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Research Article

Innovative Applications of Computer-Assisted Technology in English Learning under Constructivism

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In order to improve the effect of college English classroom teaching, this paper combines optical recognition to improve machine vision algorithms and uses computer optical vision technology to process teaching images. The system designed in this paper can be applied to philosophical teaching in college English classrooms. Moreover, the system can optimize teaching resources, manage teaching classrooms through the improved machine vision algorithm in this paper, and have a formative evaluation effect. In addition, taking into account the psychological activities of students in the classroom, this paper integrates the emotional recognition of college students in the construction of the system. Furthermore, it combines the actual teaching process to build a college English classroom teaching system based on constructivism. Finally, this paper designs an experiment to analyze the effect of the teaching model. From the research results, it can be known that the teaching system meets the demands of teaching.

1. Introduction

Under the background of the integration of the world economy, the role of English for college students is self-evident. The continuous advancement of information technology promotes the change of English teaching methods. Currently, many computer-assisted technologies are applied to university classroom teaching. However, although most universities use computer-assisted technology for online college English teaching, they are still affected by traditional teaching models. Moreover, computer-assisted English online teaching still has certain drawbacks, which affect teaching efficiency, so it needs to be improved [1]. Constructivism is a theory of learning which is further developed after the enhancement of activism to cognitivism. In addition, constructivism is a process in which learners spontaneously construct internal mental representations. In addition, the constructivist does not impart to learners the theoretical knowledge that subverts the tradition. However, learners gain from the active construction of meaning with the help of teachers, learning partners, or other people under a specific social and cultural background [2].Therefore, in education based on constructivist learning theory, providing learners with an appropriate learning environment and building a new relationship between teachers and students are the two most important aspects.

Constructivism advocates artistic conception learning, which is learning through target-oriented activities in the real application environment of the learned knowledge. The cognitive flexibility theory advocated by them is to develop learners' cognitive flexibility and form a multifaceted understanding of knowledge. Therefore, knowledge learning should be combined with specific conditions. By entering the state of rearrangement multiple times, learners can form background experience, master the complexity of knowledge and related relationships, and then use actual learned knowledge to solve real-life problems [3]. This article combines constructivism to play computer-assisted technology in college English classrooms. It constructs an efficient teaching system that can be used for college English teaching and conducts system performance analysis through experimental research.

The rest of the article is composed as follows. In Section 2, related work is studied. In Section 3, online teaching text recognition is elaborated, followed by the college English classroom teaching system based on constructivism in Section 4. The results are given in Section 5, and the article is concluded in Section 6.

2. Related Work

There are many researches on intelligent computer teaching systems. This article summarizes the application of computer-aided technology and artificial intelligence technology in college teaching, as follows: the literature [4] comprehensively analyzed the current situation of artificial intelligence education. According to its investigation, there are problems in implementing artificial intelligence courses, and there is no real teaching system. The literature [5] more specifically analyzed the shortcomings and problems of current artificial intelligence teaching materials for marketing. It believes that the difficulty of hardware is temporary. With the further development of computer technology, the price of neural computing power required for artificial intelligence-related research has also fallen sharply. The literature [6] studied the model of AI education and pointed out that AI education is mainly embodied in acupuncture preparatory courses or many fee-charging educational institutions, programming seminars, or training camps. The literature [7] conducted more profound research on case-based teaching in AI teaching and classified it into three types: model reference, question reexamination, and game reasoning. The literature [8] put forward specific corresponding opinions on different stages of artificial intelligence curriculum education. According to the different textbooks, the focus of some researchers is also different. The literature [9] discussed using problem-solving education strategies in artificial intelligence education with robot control as the content. In the literature [10], the effect of game case law is studied.

The literature [11] studied the design and implementation of a personalized learning navigation system based on data mining, introduced an adaptive organization into the distance education system, and realized personalized learning navigation according to the characteristics of learners. The literature [12] designed a multiagent-based intelligent distance education environment to realize the intelligence and adaptability of the distance education system. The literature [13] studied adaptive derivative systems and authoring tools. According to technologies in the fields of intelligent education systems, hypertext, user models, etc., it constructed a user's knowledge model based on the interactive information between the user and the system.

