Research Article

A Classification Technique for English Teaching Resources and Merging Using Swarm Intelligence Algorithm

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1. Introduction

In today’s educational system, it is frequently necessary for teachers and students to share interactive teaching tools. The organic integration of teaching resources in the development of informatization and computer networks makes it appear digital and networked. Owing to the construction of the educational system informatization platform, the integration of massive teaching resources is the main task of English teaching in colleges and universities. Among them, English teaching resources usually include English textbooks, cases, PPT courseware, and all other learning materials and auxiliary facilities that are conducive to cultivating students’ English literacy. According to their mode of operation, educational resources can be broken down into two categories: hardware resources and software resources. The term “hardware resources” is most commonly used to refer to physical hardware facilities like school conditions and multimedia equipment. On the contrary, the term “software resources” is most commonly used to refer to a variety of paper materials and software materials that support teaching.

The integration of English teaching resources helps to build a rich and flexible English teaching classroom. In today’s English teaching classrooms, due to the long writing and updating cycle of English teaching materials, the teaching content is outdated and boring, and the audio and video resources supporting the teaching materials can only
be used for listening and reading exercises, and there is a lack of interactive exercises between teaching and learning. Therefore, instructors should integrate teaching resources based on the content of textbooks and the actual situation of their students, enrich teaching content, deepen students’ understanding of knowledge, utilize multimedia resources in a flexible manner, continually change teaching methods and methods, stimulate students’ interest in learning, and improve classroom learning efficiency. Enhance the level of excellence in English education and instruction. In addition, the integration of English teaching resources helps to cultivate innovative and confident English learning groups. Students who have grown up in the age of holding mobile devices and looking at computers have a more individualized approach to learning English and their learning needs. They are good at using the power of the Internet to find information and learn more knowledge; they like cooperative learning and demonstrate the value of thinking with collective power; they insist on hands-on operation, experience interactive learning tasks and are highly efficient. Through the integration and utilization of teaching resources, teachers allow students to acquire knowledge, solve problems, develop abilities, and cultivate innovative consciousness through exploration and experience, laying a solid foundation for cultivating students’ comprehensive language and language ability. The integration of English teaching resources also helps to create professional and open English literacy teachers. By browsing and reading a large number of English teaching resources, teachers can not only update teachers’ subject professional knowledge, broaden teachers’ cultural horizons, increase the openness of teachers’ ideas but also optimize their teaching methods and enrich their teaching activities, thereby improving their English education and teaching level.

As mentioned earlier, although the development of Internet technology along with the evolution of Big Data and machine learning has made all kinds of educational resources rich and huge, network resources also face huge challenges. A large number of educational resources are still growing exponentially with complex types. There is neither an efficient organization nor good management in place. Text-based resources have the most quantity out of all the many kinds of resources that are available, which include video, audio, photos, and text. In this scenario, the question of how to properly categorize educational resources is an essential one that requires prompt resolution. In years gone by, sorting was typically done by hand, and the task was delegated to trained specialists. This categorization approach yields very accurate results when the available resources are limited. However, because there are more resources now than there were before, there is an issue with the classification accuracy and the low efficiency of manual classification. This problem gets more prominent as the amount of time spent on work increases.

In the discipline of data mining, data classification is an important activity because it can be used to mine models of significant data classes and forecast future patterns in data. The process of data classification may essentially be broken down into two stages: the first is the building of a classification learning model, and the second is the application of a classification model. The classification modeling algorithm, which constructs a classification function or model derived from the data set for each category; and then uses the established classification model to classify and predict the data of unknown categories; is the essential component of the phase in which the model is being constructed. This algorithm is at the heart of the model building phase. Data classification modeling is a function or mapping that can separate data classes through training and learning. The mapping is generally represented by classification rules or mathematical formulas. Overly complex rules will cause difficulties for people to judge, and mining a more understandable classification model is one of the goals of classification modeling algorithms. Evaluation of the generated model’s accuracy and validity in making classification predictions is required before the model can be used for classification purposes. The model established by the classification modeling algorithm from the massive data must be accurate and effective, that is, the accuracy of the classification prediction is high, and classification modeling algorithms must be able to mine classification models and extract relatively accurate classification information in a suitable time. Algorithms with exponential time complexity are useless in classification modeling.

