Improvement of Intelligent Computer Aided Chinese Teaching System

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Abstract. Starting from the case study of teaching, this paper analyzes and establishes the functional requirements and interactive requirements of the language process simulation system. Based on Box2D and Qt as the development framework, a language process simulation system based on real-time scene modeling was designed and developed. The system is mainly divided into four functional parts: scene modeling, scene management, motion simulation, and scene analysis. Among them, scene modeling allows users to use the components provided by the system to freely model scenes according to their own needs, with good interactivity; based on the JSON data format combined with a custom storage structure to achieve scene management functions such as saving and importing, not only It can avoid the repeated construction of commonly used scenes, and is conducive to the sharing of scene resources; the system completes the motion simulation of scenes by implementing the data transmission of calculations between Box2D and Qt; by performing stress analysis and instantaneously on designated components State analysis and other operations realize the system scene analysis function. This system has good interactivity and practicality and has certain application value in computer-assisted teaching.

Keywords: Intelligent computer-aided; language teaching system; Design and implementation
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1 INTRODUCTION

With the rapid development of computer technology and Internet technology, Internet has formed a scale, and Internet applications have diversified. The technology of Internet + is popularized in various industries such as industry, finance, medical care, people's livelihood, transportation, and

agriculture, and even becomes a necessary helper for people's work and life. There is no doubt that the network also involves the field of education and teaching [1]. The use of online teaching has become an overwhelming trend, and the most prominent feature of online teaching is globalization, sharing, and no restrictions on time, place, space, etc., providing students with a higher and better personality education. In many developed countries abroad, the development and popularization of online teaching have already had a large scale. Using the Internet to assist teaching has gradually become an indispensable teaching method between teachers and students. Especially in the United States, the first design of the CAI computer teaching system for elementary school students marked the beginning of computer-aided instruction. The world's first version of the computer multimedia-assisted teaching system is also from the United States, and is the product of the labor of "Illinois University Student Professionals" "PLATO". The teaching method is basically to answer the questions raised by the computer. Students can touch it when they answer. By 1994, the development of network technology became more and more mature, and the computer-aided teaching system developed by CO was widely used in auxiliary teaching in elementary and middle schools [2]. The upsurge of teaching, the application of computer-assisted teaching in higher education schools, has promoted the modernization of educational ideas and methods. Networking is a major advantage and feature of computer-assisted teaching in the United States. Today, "inorganic non-union" is precisely the use of the true portrayal of computer-aided instruction is also the country with the largest scale of online education today.

In the UK, Wang D due to the support of the government and all sectors of society, the application of the Internet to education is also at the forefront of the world, and it is better to promote the use of computers in teaching practice [3]. Zhu W issued a decree to take various measures to strengthen the guidance and training of educational computer knowledge and computer-assisted teaching in strong schools at all levels [4]. Yang Y not only has its mature online education applied in various schools but also the famous Liverpool University has extended online education to other countries [5]. As far as the web-based computer network-assisted teaching system is concerned, foreign countries started relatively early, and they are becoming more and more perfect and more and more efficient. They largely adapt to the development of social education [6]. Memon A R began to promote teachers 'online learning programs nationwide to improve teachers' ability to master online information and communication skills [7]. Min Z launched a nationwide Internet access plan so that primary and secondary schools across the country will use the Internet by 2002 [8]. The headquarters of the "European Learning Center" in the United Kingdom, through the formulation of unified online education planning and implementation rules, not only has the basic education networked but also achieved professional online training forms. Open University is the first distance education school to apply multimedia to teach. Currently, more than 60,000 students are studying online. Provide various levels of education (completion certificate or course certificate, graduation certificate, master's degree) through the network platform, covering almost all courses.