Finally, the literature [14] designed a student characteristic analysis system in a network environment. Through collecting and analyzing the dynamic and static information in the student's learning process, it proposed a theoretical module for designing the learner characteristic analysis system. The literature [15] comprehensively applied workflow technology, computer collaboration technology, data mining technology, and intelligent agent technology to intelligent education systems to realize automatic reasoning, automatic delivery of personalized learning information, teaching decision support, and various educational workflows. The literature [16] developed a personalized intelligent education system. When students can attend classes normally, in order to improve their problem-solving ability and master knowledge, they can practice in this system.

3. Online Teaching Text Recognition

The algorithm proposed in this paper is mainly used for font recognition in network teaching. Therefore, image recognition technology needs to be applied, and the recognition process needs to be combined with optical technology.

The scalar wave equation can be expressed as follows [17]:

$$\nabla^2 E(r,t) - \frac{n^2}{c^2}\frac{\partial^2 E(r,t)}{\partial t^2} = 0. \tag{1}$$

The definition of the algorithm parameters is as follows: the refractive index of the medium is n, the speed of light in a vacuum is C, and the complex amplitude of the light field is E. Then, there are

$$\nabla^2 E(r,\omega) + k^2 E(r,t) = 0. \tag{2}$$

In the formula, the wave vector is $k = n\omega/c$, and ω is the angular frequency of the light wave. When there is a point source $\delta(r-r')$ at position r', the solution of the above formula is called Green's function $G(r,r')$, that is [18],

$$\nabla^2 G(r,r') + k^2 G(r,r') = \delta(r-r'), \tag{3}$$

where $G(r,r')$ characterizes the spatial impulse response of the point source at a position r' at r. When multiplying it with any incident light field $S(r)$, we have

$$E(r) = \int G(r,r')S(r')\mathrm{d}^3 r'. \tag{4}$$

The incident surface is denoted as S_a. From the above formula, it can be concluded that the incident light field $E(r_b)$ is the sum of the light field contributions of different positions r_a in the incident light field $S(r_a)$ [19].

$$E(r_b) = \int_{S_a} G(r_b,r_a)S(r_a)d^2 r_a. \tag{5}$$

In the formula, $G(r_b,r_a)$ is the response of the light field at a position r_a at r_b, which is the Green's function of the random scattering medium. The above formula can be discretized as

$$\begin{aligned} E(r_b) = E_b &= \sum_{a=1}^{N}\int_{S_a} G(r_b,r_a)d^2 r_a|E_a|e^{i\phi_a} \\ &= \sum_{a=1}^{N} G_{ba}|E_a|e^{i\phi_a}. \end{aligned} \tag{6}$$

Among them, $|E_a|$ is the amplitude of incident channel a, and ϕ_a is the phase of incident channel a. The complex coefficient G_{ba} is a set of N weight coefficients, representing the transmission relationship of light waves from each channel a to channel b.

The complex coefficient of the light field relationship can be expressed as G_{ba}, and the corresponding complex matrix G is called the optical transmission matrix. Then, the transfer matrix model can be expressed as

$$E_m^{\text{out}} = T \cdot E_n^{\text{in}} = \sum_{m=1}^{N} t_{mn} E_n^{\text{in}}. \quad (7)$$

Among them, E_n^{in} and E_m^{out} are the light fields of the n-th incident channel and m-th exit channel, respectively, and t_{mn} is the element in the transmission matrix [20].

In the feedback wave front shaping experiment, the network English text configuration diagram before the optimization is shown in Figure 1. In the picture, we can see speckle particles shaped like "caterpillars." Because the central brightness of the speckle particles is high and the peripheral brightness is low, speckles are formed randomly distributed in the light and dark particle positions.

