A Study of Intelligent Paper Grouping Model for Adult Higher Education Based on Random Matrix

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1. Introduction

“Internet Education” has not only changed the process of traditional teachers’ teaching and students’ learning but also changed the way of education management and decision making. At present, the application of the online paper composition and practice system has become a hot research topic in teaching innovation under the background of “Internet Education.” With the help of such a system, teachers can quickly generate objective and reliable test papers with comprehensive knowledge coverage and difficulty to meet the requirements for online practice [1]. The traditional paper composition work is mainly based on teachers’ manual selection of questions, so the scope and difficulty of the test papers are limited by the level of the teachers, and teachers need to spend more time and effort to compose a more reasonable test paper. The online practice system based on intelligent paper composition deeply integrates information technology with teaching practice [2]. The system can help teachers quickly generate objective and credible test papers with comprehensive knowledge coverage and the required difficulty. In addition, teachers can
adjust the teaching pace according to the feedback of students’ practice results from the online practice function and realize the teaching concept of “graded practice” and “teaching according to student’s ability.” The code should be effectively operated and controlled, and the conceptual model should be obtained through the conceptual design of the system database. At present, the automatic test system is gradually formed and developed by combining various advanced theories, the most important one being artificial intelligence theory, in addition to various educational measurement theories and so on [3]. The combination of the above theories has formed the most advanced examination system at present. With the update of education concepts and the common application of computer network technology, the automatic, secure, and standardized system is also the development trend of the education system.

Today’s vocational education has changed from simply attaching importance to the cultivation of students’ practical operation ability to the form of combining operational ability with job requirements and refining theoretical knowledge enough for use. Course assessment is a traditional and feasible way to test the teaching effect, and many higher vocational institutions have formed a set of scientific and perfect assessment systems to test students’ operational ability [4]. However, they are not widely promoted and implemented because of the problems such as unsound test database, less scientific and reasonable test question extraction, single test paper implementation, cumbersome test procedure, and difficult management and maintenance. The combination of information technology and computer hardware is used to complete the test question database, and the selection of topics from the database is realized through artificial intelligence technology. This method avoids manual intervention, and reflects students’ real learning ability more efficiently, objectively, and accurately [5]. It is important and far-reaching for our educational institutions to improve the testing ability in teaching quality. The core theory of the intelligent scoring system is based on the quantification of educational measurement indicators and the statistical analysis of students’ ability levels. Therefore, the intelligent grouping system has strong advantages. The key to the realization of the intelligent group paper lies in the group paper algorithm that realizes the automatic extraction of test questions, and the intelligent group paper algorithm as the core directly affects the quality of the test paper.

In the past tests, teachers tested their teaching quality by asking questions to students themselves, which would lead to test results close to the ideal state of teachers, and cannot objectively reflect students’ learning effect. Therefore, the traditional way of appointing examination papers can no longer meet the needs of today’s high-speed development and needs to be improved, while the current examination system still suffers from more defects in the test bank, the test questions are not extracted according to the standard, and the final generated test papers are not reasonable. In response to the above problems, computer tools are introduced for assistance, and intelligent paper-forming algorithms are used to design online examination systems. The application of computer technology will greatly reduce the workload of classroom teachers, allowing them to have more time to think about how to teach and improve their work efficiency and use computerized question answering to achieve a paperless examination format, which in turn saves human and financial resources.

1.1. Related Works. The U.S. Educational Testing Service (ETS), for example, is one of the largest testing organizations in the world and has been moving to computerized testing since the 1990s by reducing the number of paper-based exams, especially after ETS reformed the TOEFL into the iBT, a measure that directly accelerated its use of the Internet for uniform marking scoring [6]. Many experts and scholars at home and abroad have conducted a lot of research in this field, and the core of the design of an intelligent system based on computer information technology is how to achieve an efficient and high-quality question set. Because the design of the question bank affects the speed of the algorithm accessing the database, to quickly find the test questions that meet the constraints and reduce the waste of resources caused by searching for the test questions, a table with different contents is established for different question types to store the respective question types. Although the problem of question assignment has been one of the hot topics of online examination system research, there are still many problems that remain to be solved. In the literature [7], after a detailed analysis and study of heuristic paper grouping algorithms, a new heuristic parity genetic paper grouping algorithm is proposed using automatic paper grouping and an optimized model of it, and a new heuristic parity genetic paper grouping algorithm is designed by introducing a random selection operation, a crossover operation of odd and even bits or a mutation operation, combined with the business structure of automatic paper grouping [8]. The algorithm is implemented to effectively avoid problems such as premature convergence in genetic algorithms.