This paper investigates the theory and methodology of English teaching resource classification with the goal of finding solutions to the challenges outlined earlier. It conducts in-depth research on the swarm intelligence classification modeling technique in order to increase the precision and accuracy of the data classification process. The fundamental principle of the particle swarm classification algorithm is dissected first, followed by the improvement of the particle swarm classification algorithm based on the Gaussian mutation mechanism of fireworks algorithm and the new elimination mechanism of coyote algorithm, and finally, the proposal of an English teaching resource classification model based on improved swarm intelligence. Experiments have shown that the proposed categorization model has superior characteristics and a greater level of efficiency. This demonstrates that the model has been successful in achieving its intended purpose. The key contributions of our research can be summarized as follows: (a) apply swarm intelligence algorithm to the task of classifying English teaching resources and provide a reference for optimizing the English teaching model; (b) conduct an in-depth research on the swarm intelligence classification modeling technique in order to increase the precision and accuracy of the data classification process; and (c) investigate the theory and methodology of English teaching resource classification with the goal of finding solutions to various related challenges.

The left behind portions of this paper are systematized as follows: Section 2 offers a review of the related works and techniques for classification. Section 3 provides an explanation of swarm intelligence algorithms; Section 4 outlines the model that has been proposed for the classification of English teaching resources; Section 5 details the experimental work; and Section 6 provides a summary of this paper.
2. Related Work

At present, several widely used data classification algorithms include decision tree induction, Bayesian learning, support vector machines (SVMs), etc. [1–6]. However, when these algorithms solve problems such as classification, prediction, and function discovery, there are still many problems in the comprehensibility, classification accuracy, and generalization ability of the built learning models [7–12]. Therefore, traditional classification modeling algorithms face huge challenges in terms of prediction accuracy, scalability, and efficiency. Data classification is widely used in the fields of bioinformatics [13], weather forecasting [14], network technology [15], finance [16], and text classification. The classification of texts automatically enables efficient management and organization of textual material. The text that needs to be categorized follows a set of guidelines that are determined by the classification model that is being used. Calculations are performed to determine the degree to which it is associated with each category, and the results are then automatically sorted into the appropriate categories. This technology is used in the process of retrieving information, screening incoming mail, and creating digital libraries.

The technique for automatically classifying texts reduces expenses associated with labor while also achieving high classification speeds and levels of precision. As a result, it is considered to be the primary technique of classifying various educational resources. Before the 1990s, the predominant methods relied on the information provided by specialists to manually establish rules and construct classifiers. This is an effective classification method for use with corpus data. Having said that, this technique has its limitations when applied to large-scale data sets, after the 1990s, with the growth of Big Data technology for machine learning. Similarly, Hong et al. [17] started their efforts to apply it for text classification in an effort to improve the accuracy of their results. This method of classification classifies each text in an automated fashion by learning and obtaining classified texts based on a set of preclassified texts. This approach does not call for the participation of any experts. It classifies items more quickly and has a higher degree of accuracy. Furthermore, Meng et al. [18] provided a comprehensive description of each text classification implementation in addition to its architecture. After some time had passed, this essay came to be considered as a classic in the field of text classification. Li et al. [19] presented an approach called the SVM, which is grounded on statistical philosophy. The primary objective and key goal here is to identify the hyperplane of best fit for high-dimensional classification data. The strategy could involve gaining knowledge from relatively few examples. In the same vein, the robustness and classification impact are both satisfactory, which, in fact, has engrossed a prodigious deal of focus from a variety of specialists.