The complex amplitude corresponding to the m-th output channel can be expressed as

$$E_m^{\text{out}} = Ae^{j\theta} = \sum_{n=1}^{N} a_n e^{j\phi_n}. \quad (8)$$

In the above formula, a_n and ϕ_n are the amplitude and phase of the n-th incident photon through the scattering medium, and A and θ are the amplitude and phase of the v-th output channel, respectively. Here, the superposition process of this complex amplitude is explained with a simple example. Figure 2(a) shows a schematic diagram of long-phase interference. The speckle pattern in the speckle pattern is obtained by the interference of the phase length of each light wave vector. Therefore, the thin-line light wave vector approximated in the four directions in the complex plane is the long thick-line vector obtained by the overlap of the phase length. Thus, the length of the line is the amplitude dimension.

On the contrary, Figure 2(b) shows a schematic diagram of interference cancellation. The dark speckle is obtained by canceling the interference of each light wave vector. The thin-line light wave vectors with larger differences in the four directions in the complex plane are canceled and superimposed to obtain a shorter thick-line vector.

Two discriminants are designed, which are expressed in the following form:

$$f_1 = \frac{\sum_{m=1}^{M} I_m}{I_{ref}}, \qquad f_2 = \frac{\sigma_M}{(1/M)\sum_{m=1}^{M} I_m \times 100\%}. \quad (9)$$

Among them, M is the number of focus points, I_{ref} is the background average intensity of the output light field, and σ_M is the standard deviation of the intensity of M focus points.

The discriminants of AM and GM are respectively written as

$$f_{\text{AM}} = \frac{\sum_{m=1}^{M} I_m}{I_{\text{ref}}}, \qquad f_{\text{GM}} = \frac{\sqrt[M]{\prod_{m=1}^{M} I_m \cdot M}}{I_{\text{ref}}}. \quad (10)$$

They satisfy the following relationship:

$$f_{\text{AM}} \geq f_{\text{GM}}, \qquad \frac{\sum_{m=1}^{M} I_m}{I_{\text{ref}}} \geq \frac{\sqrt[M]{\prod_{m=1}^{M} I_m \cdot M}}{I_{\text{ref}}}, \qquad \frac{\sum_{m=1}^{M} I_m}{M} \geq \sqrt[M]{\prod_{m=1}^{M} I_m}. \quad (11)$$

The above formula satisfies the following properties: $(I_1 + I_2 + \cdots + I_m)/m \geq \sqrt[m]{I_1, I_2, \ldots, I_m}$ and the equal sign holds only when $I_1 = I_2 = \cdots = I_m$.

Among them, $I_1 - I_m\,(\geq 0)$; it characterizes the intensity value of m focal points.

First, the auxiliary conclusions are introduced: if $A \geq 0, B \geq 0$, then $(A+B)^m \geq A^m + mA^{m-1}B$, and the equal sign holds only when $B = 0$.The binomial expansion can prove this lemma

$$(A+B)^m = \sum_{r=0}^{M} C_m^r A^{m-r} B^r = A^m + mA^{m-1}B + \cdots + mAB^{m-1} + B^m \geq A^m + mA^{m-1}B. \quad (12)$$

The original proposition is equivalent to

$$\left(\frac{I_1 + I_2 + \cdots + I_m}{m}\right)^m \geq I_1, I_2, \ldots, I_m. \quad (13)$$

The equal sign holds only when $I_1 = I_2 = \cdots = I_m$.

(1) When $m = 2$, the proposition obviously holds. After expanding by $(I_1 - I_2)^2 \geq 0$, it is easy to get $((I_1 + I_2)/1)^2 \geq I_1 \cdot I_2$.

(2) We assume that the proposition holds when $m = k$, that is, $((I_1 + I_2 + \cdots + I_k)/k)^k \geq I_1, I_2, \ldots, I_k$, and the equal sign holds only when $I_1 = I_2 = \cdots = I_k$. Then, when $m = k+1$, if I_{k+1} is the largest of $I_1 \sim I_{k+1}$, then there is $kI_{k+1} \geq I_1 + I_2 + \cdots + I_k$, and the condition for taking the equal sign is $I_1 = I_2 = \cdots = I_k = I_{k+1}$. If we set $S = I_1 + I_2 + \cdots + I_k$, then there is $((I_1 + I_2 + \cdots + I_{k+1})/k + 1)^{k+1} = (S/k + (kI_{k+1} - S)/k(k+1))^{k+1}$.

