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Reflections and Research on E-Learning English Teaching Activities Under Deep Learning

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Abstract. With the rapid development of information technology and social economy, the way people work and learn has changed radically. Deep learning is also receiving more and more attention from researchers. Deep learning not only focuses on student's active participation in learning, integrating knowledge, transferring applications, and creative problem solving but also advocates meaningful learning and the development of personal higher-order thinking skills. This study applied deep learning theory with high school vocabulary teaching to specific teaching activities. It was found that it can help students lay a good vocabulary foundation and develop their thinking skills. It enables students to plan their English vocabulary learning based on deep thinking and build their knowledge construction, knowledge understanding, and higher-order thinking skills.

Keywords: Deep learning strategy; English teaching; Teaching strategies; Deep convolution network; E-Learning.
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1 INTRODUCTION

The rapid development of the Internet has dramatically changed people's way of life and learning. To meet the challenges of the future society, various countries have carried out essential education reform pointing to "core literacy." Deep learning has attracted more and more attention as a critical way to improve students' core literacy. It has gradually evolved from a learning method to an educational concept, providing new ideas and directions for classroom teaching reform in various disciplines [17]. Through deep learning, deep thinking, continuous expansion and extension, and further sublimation, students can feel more of the essence of English from reading. The author's thoughts and feelings, the cultural connotation of the article, and the symbiosis and expansion of reading and writing all need more in-depth study and exploration. Students' reading ability includes reading interest and motivation, reading goals and plans, reading will and confidence, reading autonomy and cooperation, reading resources and channels, reading activities, and communication.

Students' reading ability develops through all of the English reading teaching activities. The combination of deep learning and high school English reading teaching aligns with the concept of developing students' core literacy in English, and it is also an inevitable choice for the reform of reading teaching in the information age [6].

Therefore, teachers are required to make a deep overall teaching design for the unit content and to promote students' deep learning by deeply analyzing teaching materials and learning situations and designing teaching activities based on the unit as a whole so that the content and arrangement of each part of the unit can reflect its significance and value for students' development, so that students can achieve the meaning construction of language knowledge, effectively improve their higher-order thinking ability, effectively acquire positive emotional experience, and finally learn deep learning and achieve development. Specifically, the research focuses on the present situation of deep learning in English classrooms. It explores the change of "teaching" and "learning" in deep learning, which is the change of teaching methods and learning methods and the change of teachers' and students' thinking modes from shallow thinking to deep higher-order thinking. However, there needs to be more research on deep learning in senior high school English reading classes, especially on applying deep learning strategies in old high school English reading learning. In addition, according to the current situation of English reading teaching in senior high schools, students need self-reflection, which shows that students need to learn what strengths or weaknesses they have in reading and ignore the use of reading strategies. In reading teaching, teachers seldom guide students to pay attention to their reading methods and techniques, and they need more evaluation of students' learning process [18],[11].

Theoretically, the research in this paper starts from the theory of deep learning and the basic status quo of previous studies and conducts related research. At the same time, the research of this paper is first because, in the existing research, there are few types of research from the perspective of deep learning in English teaching, which makes the research of this paper have specific theoretical innovation. The research of this paper adopts the action research method. The method also has particular innovations in the research method [12]. With the rapid development of information technology, deep learning research has received strong technical support. Compared with the theoretical research on the concepts and characteristics of deep learning in the previous two stages, this stage has entered the technical practice research of deep learning in China, and the research focus has gradually shifted from theory to implementation. From a practical point of view, the research in this paper combines its own teaching practice and specific teaching cases to carry out related research. It is possible to use in-depth learning as an entry point through the research of this paper to help students develop their skills in English learning. English core literacy. Finally, a series of teaching measures and improvement strategies proposed in this paper can provide some reference and reflection for teachers' professional development and promote the improvement and cognitive development of English teachers' professional skills. Therefore, the research in this paper has practical significance. Its innovations are:

1. This study is based on deep learning theory and proposes English classroom teaching strategies guided by deep learning theory based on analyzing the findings. Based on the experimental data, it is possible to find teaching strategies that are better than the traditional grammar-translation method and to try to improve students' ability and change the phenomenon of students' inability to read and superficial understanding based on the guidance of deep learning theory.