Nature has its inherent evolutionary laws, and biological behaviors also have their own intelligence. These laws and intelligent behaviors have been successfully modeled by researchers and used to solve many complex practical problems. Many new modeling methods inspired by nature and biological behavior have been validated through simulation experiments because nature can solve many complex problems for humans through its own genetic evolution. Individuals in biological groups are very simple, but their collective behavior is particularly complex. By studying the group behavior of organisms, many swarm intelligence models have been constructed. Simple individuals in the model can show very complex emergent behaviors through cooperation between groups. These behaviors have been effectively modeled by a huge number of researchers, and those models have been used to solve a significant number of complicated practical issues. In modern ages, some swarm intelligence procedures, for instance, the particle swarm optimization (PSO) algorithm [20], firework algorithm (FA) [21], grey wolf optimization (GWO) algorithm [22], coyote optimization algorithm (COA) [23], genetic algorithm (GA) [24], whale optimization algorithm (WOA) [25], ant colony optimization (ACO) [26], and gravity search algorithm (GSA) [27], etc., which solve problems by simulating a natural phenomenon or biological evolution process and have a high degree of self-organization, self-adaptation, and self-learning. In the disciplines of artificial intelligence, machine learning, and data mining, characteristics like parallelism and parallelism have demonstrated tremendous vitality and potential for further growth. These characteristics include: There are a great deal of algorithms of this type. These methods are used to find solutions to difficult issues involving computational optimization. On the contrary, swarm intelligence algorithms typically have drawbacks such as a low level of optimization accuracy and the ease with which they might fall into a local optimum. Researchers from both the United States, and other countries are focusing a lot of their attention on finding solutions to these issues [28].

At present, the research on swarm intelligence optimization algorithm mainly focuses on the theory of the algorithm, the improvement of the algorithm and the application of the algorithm. The theory of the algorithm is usually developed in the analysis of the convergence, stability, and time complexity of the algorithm. Many improved algorithms have achieved good results in practical applications, but they lack theoretical support. Therefore, it is very important to theoretically analyze the swarm intelligence optimization algorithm. In terms of algorithm improvement, the improvement methods adopted by researchers mainly focus on population initialization, algorithm parameters, hybrid algorithms [29, 30], and learning strategies. Although many methods are proposed every year to improve swarm intelligence algorithms, the algorithm converges. The problems of slow speed and low accuracy still exist, and no algorithm can solve any optimization problem well, which means that new and improved algorithms need to be proposed continuously in this field. In terms of the application of algorithms, it has not only been used to solve optimization problems, but also applied to medical data analysis [31], robot path planning [32], energy saving and emission reduction [33], and other fields, which have broad application prospects and research value [34]. However, all the aforementioned traditional classification methods cannot meet
the requirements of modern computing due to the limitations of implementation. Therefore, we use the swarm intelligence to overcome these limitations.

3. Particle Swarm Algorithm in Swarm Intelligence

An example of this type of algorithm is the swarm-based multipoint random search algorithm that is used by the swarm intelligence algorithm. Swarm refers to a collection of multiple similar individuals, such as biological groups such as birds, ants, and fish groups, and nonbiological groups such as quantum groups. The swarm intelligence algorithm simulates certain movement processes of various groups (such as the evolution process of biological groups, the biological foraging process, the quantum state change process, etc.) or some movement processes of constructing groups. In accordance with the manner in which they are constructed, algorithms for swarm intelligence can be classified as belonging to one of the following groups:

1. Bio-inspired: Bio-inspired computing refers to a series of heuristic intelligent computing methods that are inspired by various natural phenomena or processes in the biological world. Include, in particular, the evolutionary algorithm, the artificial immune algorithm, DNA computing, membrane computing, and a lot of other similar things.

