An Evaluation Model of Higher Vocational English Teaching Effect Based on Particle Swarm Optimization and Support Vector Machine

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Abstract. Vocational English teaching is an important educational task in vocational education. In order to achieve better teaching results, it is necessary to conduct real-time evaluation of English teaching. This paper proposes an evaluation model of English teaching effect in higher vocational colleges based on Particle swarm optimization and support vector machine. First, this paper uses Particle swarm optimization algorithm to assign weights to multiple factors in the evaluation model to ensure that the weights of evaluation factors are more accurate. Afterwards, a support vector machine algorithm was used to construct an English teaching dataset model. By analyzing and modeling the features in the data, the optimal value of teaching effectiveness was predicted, and corresponding recommendations were made.

Finally, this article verifies through experiments that the results provided by the evaluation model are consistent with the actual results. Models can play an important role in comprehensively analyzing teaching data, accurately evaluating teaching effectiveness, and optimizing teaching strategies. This model can be widely applied in the field of vocational English teaching, and is expected to provide better teaching tools and technical support for teachers, improving students' learning effectiveness and level. In a word, the evaluation model of higher vocational English teaching effect based on Particle swarm optimization and support vector machine discussed in this paper has made full use of algorithm technology and data analysis means to obtain a more accurate and efficient teaching model in the teaching field, so as to improve the teaching effect and provide new ideas and exploration methods for the education reform in English education and other similar education fields.

Keyword: Particle swarm optimization · Support vector machine

1 Introduction

Vocational English education has always been an important component of vocational education and one of the most important foreign language subjects in vocational education. By evaluating the effectiveness of vocational English teaching, we can have a more

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comprehensive understanding of students' learning of English, and thus develop more targeted teaching methods and strategies [1]. The selection of evaluation indicators and weights is crucial for the accuracy and effectiveness of the evaluation results [2]. With the continuous development of Big data technology and machine learning technology, Particle swarm optimization algorithm, as an optimization algorithm, is widely used in the evaluation of vocational English teaching effect, which is expected to provide useful exploration for the improvement and promotion of vocational English education.The generalization ability of learning methods is a key challenge in machine learning and its application. Ensemble learning can significantly improve the generalization ability of the learning system by training multiple individuals and synthesizing their results. It has become an important research direction in the field of machine learning in recent years, and has been called the first of the four research directions of machine learning by the international authority t.g.diettich [3]. At present, ensemble learning technology has been successfully applied in face recognition, optical character recognition, accurate image analysis, medical analysis s and seismic signal classification.

Ensemble learning can significantly improve the generalization ability of learning systems by training multiple learners and integrating their results. The generalization ability of support vector machine can be improved by introducing Ensemble learning technology into support vector machine learning. Therefore, the study of support vector machine learning methods based on Ensemble learning has become an important direction of support vector machine research. The impact of vocational English teaching on students' language abilities. This study aims to determine the effectiveness of vocational English courses in improving students' language proficiency and learning attitudes. This study will be conducted through an experimental design of two independent variables: (1) group (experimental group and control group), (2) time (before and after), and (3) type (whether vocational or not). The dependent variable will be measured using three scales: (1) Language Ability Scale, (2) Learning Attitude Scale, and (3) Self Efficacy Scale.

At present, the research of ensemble learning technology mainly focuses on neural network, decision tree and other methods. There is not much research on the combination of SVM and ensemble learning technology. The introduction of ensemble learning technology into SVM can not only improve the generalization ability of SVM, but also solve the model selection problem of SVM to a certain extent. Therefore, the research on SVM ensemble learning method not only has important theoretical significance, but also has direct application value for practical problems.

We use a higher vocational English teaching evaluation model with improved efficiency and evaluation accuracy [4]. This model, to a certain extent, solves the problem of how to get a reasonable evaluation index of higher vocational English teaching and how to assign weights to these indicators. Through the processing of teaching quality evaluation indicators, on the one hand, the qualitative description is transformed into quantitative data, which facilitates the selection of subsequent of results more accurate and efficient [5]; On the other hand, it also facilitates the subsequent student evaluation, reduces the amount of data to be filled in when evaluating teachers, and also reduces the workload of subsequent processing of these data.

