English Classroom Teaching Evaluation System Based on Particle Swarm Optimization Algorithm

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Abstract. Teaching evaluation system is complicated and affected by various factors. Teaching quality assessment is an important measure to ensure the quality of school teaching and meet the needs of society. The purpose of this paper is to design an English school evaluation system based on optimal particle swarm optimization. The computer has become an invaluable teaching tool, which combined with teaching evaluation can directly promote the various aspects of the educational course or programme. According to the current situation of teaching in colleges and universities, in order to meet the specific requirements of teaching quality and promote high-quality talents, the particle swarm optimization algorithm theory is introduced into the teaching evaluation system, and the evaluation index system is also established. Moreover, the optimization learning model of particle swarm optimization is tested. A total of 3000 teacher evaluation data files are used as training data for testing. Each item includes 10 ratings. The results show that expert and peer test results are within 0.2 error on 8 datasets. Among the teaching evaluation models, the evaluation system based on particle swarm optimization algorithm can better evaluate the teacher training model when it comes to the teaching evaluation and judgment of English teachers.

Keywords: Particle Swarm Optimization · English Classroom · Teaching Evaluation System · Evaluation Indicator

1 Introduction

With the continuous expansion of enrollment scale, higher education gradually develops from elite to mass, there is a common belief that educational standards are declining, which is directly affected by the quality of the curriculum. Therefore, to improve the quality of courses has become the main focus of teaching research. In order to promote the quality of teaching, it is necessary to formulate a corresponding teaching evaluation system, however, there is no systematic or unified system at present. The existing evaluation system is based on the teaching objectives of each college and is not universal. The main advantage of the construction of teaching quality evaluation system lies in that it can not only help managers understand the performance of teachers in teaching,

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but also find the advantages and disadvantages of teachers in the teaching process, help teachers optimize teaching, standardize their behavior, and promote their performance in communication and exchange.

The researchers designed and proposed related improvement strategies to further improve the optimization performance of the algorithm, and pointed out a new direction for practical applications. Nabavi S R proposed a path-based energy-saving algorithm based on several swarm particle optimization algorithms. The method uses the fitness function of the swarm particle enrichment algorithm to select the optimal cluster head according to the quality of the working face. Simulation results show that compared with other methods, this method has lower power consumption and longer network lifetime due to the balanced QoS requirements [11]. Abolhoseini S modified PSO to fix internal site issues. Crossover and mutation factors in genetic algorithms are used to change the behavior of particles. The results are compared with those of the artificial honey colony algorithm after a partial test of the Tehran transportation network. In the experiments at booths 2 and 4, both algorithms were highlighted in terms of accuracy, stability, compactness, and computation time. However, the results of experiments on 10 kiosks in a larger environment are favorable for the improved PSO algorithm to obtain the optimal value, stability, and best distributed area of interest. The results show that the proposed algorithm can solve the overall problem quickly and accurately [1]. Vijayakumar T used the proposed swarm swarm (PSO) algorithm to distribute the load capacity evenly to most composite systems. Transform and model real-world problems into their mathematical counterparts by imposing certain constraints. Additionally, a new integration process is being implemented using advanced PSO algorithms to balance local search capabilities with global optimization. In the modified PSO algorithm, several clusters are shown. Perform some standard testing tasks for a specific analysis. Finally, advanced PSO algorithms can solve the problem of economic load distribution while saving energy to a greater extent. Algorithmic evaluations can be performed using real-time models to ensure efficiency. Compared with existing programs such as artificial bee colonies (ABC), genetic algorithms (GAs), and traditional PSO algorithms, according to simulation results, the concept produces the lowest energy and overcomes the load distribution problem [12].

It is one of the important tasks of college English teaching in China to optimize the evaluation system of College English teaching and improve the quality of English education. In today's society with the development of information technology, the use of information technology can create a more complete teaching evaluation system [6]. Through this program, teachers can monitor their own learning situation in real time, and teachers can understand their own learning situation in a short time. The real-time mode in the process can help teachers adjust the curriculum in a short time to better meet the learning needs of students. The popularity of IT in many industries is an unprecedented growth trend in today's information society. The teaching evaluation system created by information technology is not only a model of social and technological progress, but also can effectively improve the quality of teaching.