According to the lemma, we can get

$$\left(\frac{S}{k} + \frac{kI_{k+1} - S}{k(k+1)}\right)^{k+1} \geq \left(\frac{S}{k}\right)^{k+1} + (k+1)\left(\frac{S}{k}\right)^k \frac{kI_{k+1} - S}{k(k+1)} = \left(\frac{S}{k}\right)^k I_{k+1} \geq I_1 \cdot I_2, \ldots, I_k \cdot I_{k+1}. \quad (14)$$

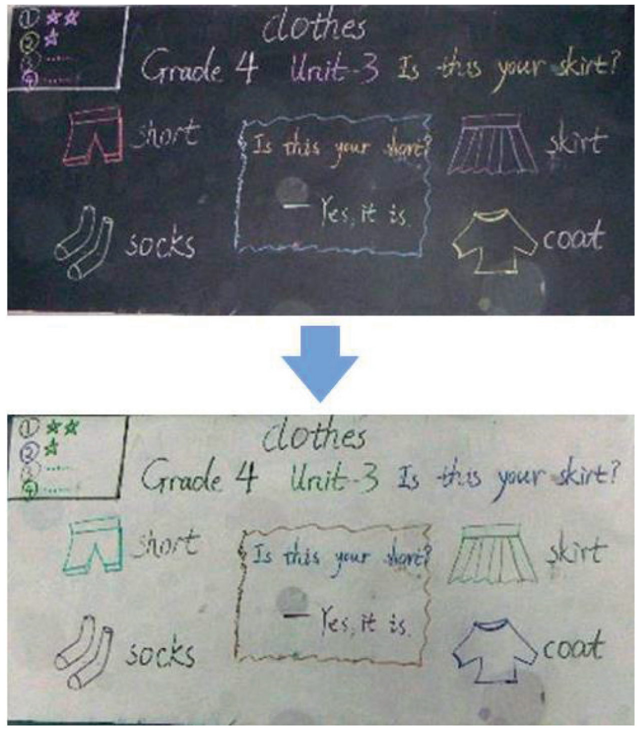
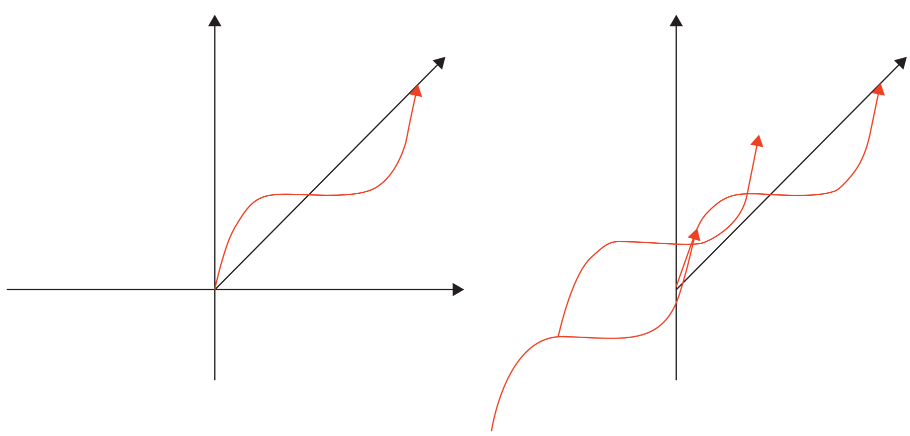


Figure 1: Speckle diagram.



(a) (b)

Figure 2: (a) Schematic diagram of constructive interference. (b) Schematic diagram of destructive interference.