2. Deep learning is applied to English teaching, and its effectiveness is explored. This paper proposes teaching strategies based on the guidance of deep learning theory and combines strategy theory with teaching practice to verify the effectiveness of teaching strategies.

2 RELATED WORK

How to promote students' deep learning through the instructional design of various disciplines; teachers and scholars at all levels have made in-depth explorations in combination with the characteristics of disciplines and students' learning situations and have put forward teaching strategies to promote deep learning. They all pay close attention to how to guide students to understand, integrate, and flexibly use in learning to learn deep learning. In recent years, the research on deep learning has been paid more and more attention and has become a hot spot in domestic education. Deep learning is no longer just a learning method but has gradually evolved into an educational concept [4]. Nowadays, project test areas about deep learning have been built all over the country, which makes more and more experts, scholars, and teachers participate in it, which brings new strength to the research of deep learning, realizes the combination of theory and practice, and provides new ideas and directions for classroom teaching reform of various disciplines.

Eric Jensen Le Ann Nickelsen believes the brain may be more active when deep thinking occurs. After the expert level is established, less brain activity is required; better understanding, better retention, and more application of concepts and skills are generally possible. The most prominent feature of expertise is the connectivity necessary for deep learning [8]. On this basis, K·Goodman proposed the holistic language teaching method. Through his research on English reading teaching, he pointed out that paying attention to the overall situation and integrity of English teaching is the key to improving the effect of English teaching [10]. Alison Rushton has researched the achievement of deep learning. He believes that the use of formative evaluation, hierarchical evaluation, and guidance can promote the realization of deep learning [1]. Danielle S. Namara thinks deep learning is a kind of understanding and feeling of thinking that can form reflection and improvement. In his research, he proposed that metacognitive strategies can help the development of deep learning and promote the improvement of learning and understanding [5]. Brian A. Korgel uses a substantial case study to propose that writing a learning log can help students achieve deep learning well [2]. Lecun Y, Bengio Y, Hinton G also suggested that the facilitator realizes the achievement of deep learning. At the same time, the effective use of virtual learning environments and mind maps can provide an effective guarantee for deep learning to achieve deep understanding and thinking [14]. Jane Mellanby proposed that deep learning can help reflect students' learning motivation and critical thinking ability [13]. Noa Aharony conducted an experimental comparison between surface and deep learning for foreign language learning and finally proposed that students' learning effects and learning abilities have been greatly improved under deep learning. Therefore, it is advocated to apply deep learning for more learning and mining in learning to form a reasonable application of deep learning [19]. From the perspective of reading teaching, Liping Chen and Jaswinder K. Dhillon proposed that to improve reading efficiency and reading comprehension in reading learning, a deep learning method must be adopted. From deep excavation and deep exploration, one Better understands the text's deep meaning to improve reading learning effectively [16]. Eillot once pointed out that action research is researchers' research on specific issues in a particular environment. To achieve the teaching purpose and process and reach a new educational concept, formulate and implement a research plan, reflect on the results, and formulate the next research plan. Efforts [7].

3 DEEP LEARNING AND CONVOLUTIONAL NEURAL NETWORKS

3.1 Deep Learning

Deep learning mainly refers to the deep development of student's learning in the process of acquiring new knowledge so that students can go through new knowledge and new content to analyze it in depth, study its essence, connotation, and meaning, and be able to achieve the purpose of learning by example, form a new teaching model in continuous analysis and research, change the original learning mindset, and create a self-learning method by deepening learning. Deep learning has a strong correlation; students must master some basic knowledge and then dig deeper into it to establish the connection between it and other expertise to complete the knowledge structure and knowledge framework. In other words, to achieve deep learning of content, it is necessary to go through multiple thinking steps. It may require basic background knowledge, is time-consuming, and requires much effort and determination [15]. In the current teaching models, many models include the idea of deep learning, and scholars generally focus their attention on the field of deep learning, hoping to combine deep learning with more disciplines, ideas, and strategies to find more effective, novel, and meaningful ways of teaching and learning.