2. Cluster intelligence: The swarm intelligence algorithm is a bionic algorithm that simulates the complex and orderly group behavior of a social biological group as it reacts to a particular internal law. This behavior is modeled after the behavior of bee hives. Include, for the most part, the particle swarm algorithm, the ant colony algorithm, the artificial fish swarm algorithm, the bee colony algorithm, and so on.

3. Social and cultural inspiration: Social and cultural heuristics are behaviors that simulate human societies. It mainly includes cultural algorithms (simulating the evolution process of human society), population migration algorithms (simulating population flow and population migration), etc.

4. Mixed way: The hybrid method refers to the hybrid application of multiple optimization methods. Most of the currently used swarm algorithms are hybrid algorithms to make up for the deficiencies of a single algorithm in some aspects. Mainly include: immune evolutionary algorithm, bee colony genetic algorithm, annealing genetic algorithm, tabu genetic algorithm, quantum genetic algorithm, etc.

An example of particle swarm optimization is a population that is made up of \( N \) particles in a search space that has \( D \) dimensions. A \( D \)-dimensional variable is associated with each individual particle. The value of the objective function is the fitness of the particle, which is used as a standard to measure the quality of the solution, and the position of the particle is continuously updated while the iteration process is taking place. The position of every particle characterizes an answer that is feasible, and the value of \( X_i = (X_{i1}, X_{i2}, \ldots, X_{iD}) \) expresses the position of the \( i \)th particle. The velocity, \( V_i = (V_{i1}, V_{i2}, \ldots, V_{iD}) \), is the value that represents the \( i \)th particle [35]. The next iteration particle will perform a fitness comparison with the optimal position of the individual’s history, set the current individual optimal position of the \( i \)th particle as \( p_{i, p} \), and the current global optimal position as \( p_{g, d} \) and then perform an update using the following formulas for the velocity and position of the particle at the \( k \)th iteration:

\[
V_{id}^{k+1} = \omega V_{id}^k + c_1 \xi (p_{id}^k - x_{id}) + c_2 \eta (p_{gd}^k - x_{id})
\]

\[
x_{id}^{k+1} = x_{id}^k + V_{id}^{k+1}
\]

Among them, \( \omega \) is the inertia weight factor, \( c_1 \) and \( c_2 \) are the learning factors, and \( \xi \) and \( \eta \) are random numbers between (0, 1). Figure 1 depicts the method known as the particle swarm in the form of a flowchart. The primary procedures and steps involved in the particle swarm algorithm are given in Algorithm 1:

4. The Proposed Classification Model for English Teaching Resources Founded on Improved Swarm Intelligence Algorithm

4.1. Improved Swarm Intelligence Algorithm. In the study of swarm intelligence algorithms, it was discovered that the update mechanism of the fireworks algorithms has good optimization performance. In addition, the coyote algorithm is a newly proposed swarm intelligence algorithm in recent years, and its elimination mechanism can enhance the global search ability. Both of these findings were discovered through the study of swarm intelligence algorithms. On the foundation of the first particle swarm procedure, as illustrated in Algorithm 1, this paper presents the Gaussian mutation mechanism of the fireworks algorithm as well as the new elimination mechanism of the coyote algorithm. In addition, this paper recommends an enhanced version of the particle swarm technique, that is, also known as GEM-PSO. The research for this paper was thorough [36]. An enhanced form of the particle swarm technique is described in more depth down below.

In the iterative process of the original PSO procedure, the local search aptitude of the procedure in the later phase of the iteration is weak, and it is frequently informal to collapse or struck into the local optimum point. This makes it more likely that the algorithm will produce a solution that is suboptimal overall. Therefore, in order to discover an appropriate solution to this issue, the authors of this research make use of the fireworks method’s Gaussian mutation mechanism to carry out position mutations everywhere around the global optimal point during each iteration of the process. The decision of whether or not to update the position of the global optimal point is made by comparing the fitness of the position of the Gaussian mutation to the fitness
of the position of the global optimal point [37]. In this way, “premature” convergence can be avoided to a large extent, while still the local search ability can be significantly enhanced.