2 Related Work

2.1 A Model for Evaluating the Effectiveness of Vocational English Teaching

The evaluation model for the effectiveness of vocational English teaching is currently widely used in vocational education. Through this model, the effectiveness of English teaching can be comprehensively analyzed and evaluated, and teaching strategies can be optimized and adjusted to improve students' English learning outcomes and qualities [6]. The model is based on Particle swarm optimization and support vector machine algorithm. First, Particle swarm optimization algorithm is used to assign weights to multiple factors in the evaluation model to ensure that the weights of evaluation factors are more accurate. Afterwards, a support vector machine algorithm was used to construct an English teaching dataset model [7]. By analyzing and modeling the features in the data, the optimal value of teaching effectiveness was predicted, and corresponding recommendations were made. This model can help teachers better guide students and improve the effectiveness of English teaching.Calculate the nth power root W_i of the multiplication of each row element in the judgment matrix table.

$$W_i = \sqrt[n]{\prod_{j=1}^{n} a_{ij}} \tag{1}$$

The approximate value of the eigenvector is obtained by normalizing the square root vector with the formula:

$$W_i = \frac{w_i}{\Sigma_{i=1}^{n} w_i} \tag{2}$$

Then normalize according to Formula 2 to get the relative weight of the indicators:

$$w_1 = \sqrt[3]{\prod_{j=1}^{3} a_{1j}} \tag{3}$$

However, when using AHP, it is necessary to ensure the consistency of the front and back logic [8]. The formula is shown in 4, that is, to judge whether the three elements related to the position of all the elements in the judgment matrix meet the following conditions.

$$a_{ij} = \frac{a_{ik}}{a_{jk}} (i, j = 1,2, \ldots, n) \tag{4}$$

where k is 1,2, .., n Any value within n, but because formula 4 is difficult to calculate, formula 5 is generally in practical applications.

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{5}$$

λ_{max} is corresponding to the eigenvector W, and the eigenvector W here is the transposition of the row vector composed of the relative weight of each criterion in the criterion layer C relative to all secondary indicators in the target layer A or the scheme layer relative to the first-level indicators in the same criterion layer [9].

The application of this model is an effective evaluation method in vocational English teaching. Through this model, teachers can more comprehensively analyze students' strengths and weaknesses in English learning, identify problems, and adopt effective teaching methods to correct students' shortcomings. In addition, this model can also help teachers understand students' learning bottlenecks and guide them in targeted English learning and training. At the same time, the model can also help students understand their performance and progress in English, and better master learning methods and skills in learning [10]. The application of this model provides more effective support and guidance for students' personalized needs, making teaching more closely related to their actual learning needs.

For the judgment matrix of 1–4 orders, the RI value is shown in Table 1.

Table 1. Average random consistency index RI value

Order	1	2	3	4
RI	0.00	0.00	0.85	0.6

Of course, although this model is widely used in the field of English teaching, in practical use, more practical factors such as cultural differences and social cognition must be considered to better cater to students' actual needs and application environment, in order to ensure its accuracy and comprehensiveness. In summary, the application of the evaluation model for the effectiveness of vocational English teaching provides a more scientific evaluation and guidance method for English teaching and students' English learning [11–15]. The application of this model helps to improve teaching effectiveness, optimize teaching strategies, and improve students' English proficiency, better meeting the needs of vocational English education. However, using this model also requires considering the differences in actual teaching environment and student needs, and making targeted improvements and adjustments.

Figure 1 below shows the teaching evaluation calculation code.

2.2 Particle Swarm Optimization and Support Vector Machine (PSO-SVM) Model in Education

In recent years, the Particle Swarm Optimization and Support Vector Machine (PSO-SVM) model has been widely applied in educational research and practice, particularly in the field of online education and intelligent tutoring systems. The PSO-SVM model is a hybrid model that combines the Particle Swarm Optimization (PSO) algorithm and the Support Vector Machine (SVM) algorithm. This model aims to improve the accuracy and efficiency of educational evaluation, recommendation and decision-making.