The convolutional neural network plays a vital role in applying deep learning technology to behavior recognition, whether human behavior recognition is based on sensor data or computer vision. In the past few years, with the significant improvement of training data and computing power, deep learning technology has better dealt with many problems, such as text processing, speech recognition, and target detection [21]. Among various types of neural networks, convolutional neural networks are widely used and have been intensely studied, as shown in Figure 1.

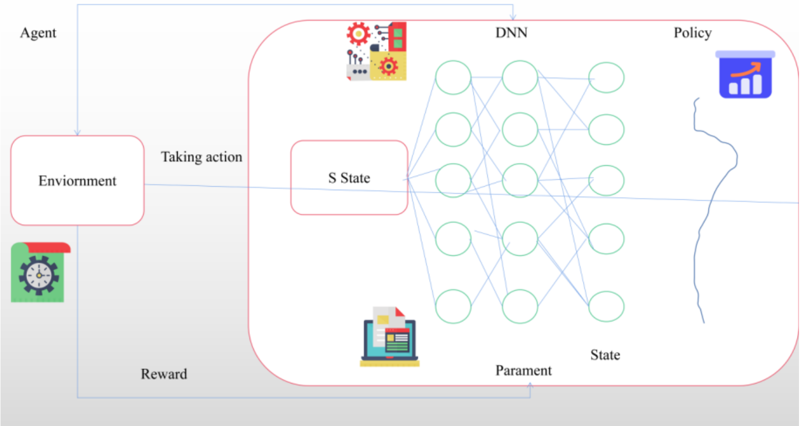

Figure 1: Deep reinforcement learning process.

In past studies on classroom behavior, most of the data were obtained by traditional classroom observation or questionnaire survey, which required a lot of manual operation, was inefficient, time-consuming, and laborious, and the results needed to be more accurate. The education industry has gradually stepped into the era of intelligence, making it increasingly necessary to realize intelligent classroom behavior recognition and implement new requirements for the results of classroom behavior recognition. Developing deep learning technology solves philosophical education for classroom behavior recognition. Deep learning has no complicated artificial feature design, which can effectively overcome noise interference and automatically select and learn features to solve various complex problems [9]. Therefore, it is of great theoretical research significance and practical application value to apply deep learning technology to classroom behavior recognition so that students' classroom behavior can be automatically recognized and fed back to teachers to analyze classroom teaching activities and improve teaching quality.

In the process of classroom teaching analysis, by identifying students' classroom behavior and linking it with students' academic performance and classroom teaching effect, a practical teaching orientation can be fed back, which is conducive to developing students and improving teaching quality. In this process, realizing behavior recognition in the classroom is very important. To conveniently obtain each student's behavior in the school and identify the classroom behavior effectively, the specific model is shown in Figure 2.

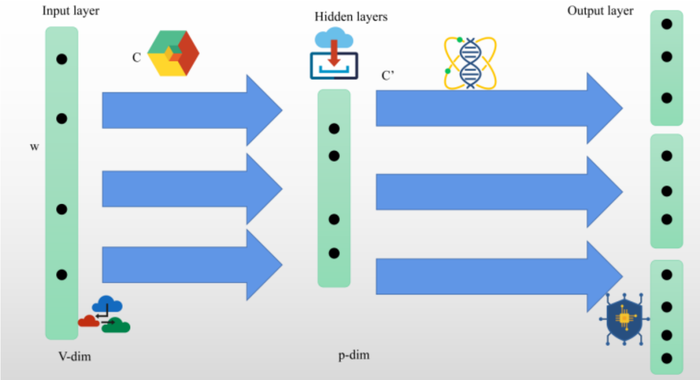

Figure 2: Skip-gram model.

3.2 Multi-layer Perceptron

Multi-layer Perceptron (MLP) is a forward artificial neural network. Its essence is a directed graph of multi-node layers. Its function is to establish the mapping relationship between input and output. Multiple hidden layers can exist between the input and output layers. The layers are fully connected; that is, the neurons in the upper and lower layers are fully connected [20]. In all nodes, except for the input node, the rest of the nodes have nonlinear activation functions, and these nodes are usually called processing units.