2 Overall Design of Evaluation System Based on Particle Swarm Optimization Algorithm

2.1 Principle of Particle Swarm Optimization

Particle swarm optimization is a kind of swarm intelligent evolutionary algorithm with parallel evolution. In particle swarm optimization, each particle represents a possible solution to the problem to be optimized [7]. Particle information is updated during flight via position and velocity update types. Each particle can interact with other particles during flight. To push itself and other particles to move to the target point, the particle is exactly the way to abandon the disadvantaged points to find the optimal point through continuous update and comparison, and finally find the optimal solution to the problem. In essence, the core idea of particle swarm optimization is that the particles in the swarm complete the decision under the combined action of the information of themselves and their peers [4].

2.2 Particle Swarm Optimization Algorithm

(1) Random parameter optimization
When preparing the particle swarm, random() can be used to expand the search range of the particle swarm, but it will cause oscillation to a certain extent and the convergence speed will be slower. To solve this problem, a Halton technique is proposed, which can fill the clothing space within a region, defined as Eq. (1). The basic idea is to take the first number as the denominator of size [0, 1], multiply that value repeatedly in the range, and then divide the two numbers by 1/a.

(2) Weight optimization
Inertia is added to the original rectifier operator, and a standard PSO model is proposed to improve the regeneration function. Equation (1) represents the rectifier operator. When the weight is large, the narrowed range can be expanded to get a better global search. When the weight is small, local search can be better promoted [9]. Inertial weight correction methods include shrink line, adaptive adjustment, randomness and display shrink weight. As can be seen from the analysis, when the particles are close to the surface, adding a binder can make the area look better.

$$v_{id}^{k+I} = wv_{id}^{k} + c_I r_I (p_{id}^{k} - x_{id}^{k}) + c_2 r_2 (p_{gd}^{k} - x_{id}^{k}) \tag{1}$$

$$v_{id}^{k+I} = \chi [v_{id}^{k} + c_I r_I (p_{id}^{k} - x_{id}^{k}) + c_2 r_2 (p_{gd}^{k} - x_{id}^{k})] \tag{2}$$

where v_{id}^{k+I} is the iterative operator, in this experiment, a shrinkage factor is chosen to improve the convergence performance, which is expressed by formula (2), where the shrinkage factor is denoted by $\chi = \frac{2}{\left|2-\varphi-\sqrt{\varphi^2-4\varphi}\right|}$

2.3 Design Idea of Particle Swarm Optimization Algorithm Applied to Teaching Evaluation System

(1) Determine the presentation scheme
According to the characteristics of the problem, choosing an appropriate encoding method for the problem will directly affect the performance of the PSO algorithm and the solution results [5]. The concept of the so-called agent problem is that when using the PSO algorithm to solve a problem, the first step is to map the solution of the problem from the D-dimensional solution point to the location and system where the agent is located. This is the concept of representing ideas and encoding problems, i.e. expressing solutions to problems with specific encoded strings.
(2) Determine the evaluation function
The fitness cost is calculated using the appropriate field function or charge function and can be used to calculate the quality of the solution. Because fitness is the only parameter that can identify and guide the improvement process [10].
(3) Select parameters
Different control parameters can be selected for different algorithm models, which can directly affect the optimization performance of the algorithm. The control parameters of the PSO algorithm mainly include: particle size, maximum algorithm algebra, inertia factor, cognitive parameters, social parameters and other auxiliary control parameters.
(4) Design particle flight models
In the PSO algorithm, the most important function is how the velocity of the particles is determined. Through the memory information of PbeSt particle itself and the social distribution of Gbest information, the speed regulation and flight direction of each component of the particle are realized [8].
(5) Determine the termination criteria of the algorithm
The most common termination requirements in PSO algorithms are to reach the maximum number of iterations or satisfy enough fitness or the optimal solution is stable. If one of the above conditions is met, the algorithm is terminated [3].
(6) Computer program
Obtain solutions to specific optimization problems based on well-designed and powerful algorithms. The validity, accuracy and reliability of the algorithm are guaranteed by the quality of the solution [2].

3 Detailed Design and Implementation of Teaching Evaluation System

3.1 Development Tools

(1) ASP.NET
ASP.NET is one of the most popular Web development tools. It provides users with a complete visual development environment to rapidly develop web applications using multiple server controls. In other words, ASP.NET is a powerful web development technology. Currently, there are many development techniques available for powerful websites. ASP (Active Server Pages) is the forerunner of ASP.NET,

which has achieved great success in the field of powerful web technology with simple syntax and embedded html. In ASP.NET, many classes have been redesigned and implemented. To achieve high growth potential, some new controls have been incorporated. ASP.NET is an important milestone in the history of web development for web application designers and developers.