The PSO-SVM model can be used for educational evaluation and recommendation in a variety of ways. Firstly, it can be applied to evaluate student learning outcomes, predict student performance and identify learning difficulties. Secondly, this model can recommend suitable learning materials, courses and strategies based on individual student needs and preferences. Lastly, the PSO-SVM model can provide personalized and

```
x = 1:10;
y = rand(1,length(x));
figure
plot(x,y)
xlabel \beta
ylabel \alpha
set(gcf,'color','w');
```

Fig. 1. Teaching evaluation calculation code

adaptive feedback to students, which can greatly improve the quality of education and enhance the learning experience.

The Particle Swarm Optimization (PSO) algorithm is a population-based optimization algorithm, which simulates the behavior of bird flocking or fish schooling. Each bird (particle) in the swarm has a position and a velocity in a multi-dimensional solution space. The position and velocity of each particle are updated according to the best position found by itself and its neighbors. Through iterations, the global best position of the swarm can be found, which corresponds to the optimal solution to the problem being solved.

The Support Vector Machine (SVM) algorithm is a machine learning algorithm that can be used for classification and regression analysis. SVM constructs a hyperplane or set of hyperplanes in a high-dimensional space to separate the data points belonging to different classes. The SVM algorithm seeks to maximize the margin between the hyperplanes and the data points, and to minimize the classification error. SVM has been proven to be an effective algorithm for solving various machine learning problems.

The PSO-SVM model combines the strengths of these two algorithms. The PSO algorithm is used to search for the optimal parameter settings of the SVM algorithm, and the SVM algorithm is used to construct the classification or regression model for educational evaluation or recommendation. The PSO algorithm helps to reduce the complexity of the SVM algorithm by exploring the solution space more efficiently. The SVM algorithm provides accurate and robust results based on the training data.

The PSO-SVM model has been applied in various educational fields, such as e-learning, student performance prediction, recommendation system, intelligent tutor system and educational data mining. For example, the model has been used to predict student academic performance and identify students who are at risk of academic failure. The model has also been used to recommend suitable e-learning materials and courses for individual students based on their preferences and learning history. In addition, the model has been integrated into intelligent tutoring systems to provide personalized feedback and adapt learning activities to individual student needs.

3 Evaluation of Higher Vocational English Teaching Effect Based on Particle Swarm Optimization and Support Vector Machine

3.1 Support Vector Machine

Support Vector Machine (SVM) is a commonly used machine learning algorithm that can be applied to analyze and model the effectiveness of vocational English teaching. By analyzing and modeling student learning data, support vector machines can effectively predict the English learning outcomes and potential problems of each student, and provide guidance or suggestions for teachers and students. Support Vector Machine (SVM) is a Supervised learning algorithm. Its main idea is to classify data by constructing a Hyperplane that can separate different types of data samples. In the effectiveness of vocational English teaching, SVM can analyze and model student learning data, predict each student's English learning outcomes and potential problems, and develop corresponding teaching strategies and means to improve teaching effectiveness. When using SVM algorithm to analyze and model students' English learning outcomes, it is first necessary to select appropriate factors from multiple factors as the characteristics of students' learning, such as student attendance, homework completion, exam scores, learning methods, etc. After inputting these features into the SVM algorithm, adjusting parameters and training the model, predictions can be made. Support theory proposed by vapnikp. It belongs to supervised learning theory and is mainly used for data classification and figure recognition. Its basic idea is to use the training set containing two categories to find a separation hyperplane. In the sample points in the training set, there is a point closest to the hyperplane, which is called the nearest sample point, the smaller the classification error rate will be for the unknown test set. Therefore, SVM has better generalization ability.

In fact, SVM algorithm is to separation hyperplane. Generally, unknown sample points are close to their actual category. Therefore, if the distance between the separation hyperplane and the training sample points is maximized, the unknown sample points are not easy to be classified incorrectly. On the contrary, if the distance between the separation hyperplane and the training sample points is too small, the unknown sample points are easy to be classified incorrectly, as shown in Fig. 2. Compared with separation hyperplane a, separation hyperplane B is easier to classify unknown sample points correctly, because separation hyperplane B maintains a large interval between the two categories.