If and only if $kI_{k+1} - S = 0$, that is, $I_1 = I_2 = \cdots = I_k = I_{k+1}$, the equal sign holds. Therefore, for $m = k+1$, $((I_1 + I_2 + \cdots + I_{k+1})/k + 1)^{k+1} \geq I_1, I_2, \ldots, I_{k+1}$ holds, that is, the original proposition is proved.

If we set $M = 2, \sum_{m=1}^{M} I_m = 10\,(I_1, I_2 \in [0, 10]), I_{\mathrm{ref}} = 1$, then $f_{\mathrm{AM}} = I_1 + I_2, f_{\mathrm{GM}} = \sqrt{I_1 \cdot I_2} \times 2$. Figure 3 shows the relationship between I_1, I_2 and f in these two discriminants.

From Figure 3, we can see that the curves of f_{AM} and f_{GM} are a straight line and a parabola, respectively. In order to make the enhancement factor f as large as possible, there are endless combinations of feasible solutions for f_{AM} (such as $I_1 = 0.5, I_2 = 9.5$, or $I_1 = 3, I_2 = 7$), but there is only one perfect feasible solution $(I_1 = I_2 = 5)$ for f_{GM}.

4. College English Classroom Teaching System Based on Constructivism

This article is to verify the English classroom teaching system under the background of constructivism. The teaching system of this paper needs to use computer optical vision technology for teaching image processing. Therefore, in the construction of the teaching system, the computer-aided technology system is constructed through the proposed scheme. This paper takes students as the center in the system research, so this paper takes students as the teaching center when constructing the system. Based on constructivism, the instructional design process is shown in Figure 4.

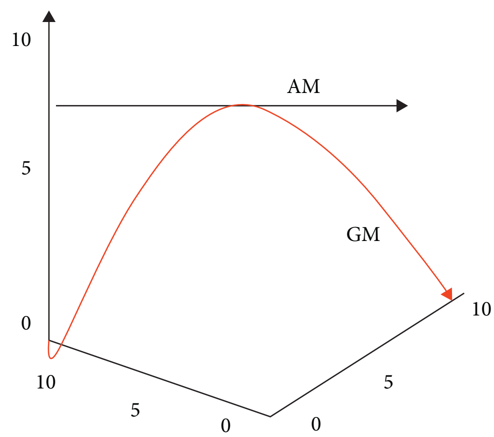


FIGURE 3: Comparison of f_{AM} and f_{GM} in the case of two-point focusing.

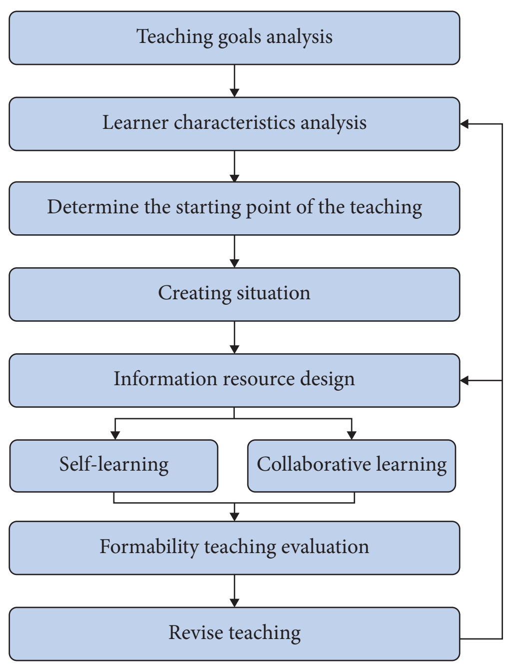


FIGURE 4: Intelligent teaching process of the college English classroom.

The application of artificial intelligence technology to college English teaching needs to be combined with the actual teaching process. The intelligent feedback system of college English teaching constructed in this paper is shown in Figure 5.

The system designed in this paper can be applied to philosophical teaching in college English classrooms. The system can optimize teaching resources, manage teaching classrooms through the improved machine vision algorithm in this paper, and have a formative evaluation effect. Moreover, the system constructed in this paper also has a database function, which can continuously optimize the teaching process and eliminate problems in teaching. In addition, as the teaching continues to deepen, the system will be continuously improved, and the teaching effect will also be improved. The database constructed in this paper has multiple functions such as data input, output, and data processing. It is based on an embedded structure and has strong scalability.