At present, the traditional teaching model is relatively adopted in teaching. Teachers use a piece of chalk, a blackboard, and courseware to teach. The teacher is the main body of the classroom, and the students are passively learning with the teacher. In this teaching model, some students can do it according to the gourd painting, while the other part of the students can no longer concentrate on the process of listening to the teacher, so this part of knowledge students ca n’t complete the tasks left by the teacher during the practice session. Over time, students' interest in learning is getting weaker and lower, resulting in the phenomenon that some students will be pulled down to the follow-up course. Such a long-term past has caused students to have no interest in learning. In-class time, they always do things that are not related to the content of the class and fail to pass the exam. Students cannot take the initiative to prepare before class, after-class homework and knowledge development are insufficient, resulting in unsatisfactory course learning. Therefore, with the help of Web technology and computer technology, the construction of the "network-assisted teaching" teaching model has become a supplement to the traditional

education model. It is precisely the practical teaching reform proposed adapting to the development of secondary vocational education.

2 ANALYSIS OF INTELLIGENT COMPUTER-AIDED TEACHING SYSTEM

2.1 System Requirements Analyses

The first task a system developer needs to do when designing a system is to analyze the needs of the system. Based on the design and implementation tasks for the Web-assisted teaching system, the three types of personnel involved are administrators, teachers, and student users. At the same time, the paper analyzes the feasibility, functionality, and non-functionality of the paper. Technical feasibility means that decision-making technology and decision-making technology cannot break through the boundaries of technical resource conditions owned by the organization or held by the relevant personnel [9, 10]. This system uses the JSP development environment and runs on the IE browser. The auxiliary teaching system includes administrators, teachers, and students. Mainly adopts B / S (browser/server) mode management system, including front desk web design, requires a friendly interface, simple and easy to operate. The background is mainly the establishment and maintenance of data, which requires clear storage and the highest security of data. The technologies of JSP, IE, B / S, and database are relatively mature. From a technical perspective, this system is feasible.

Currently equipped with advanced computer equipment, each computer can communicate with each other, and open the Internet to provide the most basic guarantee for the use of the system. The design and development of the system require a certain amount of capital investment. After the system is in normal use, the later use and maintenance are the responsibility of the school's network management teacher, and there is no need to invest capital. The design of this system should take into account the differences in the abilities of teachers of various majors, ages, and students of different majors in operating the computer. The system interface design is simple and easy to understand, and the human-computer interaction needs to be friendly and operable the rules. Each operator can log in to the IE browser and enter the corresponding content to complete their respective tasks. From the operational level, the design of the system is feasible. According to different functions and permission, users of the auxiliary teaching system are divided into three categories. The administrator is responsible for database maintenance and daily management. Teachers are responsible for uploading their courseware, video and other teaching resources, online question answering, homework correction, etc. Students can log in to the system according to their rights to achieve online learning, upload assignments, online exams, etc. Administrators, teachers, and students each have their tasks. The roles and tasks are shown in Table 1.

Roles	Features
Administrator	Responsible for adding teacher users, adding departments, assigning user rights, database maintenance and management, and daily maintenance of the system
Teacher	Responsible for adding students, uploading teaching resources, posting assignments, online Q & A, online testing, posting results and notification
Student	Online self-study, upload assignments, online exams, score query, online communication with teachers, query notification
Use case classification	The main function
Administrator use case diagram	It mainly describes the main contents of administrator login, teacher information management, department information management, and so on.

Teacher use case diagram	It mainly describes the main contents of teacher login, teaching resources, homework management, online question answering, online testing, test question bank management, and grade management.
Student use case diagram	It mainly describes the main contents of student login, online learning, homework upload, online exam, communication with teachers, and query of results.

Table 1: Role of auxiliary teaching system.

Based on the analysis of the auxiliary teaching system, the three types of personnel using the system are administrator users, teacher users, and student users. Use case diagrams to analyze the needs of the three types of personnel are shown in Table 1 and Figure 1.