(2) SQL Server
SQL Server is a great partner for ASP.NET. It is easy to use and powerful, which meets the operational needs of enterprise-level data management. It supports advanced features such as stored procedures, triggers, and user feedback data types, with rich features.

3.2 Establishment of Evaluation Indicators

(1) Student evaluation
1. Love learning, do things seriously, and concentrate on learning. 2. The textbooks are well-selected, and the reference materials are useful for learning. 3. The educational content is rich, progressive and rich in content. 4. Appropriate teaching methods, clear training skills and accurate information. 5. Guide students to explore and think about problems, focusing on the boundaries of practice.

(2) Supervision and evaluation
1. Study: No unexcused absence,be late for class or leave early, answer cell phones in class and other phenomena. 2. Wisdom: The content is complete and easy to learn, the concepts and procedures are fully explained, and the curriculum is clear and easy to understand. 3. Teaching method: explain clearly, teaching is clear and easy to understand. 4. Value information: rich in content, analysis and promotion, and high scalability. 5. School Board Meetings: School Board is well-informed, balanced and well organized.

(3) Evaluation of teachers
1. Teachers' behavior: teach by words and deeds and have a sense of responsibility, help students become talents. 2. Teaching documents: the teaching documents such as syllabus, and teaching plan are complete and meet the teaching requirements .3. Learning methods: focus on teaching methods and advanced learning methods. 4.Teaching rehearsal: actively participate in and closely cooperate with the study rehearsal. 5. Innovation: focus on problem learning and cultivate students' innovation ability.

3.3 The Overall Structure of the System

Teaching evaluation is a diversified system, in which information from all aspects is collected, analyzed, and then fed back to teachers and school-related personnel. According to the analysis of the evaluation stage and the analysis of the overall structure diagram, it can be obtained that the evaluation system mainly includes three functional points: data preparation, evaluation information collection, evaluation result analysis and feedback.

Data preparation: It mainly prepares the basic data for evaluation, such as departments, majors, semesters and other basic information.

Evaluation information collection: The content of the collection is determined according to the index system, and the information is collected by the system.

Analysis and feedback of evaluation results: relevant school personnel, allowing teachers to discover deficiencies and make adjustments in time; enable managers to grasp the overall situation of teaching timely and formulate policies accordingly.

3.4 Objective Function

In this optimization model, the goal is to calculate the optimal level of English classroom teaching evaluation, and the objective function as follows:

$$MAX\,(J) = a_i X_i \tag{3}$$

In the formula, ai represents the value-added coefficient of each evaluation value index, representing the economic added value of the total output per unit of each industry sector. Xi represents the weight score of the indicator.

4 Design and Test of English Classroom Teaching Evaluation System Based on Particle Swarm Optimization Algorithm

4.1 System Function Modules

The Internet-based network teaching evaluation system includes functional modules such as system management, teaching evaluation, evaluation result query, evaluation summary statistics, etc. The overall structure is shown in Fig. 1.

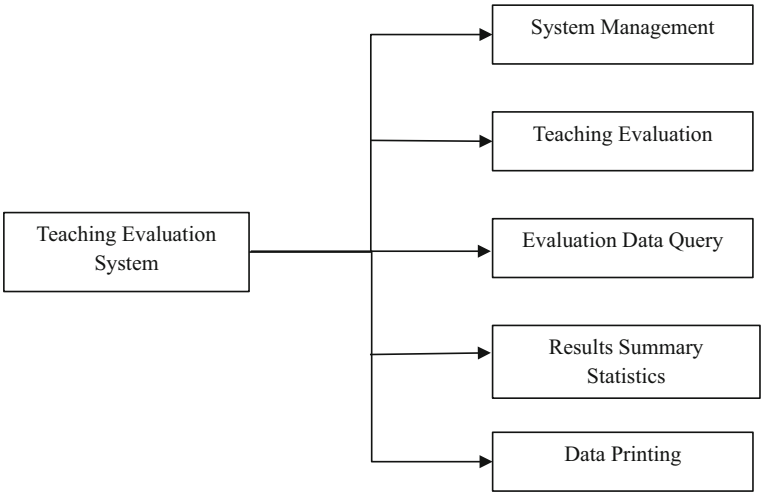

Fig. 1. System overall structure

(1) System management. The operating user of this module is the system administrator, and the main sub-function modules are: evaluation index management, evaluation batch management.