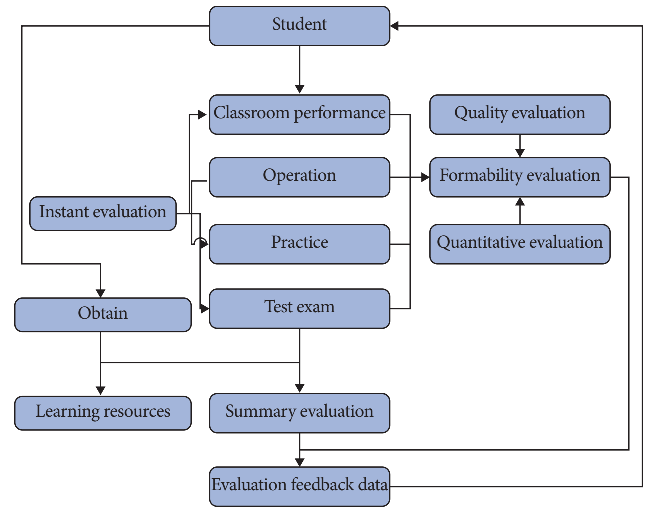


FIGURE 5: The intelligent feedback system of college English teaching.

While constructing a college English classroom intelligent teaching system, this paper considers students' mental activities in the classroom. Also, this paper incorporates the emotional recognition of college students in the construction of the system. The curve of the psychological emotion recognition model constructed in this paper is shown in Figure 6, which shows the theoretical curves of three levels of difficulty. In order to improve the effectiveness of system emotion recognition, an optical vision algorithm is applied to classroom student emotion recognition. It makes the algorithm model constructed in this paper more intelligent. At the same time, teachers can effectively adjust classroom teaching strategies according to the system recognition results.

A constructivist-based intelligent teaching system for college English is constructed by integrating emotion recognition into college English teaching, as shown in Figure 7.

5. Performance Analysis of the Proposed System Based on Constructivism

After constructing the intelligent teaching system of college English based on constructivism, the performance verification and analysis of the system are carried out. According to the actual needs of English teaching, this paper mainly starts with two aspects of English character recognition and student emotion recognition when constructing the system. Moreover, this paper uses video and image English character recognition to acquire and process teaching resources effectively and uses emotion recognition to facilitate the real-time formulation of classroom teaching methods, which will help improve teaching efficiency and help students grasp English knowledge quickly and in a effective manner.

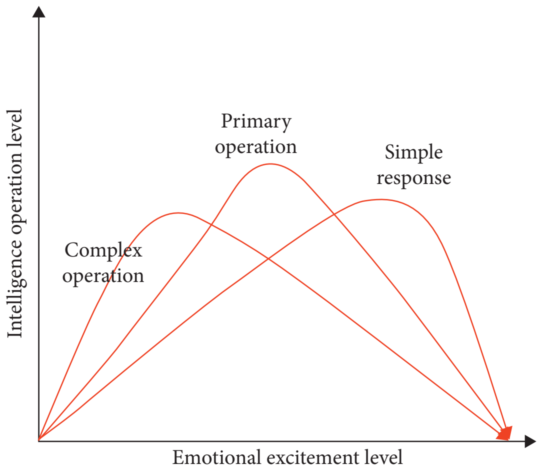


Figure 6: Emotional level curve of thinking activity.