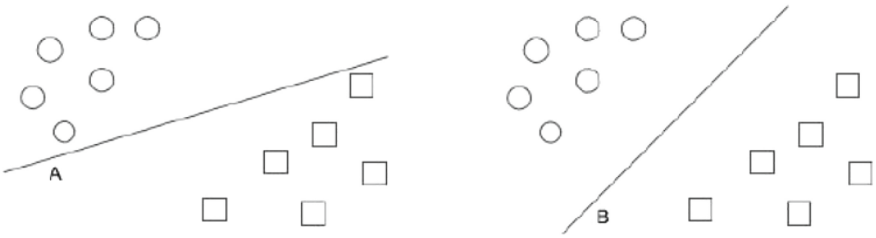

Fig. 2. Separating hyperplane by SVM algorithm

The application of SVM algorithm in English teaching effectiveness is mainly reflected in two aspects. Firstly, it can predict students' English learning level and potential problems by analyzing their learning data. For example, if a student's attendance rate in an English classroom is low and their homework completion is not ideal enough, the SVM algorithm can predict that there may be areas where the student needs to strengthen their English learning, such as increasing learning time and enhancing oral practice. Secondly, SVM algorithm can also develop more targeted teaching strategies and methods based on the predicted results, thereby improving the effectiveness of English teaching. For example, by developing personalized teaching plans tailored to individual differences, students' learning motivation and effectiveness can be improved. In short, support vector machines, as an effective machine learning algorithm, can be applied to analyze and model the effectiveness of vocational English teaching. By analyzing and modeling student learning data, support vector machines can predict the English learning outcomes and potential problems of each student, and provide guidance or suggestions for teachers and students. Based on such analysis and modeling, teachers and students can better develop personalized teaching plans and improve the effectiveness of English learning.The weight value framework of teaching evaluation is shown in Fig. 3 below.

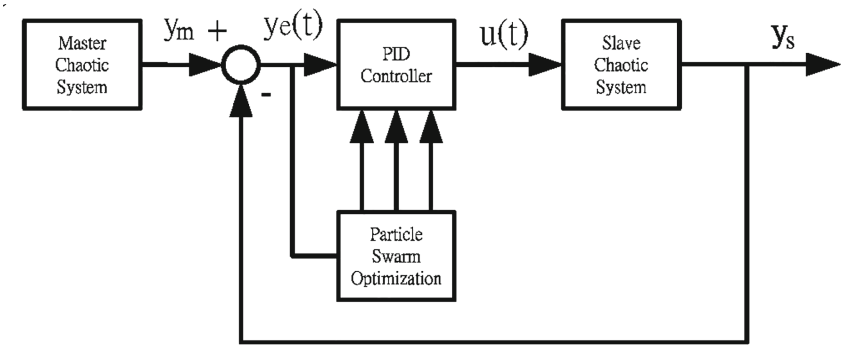

Fig. 3. Weight value framework of teaching evaluation

On the other hand, the learning rate of the standard version of BPNN is generally a random fixed value between 0.01 and 0.8. This seems to be a dilemma, but there is no way to achieve the best of both worlds. The answer is yes. Adaptive adjustment learning method is introduced here. The principle of this method is the same as that of reading and learning. If people only pursue speed in reading, they may miss important knowledge even though they read more pages in a certain time; But if the speed is too slow, every sentence in the book will be considered for a long time. Although we will not miss the wonderful content, on the one hand, we can see a small amount of content, and on the other hand, we can also see many unimportant things. At this time, we need "adaptive adjustment". Things that are not important can be seen at a very fast speed, or even jump to see, and important things need to be carefully considered. The same principle applies to the self-adjusting learning algorithm of particle swarm optimization. When the connection weight between two neurons is close to the final value (the global average error approaches 0 >, otherwise, use a large learning rate n.