The forward propagation formula of the multi-layer perceptron is shown in (1) and (2):

$$Z_j^l = \sum k\, W_{jk}^l a_k^{l-1} + b_j^l \tag{1}$$

$$a_j^l = f(\sum k\, W_{jk}^l a_k^{l-1} + b_j^l) \tag{2}$$

The loss function of the multi-layer perceptron transmitted to the final layer is:

$$C = \frac{1}{2n} \sum x \left\| y(x) - a^l(x) \right\|^2 \tag{3}$$

Artificial neural networks are usually optimized using a batch gradient descent method, which is trained to minimize the loss function.

The backpropagation of the MLP is represented as follows: define the error between the actual result and the predicted result produced by the jth neuron in layer l as

$$\delta_j^l = \frac{\partial c}{\partial z_j^l} = \frac{\partial c}{\partial a_j^l} \cdot \frac{\partial a_j^l}{\partial z_j^l} \tag{4}$$

C is the value of the loss of the function, which is first calculated in the last layer of the neural network to produce the error. :

$$\delta^l = \frac{\partial c}{\partial a^l} \otimes \frac{\partial a^l}{\partial z^l} \tag{5}$$

The gradient of weights w and biases b are calculated layer by layer.

$$\frac{\partial c}{\partial w_{jk}^{l}} = a_k^{l-1}\delta_j^l \tag{6}$$

$$\frac{\partial c}{\partial b_j^l} = \delta_j^l \tag{7}$$

Finally, the weights and biases are gradually updated according to the learning rate.

The role of the activation function is to improve the nonlinear representation of the neural network. Usually, in practice, nonlinear problems cannot be solved directly using linear expressions. However, the convolution operation in neural networks is still linear, i.e., matrix multiplication, which requires using the activation function in neural networks, especially for ANNs in learning complex functions [3].

The expression of the Tanh function is shown in (8), which is essentially a hyperbolic tangent function, and its expression can be obtained very quickly according to the formulas of hyperbolic cosine and hyperbolic sine functions as follows.

$$f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}} \tag{8}$$

The convergence speed of the tanh function is faster than the sigmoid function, and its output is centered on 0, so it is more widely used in practical problems but does not solve the problem of gradient disappearance.

The calculation process of the result y_t obtained by the output layer at the final time t is shown in formula (9), in which softmax is used to normalize the result.

$$y_t = soft\,max(Vs_t) \tag{9}$$

The formula of PReLU is shown in (10), and Relu and PReLU are widely used in actual applications.

$$\sigma = \begin{cases} ax, x<0 \\ x, x>0 \end{cases} \tag{10}$$

After extracting the local features of the convolution kernel, the data input to the convolution neural network will be filtered twice by the pool layer. The pool layer has two main functions. On the one hand, it reduces the dimension of the feature graph input into the pool layer and reduces the network's training parameters. On the other hand, the pool layer abstracts the features of the feature graph, which can improve the over-fitting problem. There are two ways of pooling operation: average pooling and maximum pooling. Average pooling is to slide a pooling window on the characteristic map obtained after convolution and calculate the average value in the window. Then, the obtained average value forms a new distinct map to output as a result, while maximum pooling is to take the maximum value in the pooling window.

4 RESULT ANALYSIS AND DISCUSSION

From passive acceptance to active thinking, students' active learning awareness strengthens. Teachers' timely and pertinent evaluation and encouragement, timely guidance, and help among classmates can motivate students to participate actively in classroom activities, and their learning will be recognized, thereby establishing self-confidence. After class, teachers will reflect on in-depth teaching and in-depth knowledge in this class. Teachers recognize which links are conducive to stimulating students' in-depth learning and which links hinder the cultivation of students' thinking quality. Students will reflect on their classroom performance, recognize their strengths and weaknesses, and learn how to improve in the future to learn more efficiently. Students' analytical, critical reading, reflection, knowledge transfer, application, and innovation abilities have been enhanced. Possessing these abilities can better help students read in-depth and cultivate thinking quality under core literacy.

KMO measure: The closer the KMO value is to 0, the weaker the correlation between the variables and the less suitable the original variables are for factor analysis. The details are shown in Table 1.