Evaluation indicator management: After completing the formulation of evaluation indicators, administrators can add required indicators and delete unused indicators.

Evaluation batch management: It can add and set up teaching evaluation batches. Such as the addition of a semester teaching evaluation, setting the start and end time of student evaluation, and the start and end time of teacher query, etc.

(2) Teaching evaluation. The participants of this module are students. After logging in and verifying the authority, they can score all teachers who undertake teaching tasks item by item and fill in comments.

(3) Querying the evaluation results. Provide teaching evaluation of designated batches, designated departments, designated teachers and query the results.

(4) Summary statistics of evaluation results. Provide data sorting of evaluation results, summary calculation and summary comments

(5) Data printing. Provides the printing function of querying evaluation data and summarizing statistical data.

4.2 Teaching Evaluation Model Experiment Based on Particle Swarm Optimization Algorithm

The training data uses a total of 3,000 records of the school's teacher evaluation data for experimental testing. Each data contains 10 scores. These scores mainly include the scores of teachers' peers, students in the teaching class, and grading of expert. Select 10 scoring options with more complete data and divide the data into 10 groups, after the experimental simulation test, the results are shown in Table 1.

According to the final results obtained in Fig. 2, it can be found that most of the errors between the experimental results and the test results of experts and peers are kept within 0.2, and the rating results of the two are basically the same. In the teaching evaluation model, related English subjects are involved. When implementing teacher teaching evaluation and judgment, it is necessary to use the teacher teaching evaluation system of particle swarm optimization algorithm to judge the training model.

Table 1. Comparison of experimental test results and manual evaluation results

	1	2	3	4	5	6	7	8	9	10
Experimental results	0.7765	0.7755	0.8927	0.8039	0.7398	0.6739	0.8267	0.7836	0.7836	0.7829
Expert and Peer Test Results	0.7927	0.7895	0.8701	0.8128	0.7293	0.7638	0.8398	0.7739	0.779	0.7919
error	0.0162	0.014	0.0226	0.0089	0.0105	0.0899	0.0131	0.0097	0.0046	0.009

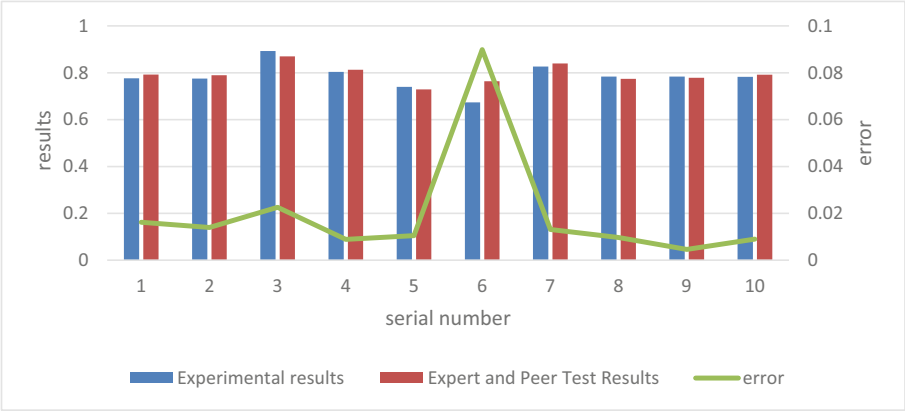

Fig. 2. Experimental test results and manual evaluation results

5 Conclusions

This system is a concentrated application of theoretical achievements in the field of teaching evaluation of higher education, such as the feedback of teaching evaluation results, the basis of reward and punishment teaching evaluation, the hierarchical design of evaluation indicators, and the analysis of factors affecting the results of teaching evaluation. With the continuous evolution of the depth and breadth of complex system evaluation theory and applications, there are a large number of high-dimensional non-linear optimization problems in the process. An improved algorithm of particle swarm optimization is proposed, and it is applied to the evaluation system of English classroom teaching, which further enriches the theory and method of system evaluation, and shows the broad prospect of particle swarm optimization in complicated system evaluation.

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