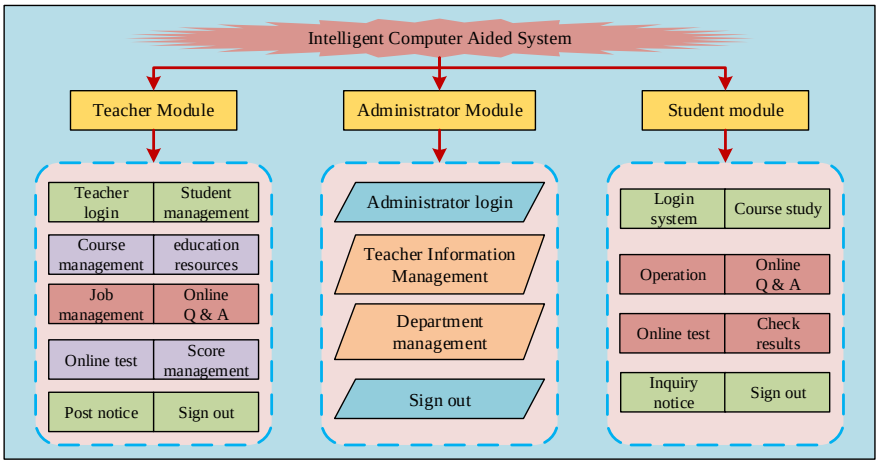

Figure 1: System use case diagram.

The design goal of this system is to assist students in learning and provide students with a diverse learning platform. The design principle of the system lies in its reliability, practicality, and easy maintenance. Realize online learning function: students use the system to study in their spare time, and the learning methods are multi-styled with teaching resources such as lesson plans, courseware, micro-classes, videos, and excellent cases. Achieve online homework function: students use the system to complete homework efficiently in their spare time. Realize online test functions: students use the system to test in their spare time. Realize online question-answering function: students encounter problems, first, find the answer from the pushed questions, and then learn to find the answers to the questions. If you cannot find it, ask the teacher again and wait for the teacher's reply. Realize the achievement management function: After the test is completed, the teacher will feedback on the achievements of the students in time and evaluate the students, so that the students can understand their learning status. (2) The design principles of the auxiliary teaching system, such as scalability, management, and security, are the key factors. The design should be from the following aspects: standardized design principles, safety design principles, advanced design principles, open design Principles, reliability design principles, practical design principles, and easy maintenance design principles.

2.2 Analysis of System Design

After the system carries out scene modeling and completes the assignment of component attributes, it is possible to simulate and demonstrate the learning process. Before performing the system motion simulation demonstration, the system will determine whether the system will perform the simulation motion for the first time to facilitate the resetting of the scene later. Then conduct a movement simulation. In the process of movement simulation, you can select the pause button to stop the simulated movement, to observe the instantaneous situation of some movement. After the motion simulation is over, if you want to perform the motion simulation again, by clicking the restore button, the system will re-read and load the scene data from the scene data objects in the memory. By analyzing the needs of a language process simulation system based on real-time scene modeling, this paper takes the entire system according to the software architecture "4 + 1" view method as a guide method for architecture design. This method provides design decisions for different architectural designs through different architectural views, including five views: logical view, process view, view, development view, and scenic view. This article divides the system into three levels, namely the application layer, the communication layer, and the motion simulation layer. The system architecture is shown in Figure 2.

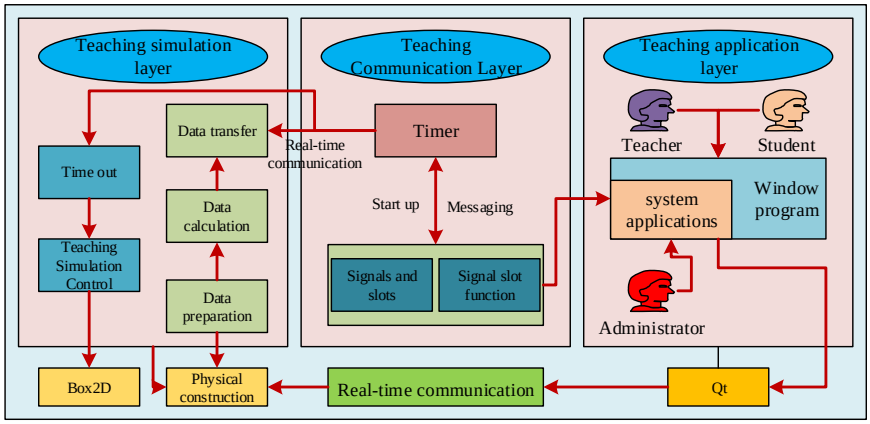

Figure 2: System architecture diagram.