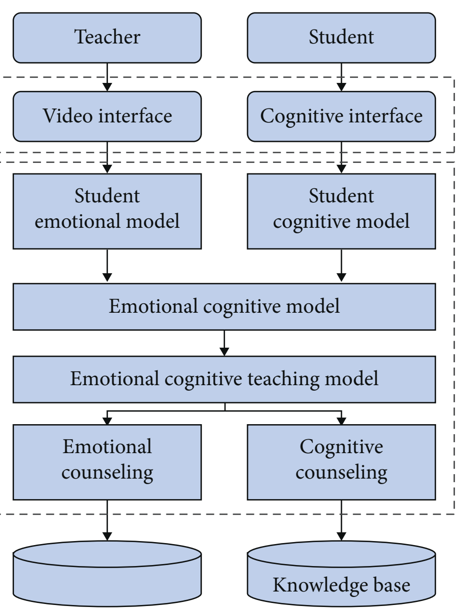


Figure 7: The intelligent teaching system of college English based on constructivism.

In the English teaching experiment, this paper evaluates the system performance through two sets of experiments. One group evaluates the English character recognition effect based on the improved optical machine vision algorithm, and the other group evaluates the student's emotion recognition effect. First of all, this paper conducts automatic character recognition in an English classroom. Through automatic English recognition, teaching content can be delivered to students promptly. This method is also convenient for teachers to obtain teaching resources promptly. Then, the English character recognition effect of the system constructed in this paper is evaluated. The outcomes are as shown in Table 1 and Figure 8.

From the abovementioned research, we can see that the intelligent teaching system of college English based on constructivism has a perfect result in English character

Table 1: Statistical table of the rating of the English character recognition effect of intelligent teaching system of college English based on constructivism.

Group	English recognition (%)
1	96.2
2	95.5
3	97.3
4	96.4
5	95.0
6	97.5
7	95.2
8	98.0
9	95.1
10	97.0
11	96.6
12	97.9
13	96.1
14	95.3
15	96.8
16	96.3
17	95.0
18	97.5
19	97.9
20	97.6
21	97.2
22	97.5
23	97.2
24	95.8
25	95.5
26	96.6
27	97.4
28	97.0
29	96.6
30	96.2
31	95.7
32	98.0
33	95.9
34	97.8
35	95.7
36	97.9
37	95.5
38	97.5
39	96.6
40	97.8
41	96.7
42	95.7
43	96.7
44	97.4
45	96.0
46	97.1
47	95.2
48	97.1
49	97.2
50	96.7
51	95.3
52	97.6
53	97.4
54	95.2
55	96.0
56	96.6
57	97.7
58	97.9
59	95.8

Table 1: Continued.

Group	English recognition (%)
60	95.1
61	97.7
62	95.3
63	95.6
64	96.9
65	97.5
66	97.9
67	96.3
68	96.8
69	95.6
70	95.7
71	97.0
72	95.4
73	96.7
74	95.7
75	95.1
76	95.9
77	95.2
78	96.0
79	97.4
80	97.3
81	95.5
82	96.1
83	95.3
84	97.2
85	97.0
86	97.5
87	97.2
88	96.8
89	97.5
90	97.2
91	97.2
92	96.6
93	95.6
94	95.9
95	96.3
96	97.4
97	95.1
98	96.5
99	95.4
100	97.8

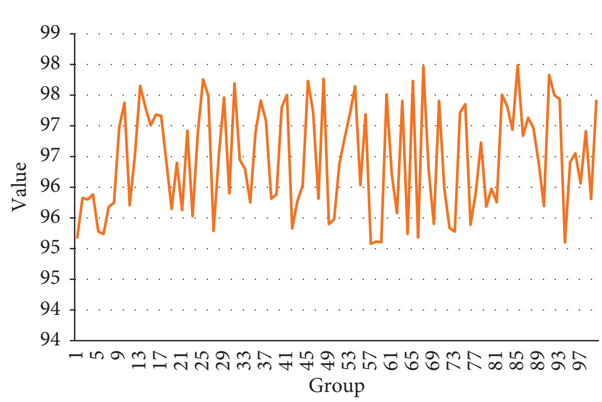


Figure 8: Statistical diagram of the rating of the English character recognition effect of intelligent teaching system of college English based on constructivism.

Table 2: Statistical table of the rating of student emotion recognition effect of intelligent teaching system of college English based on constructivism.