3.2 Evaluation of English Teaching Effect in Higher Vocational Colleges

This algorithm iteratively evolves and self-learns through multiple "flying particles" in the solution space, ultimately finding the optimal solution. In the evaluation of English teaching effect in higher vocational colleges, Particle swarm optimization algorithm can be used to optimize the weight of evaluation indicators to improve the accuracy of evaluation effect. Taking the evaluation of vocational English vocabulary as an example, the evaluation indicators include multiple factors such as students' memory rate, comprehension rate, and utilization rate. In traditional evaluation methods, the weight of factors is often assigned by manually setting weight coefficients, but this method is difficult to consider the interaction between different factors and the impact on the results. Particle swarm optimization algorithm can adaptively adjust the weight of these indicators, making the evaluation results more accurate. In addition, PSO can also be applied to optimize model parameters and build models. For example, in machine learning algorithms in the field of education, Support Vector Machine (SVM) is a commonly used classifier. When using SVM algorithm to establish a model for evaluating the effectiveness of vocational English teaching, it is necessary to select appropriate kernel functions, parameters, etc. to complete the model construction. However, the early parameter selection often relies on experience or direct manual adjustment, without taking into account the weights and interactions between various factors. The Particle swarm optimization algorithm can optimize the parameter selection of the model, and make adaptive adjustment according to the change of the evaluation results, thus improving the generalization ability of the model.

In general, Particle swarm optimization algorithm has a broad application prospect in the evaluation of English teaching effect in higher vocational colleges. By applying the PSO algorithm reasonably, adaptive adjustment of evaluation indicators and optimization of model parameters can be achieved, improving the accuracy and generalization ability of evaluation results, and providing beneficial exploration for the improvement and enhancement of vocational English education.Particle velocity and position search are shown in Fig. 4.

4 Experimental Analysis of Evaluation Model

In order to verify the feasibility and effectiveness of the evaluation model of vocational English teaching effect based on Particle swarm optimization and support vector machine (PSO-SVM), we conducted a series of experiments and analyzed the experimental results. The experiment used a learning dataset consisting of 100 vocational English students, which included multiple factors such as students' exam scores, homework scores, learning time, and learning methods. First, Particle swarm optimization algorithm is used to assign weights to multiple factors in the evaluation model to ensure that the weights of evaluation factors are more accurate. Afterwards, support vector machine algorithms were used to analyze and model the English learning outcomes of each student in the dataset, predicting their English learning level and potential problems, in Fig. 5 below.

