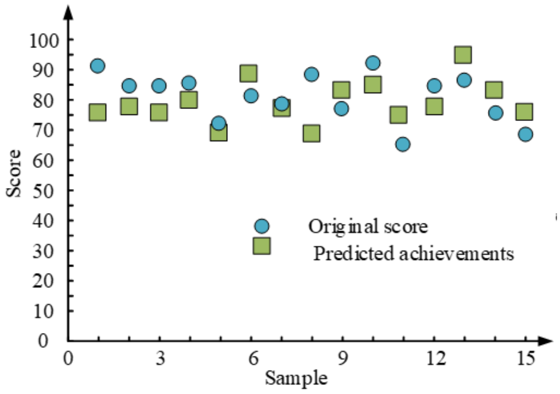


(b) Testing time

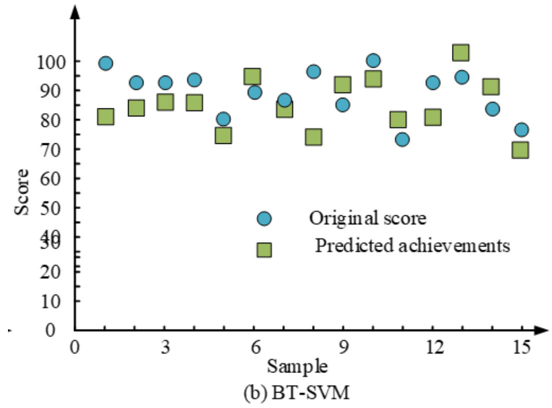
Fig. 4.3: Evaluation time of three algorithms

to large in Figure 4.5. This further shows that DBT-SVM can be used to build a mixed TQ evaluation model for college volleyball, which can achieve more accurate evaluation of teaching effect and quality. Then, it can monitor the teaching mode for a good college volleyball teaching environment creation.

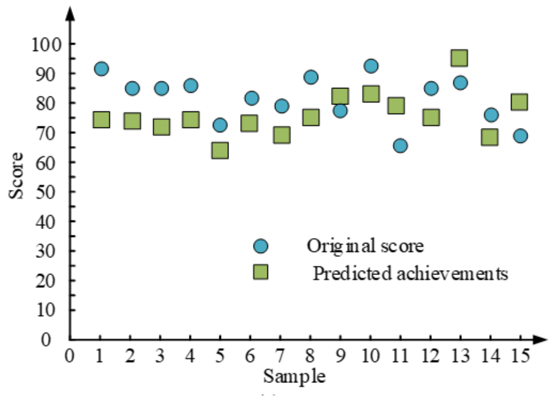
5. Conclusion. The information society has triggered the information wave of education. The development of MOOC had promoted the education equity, and provided sufficient high-quality resources to improve the flipped classroom. This provided a good choice for many universities to carry out teaching reform. “MFC” can form a student-centered teaching model. And it can make students' learning initiative and enthusiasm stimulated. To promote college volleyball teaching, it needs build a volleyball mixed teaching mode of “MFC”. To further evaluate the effectiveness of this model, a model for evaluating the TQ was established based on DBT-SVM. Under the volleyball mixed teaching mode of “MFC”, students' performance had been significantly improved. Students were also highly motivated to use online resources. The attendance rates of online learning and online discussion were 100% and 99.58% respectively. The attendance rate of the experimental group was higher than that of the observation group, which was 99.79% and 98.96% respectively. In the experiment, the TQ was evaluated by DBT-SVM. The accuracy of DBT-SVM in dataset data1, data2 and data3 was 97.01%, 98.03% and 97.34% respectively, and its comprehensive performance was better than BT-SVM and SVM. This showed that the TQ evaluation based on DBT-SVM is effective. In the future, more objective and scientific indicators will be selected to deeply evaluate the college volleyball mixed TQ.



(a) DPT-SVM



(b) BT-SVM



(c) SVM

Fig. 4.4: Prediction results of three algorithms

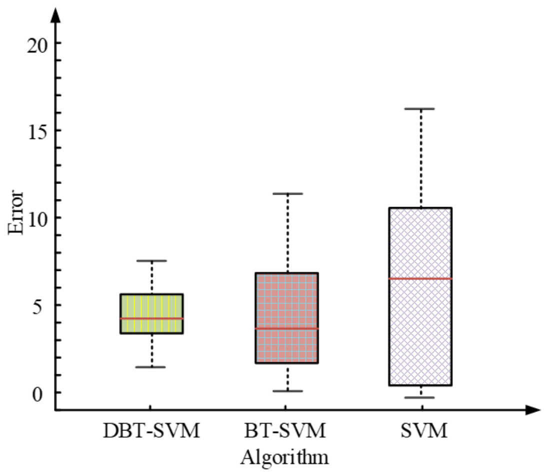


Fig. 4.5: Comparison of evaluation results and errors under three algorithms

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