Group	Emotion recognition (%)
1	79.76
2	69.22
3	86.09
4	71.94
5	76.33
6	81.45
7	80.18
8	70.35
9	86.57
10	77.53
11	86.83
12	81.18
13	87.56
14	78.47
15	87.91
16	86.84
17	73.88
18	76.38
19	86.99
20	71.63
21	76.19
22	87.08
23	80.86
24	74.99
25	85.29
26	73.23
27	77.86
28	81.08
29	76.16
30	70.97
31	70.30
32	75.55
33	70.70
34	71.28
35	75.82
36	74.59
37	86.02
38	78.25
39	80.37
40	78.78
41	77.45
42	78.53
43	77.57
44	81.28
45	85.62
46	78.99
47	85.49
48	72.07
49	82.40
50	76.98
51	83.93
52	78.33
53	81.08
54	84.12
55	80.19
56	85.23
57	78.88
58	81.16
59	70.57

Table 2: Continued.

Group	Emotion recognition (%)
60	78.00
61	84.35
62	80.13
63	75.67
64	70.41
65	84.15
66	81.93
67	74.91
68	82.34
69	72.08
70	82.86
71	86.44
72	83.20
73	75.84
74	77.40
75	74.98
76	79.85
77	74.69
78	71.96
79	75.49
80	74.76
81	74.91
82	82.90
83	80.60
84	74.73
85	70.58
86	81.98
87	75.55
88	86.81
89	83.52
90	75.44
91	72.72
92	72.96
93	75.05
94	82.74
95	87.43
96	76.89
97	81.31
98	79.67
99	80.62
100	86.63

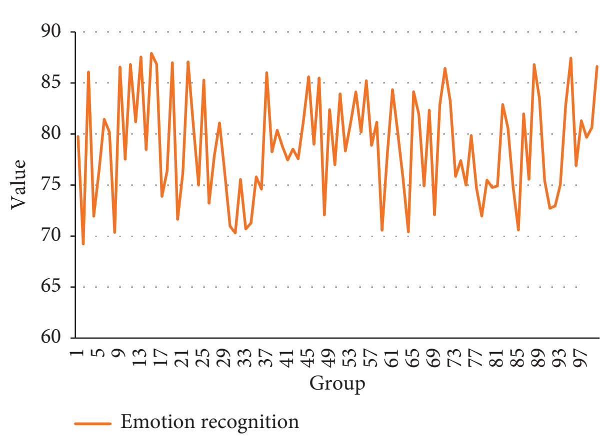


Figure 9: Statistical diagram of the rating of student emotion recognition effect of intelligent teaching system of college English based on constructivism.

recognition. On this basis, this paper further researches and analyzes the effect of the system on student emotion recognition. The outcomes are as shown in Table 2 and Figure 9.

From the abovementioned chart analysis, we can see that the intelligent teaching system of college English based on constructivism has an excellent result in student emotion recognition. The system meets demands, and the system constructed in this paper can be used for practical teaching in subsequent experimental teaching.

6. Conclusion

The current English teaching method is relatively single. The teaching process still uses the traditional teaching mode, so the teaching mode still has certain drawbacks. This paper uses computer-assisted technology in college English classrooms to construct an efficient teaching system based on constructivism. It can be used for college English teaching and conducts system performance analysis through experimental research. The proposed model is mainly used for font recognition in network teaching, so it needs to apply image recognition technology. Furthermore, the recognition process needs to be combined with optical technology for research.

Moreover, by improving machine vision, English characters can be effectively recognized in English classroom teaching, which allows teachers to collect and send teaching resources. It is convenient for students to take notes in time. In addition, this paper mainly starts with two aspects of English character recognition and student emotion recognition when constructing the system. First, this article uses video and image English character recognition to acquire and process teaching resources effectively. Second, it also uses emotion recognition to facilitate the real-time formulation of classroom teaching methods. It will help improve teaching efficiency and help students grasp English knowledge quickly and effectively. From the experimental research results, we can see that the method proposed in this paper has certain feasibility.

Data Availability

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

Conflicts of Interest

The author declares no conflicts of interest.

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