Test Category	*Scope*	*Factor analysis situation*
KMO value	*Greater than 0.85*	*Very Excellent*
	0.75-0.85	*Very good*
	0.65-0.75	*Excellent*
	0.55-0.65	*Not so good*
	0.45-0.55	*Barely Excellent*
	Less than 0.45	*Not Excellent*
P value	*Less than or equal to 0.2*	*Excellent*

Table 1: KMO metrics.

According to the relevant knowledge of statistics, the data of this questionnaire is analyzed by validity, that is factor analysis. Compared with the above statistics, the km value is 0.794, between 0.75-0.85, and the P value is 0.01, less than 0.02. It shows that it is very suitable for factor analysis, which shows that this questionnaire has good validity.

To judge the results and effects before and after the experiment, scholars processed the data by comparing the pre-test and post-test data. To further verify the hypothesis proposed in this study, the author used software to make statistics and operations on the relevant data to judge the differences before and after the experiment, as shown in Figure 3 below.

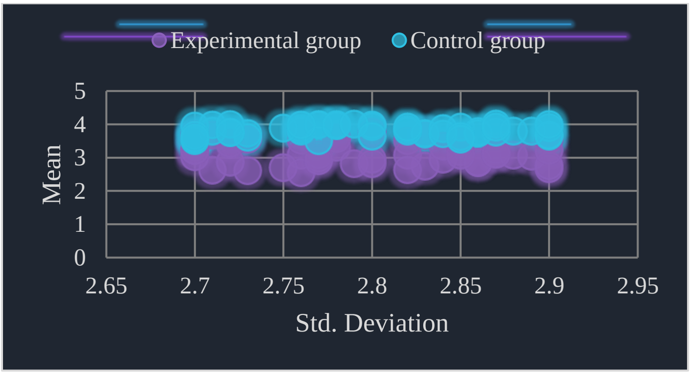

Figure 3: Results and effects before and after the experiment

The experimental results show that the average scores of the pre-reading tests in the practical and control classes are 3.745 and 3.514, and the standard deviations are 2.258 and 2.114, respectively. According to the comparison of the above data, we can see that the data of the two classes did not change much before the experiment, indicating that the two classes are equal in level.

The post-test results are shown in Figure 4.

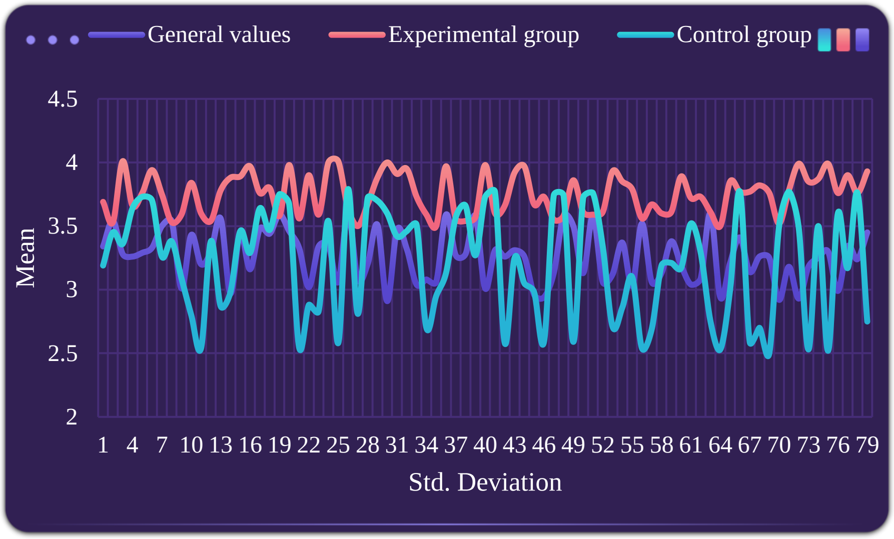

Figure 4: Comparison of post-test scores between the experimental and control classes.

This experiment is a network model training on a local server. To evaluate the model, the CNN or RNN single algorithm model and the CNN combined with the RNN hybrid algorithm model were used in the training process for comparison (the single algorithm model mainly includes CNN, LSTM, GRU, and BILTM. Figure 5 shows the single algorithm model in the test and the correct rate curve in the set; Figure 6 shows the proper rate curve of the hybrid algorithm model in the test set.