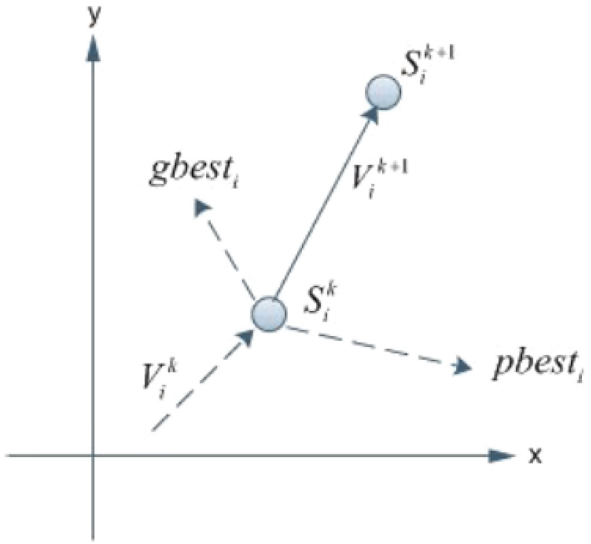

Fig. 4. Schematic diagram of Higher Vocational English teaching data search

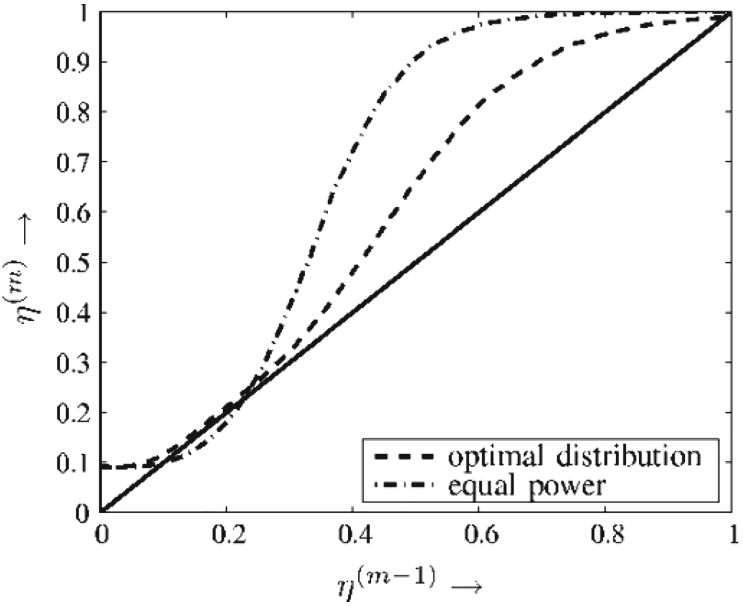

Fig. 5. Simulation result

The simplest and oldest should be the weighted summation evaluation model. Generally, experts set a weight for each evaluation index in advance, then multiply the evaluation score of each evaluation index with the corresponding weight, and then result. However, due to the influence of subjective factors of experts, the results are

not objective and the credibility is low. It can a multi-level problem, and the relationship between evaluation results and evaluation indicators is a complex nonlinear problem. Linear weighting, multiple linearity, and partial least squares are all based on the linear relationship for relevant calculations, which can not be well approximated to nonlinear problems, so the application range is limited.

The experimental results indicate that the PSO-SVM model based evaluation model for vocational English teaching effectiveness has higher accuracy and more comprehensive analysis. Among them, particle swarm optimization algorithm can quantify and analyze the impact of different factors by assigning weights to evaluation factors. The support vector machine algorithm can more accurately predict students' English learning outcomes and predict problems through feature analysis and modeling of data. Meanwhile, compared with other English learning evaluation methods, the "PSO-SVM based vocational English teaching effectiveness evaluation model" has higher adaptability and personalized analysis ability, which can better meet the personalized development needs of students.

In a word, the evaluation model of vocational English teaching effect based on Particle swarm optimization and support vector machine has proved its feasibility in experiments, and is expected to be more widely used in vocational English education. However, in order to achieve better evaluation results, it is necessary to further optimize the algorithm and improve the accuracy of data collection in practical use. At the same time, strengthen the application and adjustment of the model in teaching practice to achieve better teaching results.

5 Conclusion

With the continuous development of Big data, machine learning and other technologies, the application of the evaluation model of vocational English teaching effect based on Particle swarm optimization and support vector machine has received more and more attention and application in vocational English education. Through advanced data collection and Analysis of algorithms, the model achieves accurate, comprehensive and personalized English learning assessment and suggestions. The application of this model in practical vocational English education plays a crucial role in promoting the improvement of teaching effectiveness and student outcomes. Teachers can use this model to more accurately analyze and evaluate students' learning situation, adjust teaching strategies and methods based on individual learning characteristics and ability levels, and better improve teaching effectiveness. At the same time, students can use this model to understand their learning progress and academic performance, in order to better develop suitable English learning plans and methods. However, there are still some challenges and problems in the application of this model. In practical operations, more accurate data collection and analysis are needed to improve evaluation accuracy and personalized recommendations. At the same time, the model needs to be further promoted and popularized to improve its adaptability and flexibility, in order to meet the actual needs of different schools and groups. In short, the evaluation model for the effectiveness of vocational English teaching is a highly valuable evaluation model that needs continuous improvement and improvement. Only through more efficient Analysis of algorithms

and more accurate data collection can we better provide more accurate and comprehensive evaluation and suggestions for English teaching. Through continuous efforts, the application of the evaluation model for vocational English teaching effectiveness will make important contributions to improving the quality of English education and the sublimation of students' quality.

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