After the global optimal particle $x_{gd}$ of each iteration is updated in the $i$th iteration, the Gaussian mutation process is performed. First, the number of mutations in the $D$ dimensions of the particle is calculated, and $z$ dimensions are randomly selected from the dimensions of $x_{gd}$. The index list sort of the dimensions of the variation is then obtained. Note that the diffusion formula for $z$ and $x_{gd}$ is given by equations (3) to (6), respectively.

\begin{align}
    z &= D \ast \text{rand}(0, 1), \\
    g &= \frac{1}{\sqrt{2\pi}} e^{-z^2/2}, \\
    \text{gaussian} &= x_{gd}[\text{sort}] \ast g,
\end{align}

\begin{align}
    x_{gd} &= x_{gd}, \text{if } \text{fit}(x_{gd}) < \text{fit(gaussion)}, \\
    x_{gd} &= \text{gaussian}, \text{if } \text{fit}(\text{gaussion}) < \text{fit}(x_{gd}).
\end{align}

In the aforementioned equations, $g$ is the Gaussian function value whose mean and standard deviation are both 1, and gaussian is the particle position array after mutation, such as formula (3). Taking the minimum value as an example, compare the fitness values of each mutation point in the gaussian array and $x_{gd}$. If the fitness value of the point in the gaussian is smaller, replace the global optimal point with the Gaussian mutation particle, and then proceed to the next iteration. The findings of the experiments indicate that by combining the particle swarm with the Gaussian variation mechanism of fireworks, it is possible to successfully leap out of the local optimal state and increase the correctness of the algorithm.

The novel elimination mechanism from the coyote algorithm is amalgamated into the particle swarm algorithm in order to improve the particle swarm algorithm’s ability to
conduct a global search and to raise the likelihood of locating a solution that is optimal on a global scale. Following the completion of each iteration’s update of the particle’s individual extreme value and global extreme value, a subset of particles from the population are chosen at random, new particles are generated using the coyote regeneration mechanism, and the newly generated particles are used to replace the particles in the population that have the lowest fitness. Following the completion of each iteration of the update to the position and velocity of the particle swarm, a random selection of 2a particles from the total number of particles is made, and these particles are then merged in pairs to produce new particles [38]. The formula for determining the position of the i\textsuperscript{th} new particle is given by equation (4) below:

$$p_{i\text{new}} = p_1 \cdot x_{m} + p_2 \cdot x_{n} + n(\text{ub} + \text{rand}(1, D) \cdot (\text{ub} - \text{lb})),$$

where $x_{m}$ and $x_{n} (m, n \in (1, 2, \ldots, 2a))$ are one of the 2a particles, ub and lb are abbreviations that stand for the upper and lower limits of the spatial extent, respectively. Furthermore, D represents the dimension of the space, $p_1$ and $p_2$ are two D-dimensional arrays with array values 0 or 1. The generated a particles are sorted from poor to excellent according to the fitness of the objective function. In the next phase, the fitness function is compared with the a particles with the worst population fitness in the current iteration. Note that the good new particles are always replaced by the poor ones, and enter the next iteration. Figure 2 presents the flow chart for the proposed GEM-PSO algorithm [39]. This should be noted that the seven steps, as shown in Algorithm 2, is a rundown of the primary phases involved in enhancing the traditional particle swarm algorithm.

4.2. Classification Model of English Teaching Resources Based on Improved Swarm Intelligence Algorithm. In the field of machine learning, SVM is an established classification technique. In solving machine learning tasks for instance classification, regression, and density estimation, it has numerous distinct advantages [40].