The application layer is responsible for the display of the motion state of the motion simulation and provides an attribute bar for users to send component attribute parameter change signals, and the operation bar sends execution command signals. The application layer and the motion simulation layer transfer data through the communication layer, but the application layer is not responsible for the specific implementation of the communication layer. In the design of the motion simulation layer, by using time interruption to process the corresponding logic of motion simulation playback, the function of simulation playback control is achieved. Under the timer message mechanism of the communication layer, the attribute data of the component calculated by the engine layer is transferred to the component in real-time. In the calculation of similarity, this paper uses a similarity calculation method based on word matching position. The algorithm first uses A = "A_1, A_2...A_m" and B = "B_1, B_2...B_n" to represent sentences containing m and n-words, respectively. Since the similarity depends on the position of the same word in two sentences, first define the position set of the i-th word in A and the matching word in B is:

$$D(A,i,B)=\left\{k\left|B_k=A_i,k=0,1,....m-1\right.\right\} \quad (1)$$

Matching words do not exist. Then D (A, i, B) is an empty set. Also. The minimum assigned offset value for a person is:

$$D(A,i,B)=\begin{cases}\min\left\{\left|k-i\right|\right\} \\ n\end{cases} \tag{2}$$

The matching contribution value of the definition word DD is:

$$DD(A,i,B)=\left[n-d(a,i,b)\right]/n \tag{3}$$

Define the similarity between sentence A and sentence B is:

$$GH(A,i,B)=\sum_{i=1}^{m}DD(A,i,B)\Big/m \tag{4}$$

Finally, the similarity calculation formula for two sentences is obtained:

$$K(A,B)=1-\frac{edit(i,j)}{\max(i,j)} \tag{5}$$

The collaborative filtering push algorithm is based on the given questions and is divided into a user-based collaborative filtering algorithm, item-based collaborative filtering algorithm, and model-based collaborative filtering algorithm. The collaborative filtering algorithm can use various information about users, and the recommendation result is accurate and reliable, but it requires a lot of data. If the amount of data is small, the degree of similarity is not accurate enough, resulting in insufficient accuracy of the content being pushed. At the same time, the collaborative filtering push algorithm cannot avoid the problem of a cold start. The content-based push algorithm pushes this product or a similar product to the user based on the characteristics of the product that the user once liked. Create a document based on existing historical information and mining information. The document is stored in the form of keywords. After excluding useless words based on the number of keyword repetitions, the weights are set and the cosine similarity is calculated. Based on the content push algorithm to avoid the problem of a cold start.

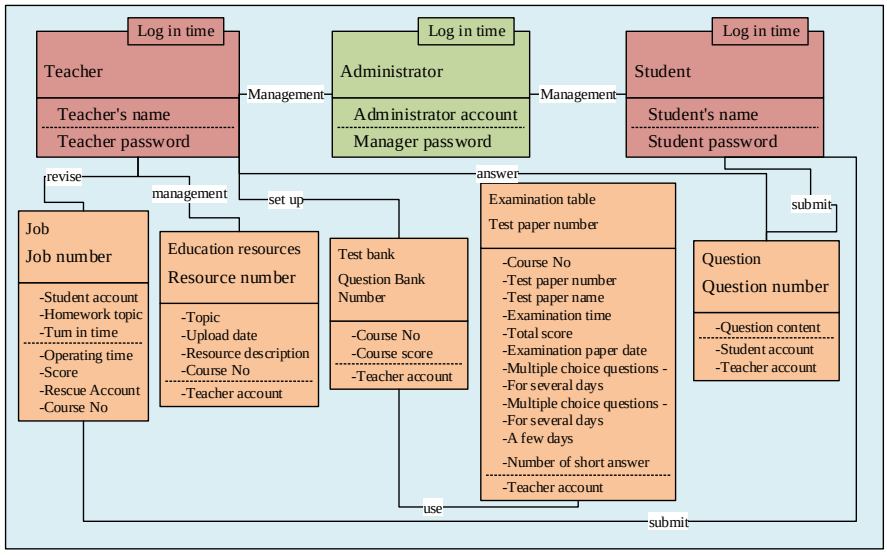

Figure 3: Data system model.