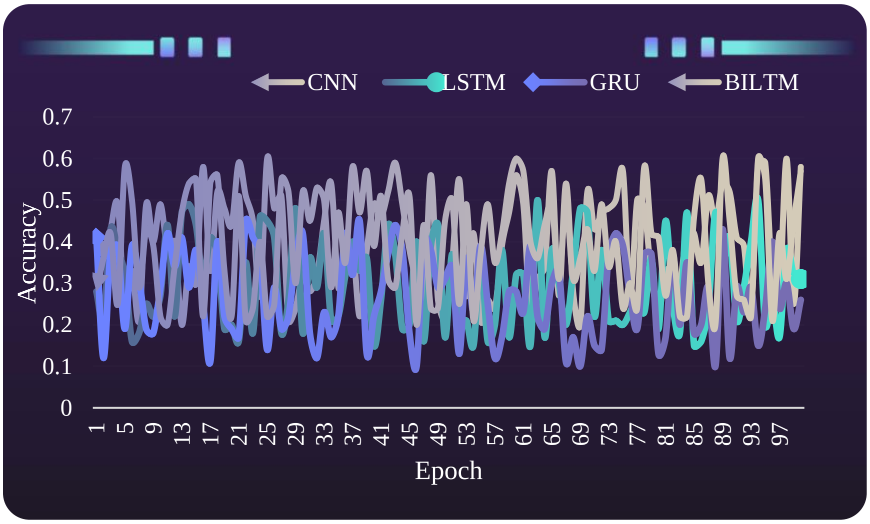

Figure 5: Single algorithm model correctness curve.

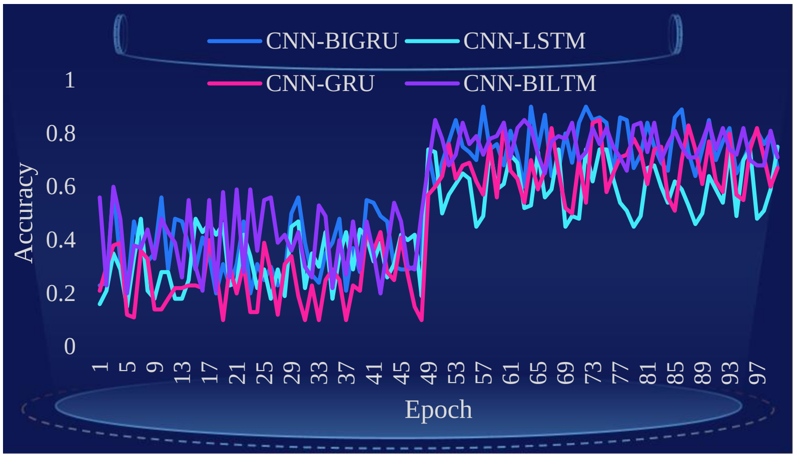

Figure 6: Correctness curve of CNN and RNN hybrid algorithms.

From the single-algorithm model correct rate curves in Figure 5, it can be seen that the CNN and the BILSTM algorithms have similar test valid rates in the test set and are more accurate than LSTM, GRU, and BIGRU. It can be seen from Figure 6 that the four hybrid algorithms' correct rate curves are relatively close to each other. In contrast, the CNN-LSTM proper rate curve has some fluctuations compared to the three model accurate rate curves.

Its detection performance is improved after proposing improved detection and feature extraction modules for the Faster RCNN algorithm. It outperforms most of the current classical algorithms for target detection, as shown in Figure 7.

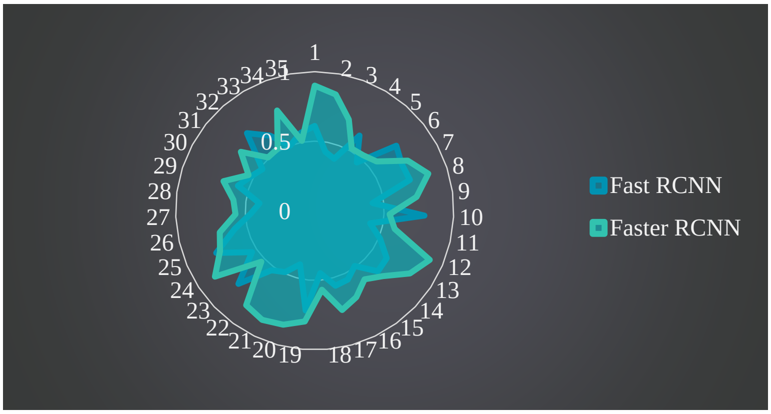

Figure 7: Performance comparison of the improved, faster RCNN with the detection algorithm.