As shown in Figure 3, the circle point and the triangle point in the figure represent two types of things, respectively. This should be noted that $H$ symbolizes the classification line in two-dimensional space, whereas in three-dimensional space, it is represented as a curved surface. Furthermore, $L_1$ and $L_2$ represent the classification lines that pass through the training samples closest to $H$ in the two classes of algorithms and are parallel to $H$, respectively. The interval between $L_1$ and $L_2$ is the classification interval. The choice of kernel function and the settings for the kernel function have a momentous influence on the performance of the SVM. The RBF kernel function, which takes in $g$ and $C$ as its parameters, is the kernel function that is utilized the most frequently. When using a classification model such as the SVM, the suitability of parameter selection has a significant influence on the outcomes of the classification. The parameters of the current SVM are currently adjusted with swarm intelligence algorithms to improve performance [41].

In this paper, the digital resources are represented as high-dimensional vectors, the GEM-PSO-SVM classification model is recognized and suggested. Furthermore, the improved swarm intelligence procedure is used to iteratively discover the parameters of the optimal RBF kernel function to advance the classification precision of the SVM technique, and then the trained SVM is used. Finally, the paper makes use of the SVM that was previously trained. The classification model classifies other test set samples to achieve the purpose of accurately classifying resources. The advantage of the proposed classification model is that the calculation is simple and fast, and its block diagram is shown in Figure 4.

5. Experimental Design and Results

5.1. Experimental Design

5.1.1. Data Sets. Assuming that there are 200 digital English teaching resources, they can be divided into four categories by identifying them in a third-party way. Through the proposed English teaching resource classification model based on swarm intelligence algorithm, 200 resources are classified.
5.1.2 Data Enhancement. In English texts, the verb tense changes and the irregular plural changes of nouns cause words to appear in various forms. Therefore, during vocabulary processing, different forms of the same word will be processed as different words, resulting in complex feature items and an increase in the number. Affects feature vector extraction and reduces the accuracy of automatic resource classification. In this regard, the root can be restored using the Python version root reduction technology.

In English digital teaching resources, the vocabulary is large, so feature extraction is required, that is, the keyword set that can represent the content is automatically selected from the resources. This module’s purpose is to filter out words that provide little to no information and to make use of the dimension of vector space in order to simplify the calculation process, avoid overfitting, and ultimately accomplish the goal of improving classification accuracy while also reducing the complexity of calculations. At present,
there are various ways of lexical feature extraction. In this paper, the information gain method is selected to extract lexical feature items.

5.1.3. Performance Evaluation. The precision rate, the recall rate, and the F1 value are the three metrics that are typically used in practice to evaluate the classification performance of an algorithm [42]. According to the possible outcomes of classification prediction, if we define TP as the number of texts predicted to be positive but actually positive, FP as the number of texts predicted to be positive but actually negative, and FN as the number of texts predicted to be positive but actually negative, and TN as the number of texts that are predicted to be negative classes and are in fact negative classes, then the calculation formulas for precision, recall, and F1 value are as follows: TP is the number of texts predicted to be positive but actually positive:

\[
\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN},
\]

where TP denotes the true positive, TN stands for true negative, and FP characterizes false positive. Furthermore, FN symbolizes false negative.

(2) Recall rate:

The number of texts that are accurately anticipated as belonging to a positive class and a proportion of the total number of texts that are predicted to belong to a positive class is referred to as the recall rate. Another name for the recall rate is the remembers rate. It is possible to describe it as given by equation (6):

\[
\text{Recall} = \frac{TP}{TP + FP}.
\]

(3) The F1 value:

The F1 value is a type of assessment index that considers both the precision rate and the recall rate in a comprehensive manner. The larger the F1 value, the better is the predictive approach and vice versa. The F1 value can be defined as given by equation (7).

\[
F1 = \frac{(2 \times \text{Accuracy}) \times \text{Recall}}{\text{Accuracy} + \text{Recall}}.
\]

For classification accuracy, recall, and F1 value, we specifically evaluate the performance of the proposed classification model using these evaluation metrics for each class.

5.1.4. Compared Methods. We compare the proposed GEM-PSO-SVM classification model with four other state-of-the-art techniques as discussed below.