Assuming that the user makes two judgments about the product likes and dislikes, and these products already have corresponding vectored representations, then this is the user's profile, which is expressed by formula (6).

$$P = \frac{\sum_{i=1}^{a} x_1 + x_2 + .. + x_a}{a} \tag{6}$$

Where x is the product that the user likes, a is the total number of products that the user likes, y is the product that the user does not like, and b is the total number of products that do not like it. Get another user matrix, as shown in Table 2.

Id/Feature	F1	F2	F3	...	Fn
Id1	0.02	1	0.03	...	0
Id2	0.02	0	0.005	...	1
Id3	0.2	1	0.7	...	0
...	...	...	...	...	...
_Id4	0.02	1	0.05	...	1

Table 2: Matrix table.

According to the requirements of the auxiliary teaching system, the entity has an administrator entity, a teacher entity, a student entity, a resource library entity, a question library entity, a test question entity, a grading entity, and a course entity. The relationship between data needs to determine the relationship between entities. There are three types of data relationships: one-to-one, one-to-many, and many-to-many. The data relationship of the auxiliary teaching system is shown in Figure 3.

3 RESULTS ANALYSIS

3.1 Computer Skills Analyses of Teachers

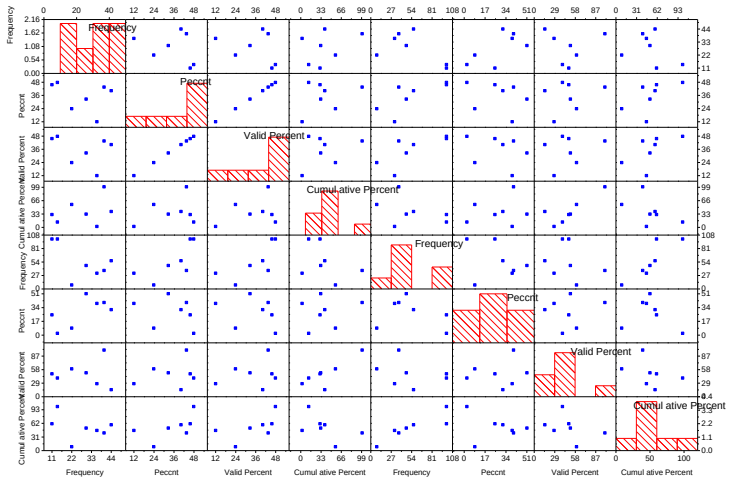

Figure 4: Computer skills analysis of teachers.

As can be seen from Figure 4, from the perspective of "applications", the proportion of selecting "basic" is 48.9%, the proportion of selecting "intermediate" is 42.4%, and the proportion of selecting "proficient" is 8.7%; from the perspective of word (word) processing, The ratio of "basic" is relatively high, the ratio is 45.7%, the ratio of "intermediate" is 39.1%, the ratio of "proficient" is 15.2%; the ratio of "basic" in the "spreadsheet" is 47.8% The ratio of "intermediate" is 40.2%, and the ratio of "proficient" is 15.2%; from the "report", most teachers are at the "basic" level, the ratio is 45.7%. Another 39.1% of teachers are at the intermediate level and 13% are "proficient". In the "Internet Search Engine" section, 43.5% of teachers are at the "intermediate" level, the ratio of "basic" is 32.6%, and the ratio of "proficient" is 23.9%; in the "communication" section, select "intermediate" The ratio of " is 43.5%, the ratio of the basic level is 31.5%, and the proportion of computer level is "proficient" is 25%; The proportion of "proficient" is 16.3%; from the perspective of web design, most teachers are "basic" with a proportion of 43.5%. 35.9% of teachers do not know web design, and only 5.4% of teachers are at the "proficient" level; in the "database" section, more than 50% of teachers are at the "basic" level, and 20.7% of teachers will not make a database.