As shown in Figure 7, on the data set, the accuracy of the improved faster RCNN algorithm has been significantly improved compared with that before the improvement. Through the improvement of the detection module and the feature extraction module, the algorithm not only improves the quality of positive samples but also avoids the problem of overfitting and increases the network depth to ensure the resolution of the feature map. The accuracy of the improved fast RCNN algorithm is 5.4% higher than that of the original fast RCNN algorithm using the vgg-16 backbone network, which has better applicability in classroom scenarios.

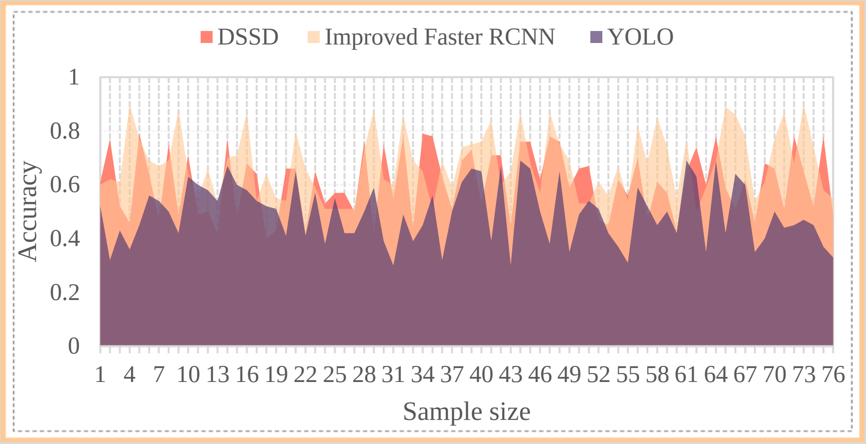

Figure 8: Classroom behavior recognition dataset.

Next, the experimental part of classroom behavior recognition is carried out. First, the improved Faster RCNN algorithm is pre-trained, and the deep network model of behavior recognition is obtained. Specifically, the self-made classroom behavior recognition data set is used, and the parameter configuration method set in this section is followed: the random gradient descent optimization method is adapted to recognize the deep network model. The accuracy of this model on the test set reaches 91.7%, and it has good detection accuracy.

However, due to the limited workforce in collecting the data set of students' behaviors and the single scene, the accuracy of identifying ordinary people in practical application will decrease correspondingly. To improve the adaptability of the network to different actual scenes, we should collect more universal samples and increase the proportion of the network in the data set.

5 CONCLUSIONS

This research mainly explores the role of deep learning strategies in improving students' English ability through action research. This study designed an action research protocol to guide students using deep learning strategies in reading comprehension and help them develop good reading habits. This study gradually integrates deep learning strategies into English reading classroom teaching and students' reading learning according to the action research method to improve students' reading ability. After the experiment, the final grades of the two classes are different. The average grade of the experimental class has effectively improved by about 14.15%, indicating that the efficiency and performance of the deep learning practical class have been significantly improved, which further verifies deep learning. Role in English learning. In addition, based on deep learning, teachers can use multimedia information technologies such as information networks, social networks, and mobile terminals to create accurate and vivid teaching situations and encourage students to take the initiative to carry out personalized inquiry activities to achieve deep learning. Students' deep learning is not limited to classrooms. Teachers can also guide students to realize extracurricular mobile learning through various information media and use new media texts to carry out thematic reading, expand the amount of reading, and promote deep reading learning. With the complexities of integrating deep learning technologies into e-learning environments, it is essential to prioritize student-centered approaches, ensuring that technology enhances rather than detracts from compelling language learning experiences. Furthermore, addressing ethical concerns such as data privacy, algorithmic bias, and digital equity is paramount to fostering inclusive and equitable learning environments.

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