(A) SVM classification model based on particle swarm algorithm PSO-SVM.
(B) SVM Classification Model Based on Coyote Algorithm COA-SVM.
(C) SVM classification model based on fireworks algorithm FA-SVM.
(D) SVM classification model of improved particle swarm algorithm based on hierarchical autonomous learning HCPSO-SVM.

5.2. Experimental Results. We use the proposed GEM-PSO-SVM classification model and other classifiers in the classification of English teaching resources. We take the average precision, recall, and F1 value from 10 distinct experiments and use that information to evaluate the classification performance of the algorithm. This allows us to check the classification performance of the improved SVM. The use of 10-fold cross-validation is recommended as a method for separating the training sets from the test sets.

Figure 5 demonstrates that the classification of English digital teaching resources results in an average accurate rate that is as high as 99.25%. Furthermore, as can be seen by examining the data presented in this figure, our proposed model is superior that other ones. For other models, the average correct rates were observed 92.5%, 93%, 93%, and 94.25%, respectively. In this comparison, the proposed classification model has higher accuracy.

On the F1 value classification index results, as shown in Figure 6, the classification performance of the proposed GEM-PSO-SVM model is better than other classification models. Similarly, the classification performance shows a balanced trend among the four types of samples.

Figure 7 shows that the five classification models have relatively good classification results in the four categories of samples, but the performance of the PSO-SVM classification model is relatively weak, and the proposed GEM-PSO-SVM model has the best results. Classification performance, the average classification recall value is 96%.

The comprehensive results of the aforementioned three evaluation classification models show that the proposed GEM-PSO-SVM model has superior performance on the English teaching resource classification task.

5.2.1. Classification Efficiency. PSO-SVM, COA-SVM, FA-SVM, HCPSO-SVM, and GEM-PSO-SVM were all ran on the test set for 50 times and iterated 500 times in order to further validate the classification efficiency of GEM-PSO-SVM. HCPSO-SVM was also performed on the test set. As can be seen in Table 1, the typical amount of time spent running is as follows:

Table 1 shows that the HCPSO-SVM classification model has the highest classification efficiency, while the GEM-PSO-SVM classification model has the second-highest classification efficiency.

Based on the aforementioned comparative classification models and the evaluation results of the proposed classification model in terms of classification performance and
Figure 5: Comparison of classification accuracy of each class of samples under different classification methods.

Figure 6: Comparison of classification $F_1$ values of each class of samples under different classification methods.

Figure 7: Comparison of classification recall values of each class of samples under different classification methods.
classification efficiency, GEM-PSO-SVM is one of the more superior classification models.

6. Conclusion and Future Work

In this paper, we proposed an updated particle swarm optimization technique to categorize English teaching resources. Driven by the computer networks, the resources and forms of digital English teaching are becoming more and more diversified, which not only arouses the enthusiasm and interest of students in learning but also realizes the real-time transformation of the traditional learning mode. However, when teachers and students share resources, it is difficult to query. As a result, the purpose of this research is to provide a categorization model of English teaching resources that is based on an algorithm for swarm intelligence. The proposed classification method ensures improved classification accuracy and classification efficiency. This classification model is not only conducive to changing the traditional English teaching mode and expanding the learning methods but also conducive to improving the efficiency and quality of learning. It is worth popularizing and applying to other disciplines.

In the future, we will consider improving the proposed PSO technique while introducing parameters adaptation in which the inertia weight, $c_1$, and $c_2$ can be dynamically computed. Furthermore, we will integrate the well-known concept of Markov jumping to control the movements of the particle and to avoid early or immature convergence. Also, we will work on increasing the number of states which we believe may lead to significant improvements. As a final recommendation, we will consider improving the execution time of the proposed method. In fact, Big Data technologies such as cloud and edge computing model can be used to further improve the convergence speed and execution time of the proposed algorithm.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest to disclose.

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