However, in the generally readable evaluation with a high score, the ability radar score (average 6.85) is far lower than other components, as shown in Figure 5. Five interview participants expressed similar views on their learners in the questionnaire survey do understand the effective lifetime scale and cannot resonate with the information presented in. Radar charts are indeed suitable for demonstrating multi-dimensional learning capabilities, and the moderately high score (average 3.88) in the usability evaluation also proves this.

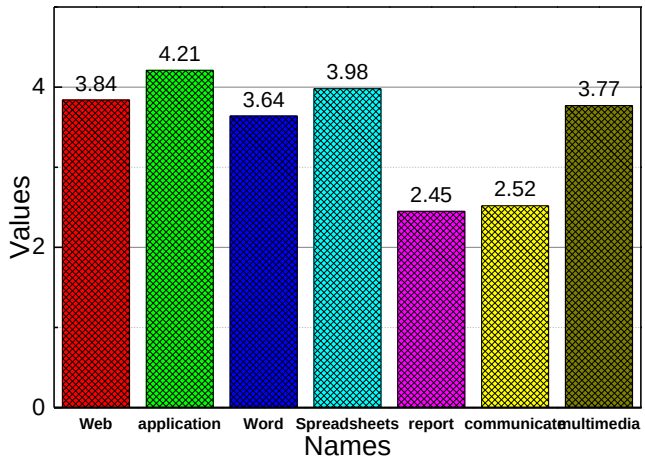

Figure 5: Histogram of scores driven by teaching components.

The overall driving score is low, and only the login status (mean 4.21) is outstanding. Respondent student B believes that the learning analysis suggestions given in this language are the easiest to implement, and the impact on learning effectiveness is almost immediate. Among the low-level components, especially in terms of homework (work) changes, learning plan adjustments, and social performance, the learner showed a willingness to change far below the level of understanding. Combined with the description of the interviewee student D in the interview, the three-component content very clearly shows the corresponding online learning activities, but most learners "liberated themselves" after completing the course tests and assignments, so this information "doesn't help" their learning. This lack of retrospective learning habits is manifested in the traditional physical classroom learning, and it is naturally more obvious in the online learning environment with weaker discipline.

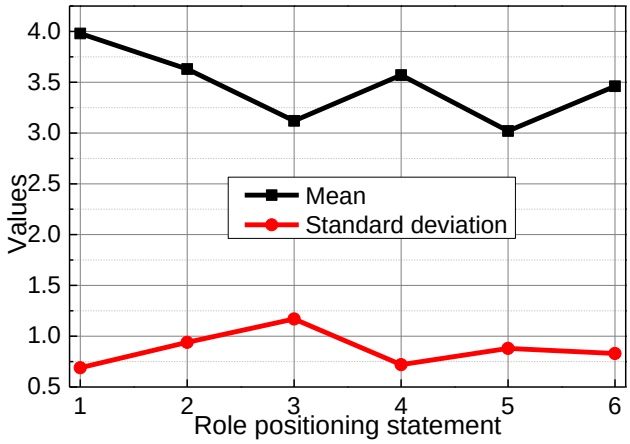

Figure 6: Learning role positioning score.

As shown in Figure 6, in the investigation of the role of learning, learners tend to have ambiguous answers (average 3.46, close to the median of 3). This means that although it is easy for learners to understand the visual content of learning. It is difficult to connect this information with learning changes. Therefore, the author believes that learning still needs to be strengthened in assisting positioning and driving forces.

3.2 System Performance Analyses

As showed in Figure 7, the function of opening a new course and designing the course id on the teacher's end is shown. Certified teachers can add a new course, start the teaching of new courses, and add related question banks. Figure 7 shows a graph of the visits of Cloud platform from September to October, where PV is the number of application requests, UV is the independent visitor, and all visits of the same IP within ten minutes are regarded as an independent visit, Because the request through curl is a header without cookies, so in the statistical chart of the cloud platform, the URL of the same IP source for multiple requests will be calculated multiple times, you can see that the average value is almost five thousand more than one day, the highest The value was around 13,000 on September 20, and was slightly lower during the National Day holiday.

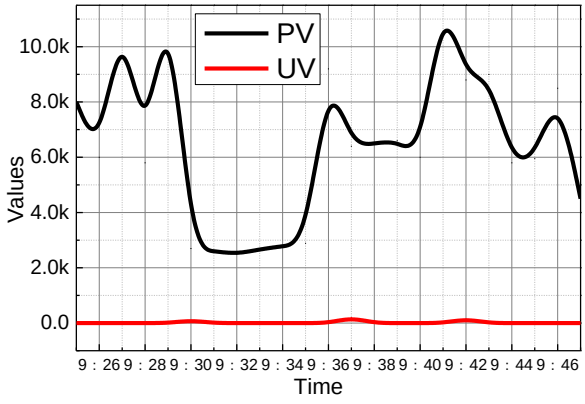

Figure 7: System platform traffic statistics.

The method of data filtering is mainly for data with missing values and noise, by filling in the missing values, smoothing the noise data, or deleting these missing values, noise data, etc., to solve these "bad" data, because these data will be experimental The result is an uncontrollable impact.

In the real world, the ways to obtain information are diverse, and the data obtained will have null values or data vacancies caused by various reasons. For null values or vacant data, the processing methods mainly include deleting variables, statistics filling the method and dummy variable filling. For those with high missing rate and low importance of the variable, you can consider deleting the variable directly to ensure the integrity of the entire data set; for missing data with low missing rate and low importance, you can according to the data distribution To fill in the data, you can use the average method, median method, etc. to fill in the vacancy value, because the importance of the variable is low, the impact on the entire data set is small, but you can't do without the data, you can Consider using random interpolation, multiple difference, Varangian interpolation, Newton interpolation. You can also use model filling methods, such as Bayesian, random forest, and decision tree models. The processing of noise mainly includes binning operation and equal frequency. Noise is the difference between the observation point and the real point. After binning or equal frequency operation, the average or median or boundary value of each box is used. Instead of all the values in the box, smoothing is performed.

As shown in Figure 8, it is the null value and outlier processing in data processing, which are two cases that are more processed in this experiment. It will lead to inaccurate experimental results, so all such anomalies should be eliminated during data preprocessing.

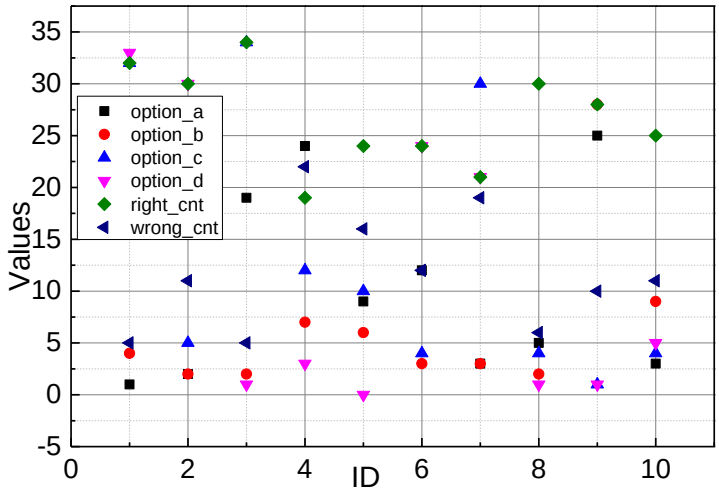

Figure 8: Null and outlier handling.

To verify the effectiveness and accuracy of the algorithm, this paper first calculates the student's knowledge point score rate matrix, and on this basis, derives the evaluation indicators recommended by the exercises based on the knowledge graph. Finally, according to the test set, the exercise recommendation algorithm proposed in this paper is compared with the traditional content-based recommendation method, collaborative filtering algorithm, and probability matrix decomposition algorithm, and it is found that the exercise recommendation algorithm in this paper recommends better performance.

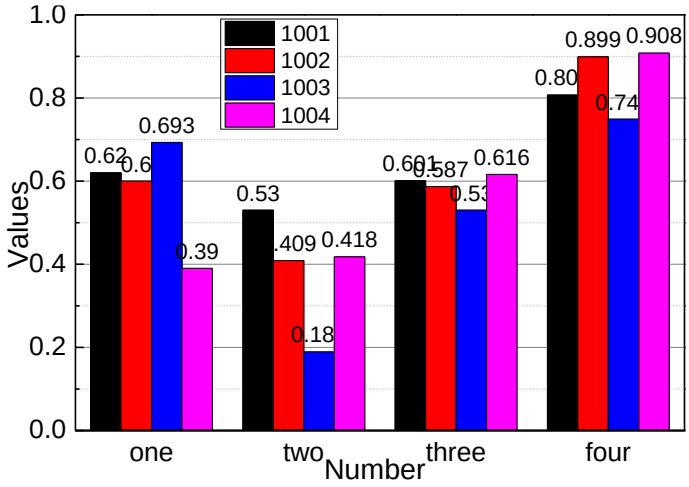

Figure 9: Sequence of scores of knowledge points of some students.

As shown in the part of the student knowledge point score rate sequence in Figure 9, four student knowledge point score rate sequences are shown, including the original student knowledge point score rate and the knowledge point score rate sequence after the knowledge point importance ranking algorithm is added Compared with the original scoring rate series, the gap between the score points of students 'knowledge points on different topics is reduced, and compared with other knowledge points, some of the four knowledge points in the scoring rate series of students' knowledge points 1001-1004 have a strong The relevance of is in the same level relationship, so the same student's score rate at different knowledge points is not very different. From the perspective of different students, the scoring rate is almost different, and the gap is large.

As shown in the comparison of the four algorithms in Figure 10, it is a comparison of the experimental results of the problem recommendation algorithm based on the knowledge graph and the above three algorithms in this paper.

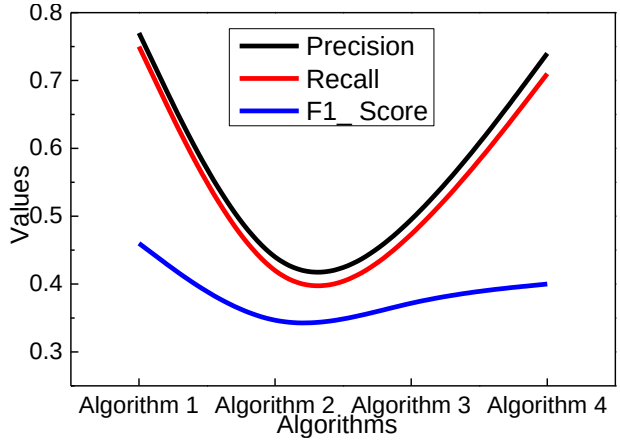

Figure 10: Comparison of four algorithms.

By using the system, users can build different application scenarios in the system according to their need for learning knowledge. Among them, after being assigned to different attributes, the

components (objects) in the scene can be used to simulate the movement according to the actual situation. This direct and dynamic way to show users movement simulation is difficult to achieve with traditional learning methods based solely on personal space imagination or manuscript drawing. Through this system, it is hoped that it can be used to give full play to the advantages of computer-assisted teaching and help the majority of learners to understand some knowledge more vividly.

4 CONCLUSION

This paper completes the design and implementation of a -language process simulation system based on intelligent computer-aided real-time scene modeling. However, due to the lack of personal research on language-related knowledge and the limitation of research time, there are still some problems that need to be further resolved. Part of the work can still have a lot of room for improvement, and the discussion can be continued in the following aspects: The design of this paper to realize the simulation function of the learning process is mainly based on dynamics and kinematics, but the research scope of subjects is far beyond Here, we can further improve the research field of moving objects supported by the system. Although most of the scenes of the current system in motion simulation show good, for some complex motion scenes, there are still situations where the error of simulation is improved. The system is further optimized through the more comprehensive use of the engine and the optimization of simulated objects. Performance and usability improvements will be of great significance. The current system is still limited to the automatic calculation of objects such as force analysis and transient state during motion simulation. The system's intelligent solution function needs to be further improved.

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