In the literature [9], it is pointed out that most existing intelligent grouping rolls use a single algorithm, and each algorithm has its drawbacks, and a hybrid intelligent grouping roll algorithm combining the advantages of artificial fish swarm algorithm and genetic algorithm is proposed to address this drawback. At the beginning of intelligent grouping, the artificial fish swarm algorithm is used to quickly approach the grouping target, and in the process of grouping, the genetic algorithm is used to jump the artificial fish individuals when the optimal individuals do not change in several consecutive iterations or change very little to improve the convergence speed [10]. It was demonstrated through simulations that this hybrid intelligence algorithm can effectively optimize the effectiveness of a single algorithm alone for the intelligent grouping of rolls among them. In the literature [10], to preferentially satisfy the constraints of question type and corresponding question data, genetic algorithms are used to solve the problem of question selection strategy, integrate the difficulty of questions and knowledge coverage as its optimal constraints, and construct the weight adaptation function to complete the control scheme for effectively evaluating the quality of test
papers. Zuckerman studied the traditional particle swarm algorithm and improved the algorithm, pointing out that the traditional particle swarm algorithm converges slowly in the late stage and is easy to fall into the local optimum affecting the algorithm efficiency problem, and proposed a scheme to improve efficiency by using genetic algorithm cross variation, and the experimental results meet the requirements [11]. Kong realized the intelligent grouping method of the genetic algorithm through the study of grouping theory as well as analysis, compared the advantages and disadvantages of coding methods, used the segmented coding method, and improved the online grouping system by using the dynamic parameter adaptive method and elite retention method for the phenomenon of easy premature convergence in the genetic algorithm [12].

In this paper, on the premise of the analysis of the artificial fish swarm algorithm, the basic process and behaviour of the artificial fish in the grouping system, etc. are designed, and the implementation of the artificial fish swarm algorithm is based on the programming language is carried out, making it possible to apply it to an intelligent grouping of papers. Through class diagram and timing diagram, the system management, question bank management, test paper management, and module detailed design are completed. Through question bank management, the delineation of alternative question types, covered knowledge points, and difficulty is realized, and through test paper management, the preparation of test papers and the management of test papers after assembling are completed. The implementation of the function can be set according to the basic requirements of the user, and the system will display the corresponding prompt information every time an operation is performed. Finally, the detailed design of the artificial fish swarm algorithm used in the test paper management module is carried out. After analyzing the basic idea of intelligent paper grouping, the overall design of intelligent paper grouping algorithm based on artificial fish swarm is completed by using artificial fish swarm algorithm to describe the process of condition initialization, fitness calculation, chasing activity, clustering activity, foraging activity, etc. The algorithm is compared with other grouping algorithms, which proves the superiority of the artificial fish swarm-based intelligent grouping algorithm.

1.2. Genetic Algorithm Fusion Random Matrix Design. In this paper, a genetic algorithm is used to solve the core of the encoding scheme of the group paper problem depends on the characteristics of the application problem itself, the encoding scheme will directly affect the performance of the algorithm itself, and the common encoding methods are binary, decimal, and real numbers three types of encoding methods [13]. To realize the process of assembling papers, we need to establish separate tables for all question types in the process of building the database. In this paper, we use a segmented real number coding scheme to design real number coding independently according to different question types, and the question types and coding are accessed by mapping. In the genetic algorithm, each set of test papers is mapped as a separate chromosome, while each question in the test papers is mapped as a gene, and the value of the gene is represented by the question number of the test questions.

At the beginning of the initial population data generation in the consideration of obtaining higher quality test papers, the completely random method is abandoned, and the attribute fields based on the proposition blueprint are used as constraints to achieve the convergence speed of the genetic algorithm and reduce the number of iterations during its operation, a good set of test papers needs to guarantee the uniqueness of the knowledge points encoded in all genes of each chromosome, and since different question types come from independent question lists, it is normal to have identical test numbers in the same gene strings, mainly because these test questions come from different question types [14]. The real number encoding based on the grouping approach effectively overcomes the defects of too large search space and too long encoding structure, allows the decoding time of individuals to be effectively controlled, and improves its speed for problem-solving.

In this paper, a roulette wheel selection method is used, and the selection operator value is simply based on the quality of an individual to decide whether it will be either eliminated or copied in the next generation. Through the selection process, the chances of survival of those individuals with higher fitness are improved. The higher the survival rate, the higher the survival rate. The roulette wheel selection method is one of the classical selection methods currently used in genetic algorithms. This selection method needs to focus on the following two aspects, one is the fitness information must be nonnegative; the second execution of the optimization process of the current objective function and the population evolution process must be consistent with the direction of change in the fitness function.

The intelligent grouping problem itself belongs to a kind of problem where multiple conditions are mutually constrained and optimized for improvement, which is the combination of the objective function and the constraints we often mention. Here, we need to set separate parameters for each question, including chapter, question type, difficulty factor threshold, differentiation threshold, maximum response time, and full score value. The composition of the test paper is based on a fixed number of questions taken from the question bank [15]. All questions have six attributes that determine the composition of the matrix S-value formula. A range is generated, within which a random selection is made. The purpose of this is because the level of the teacher or the team’s questions is basically fixed, or the level of the teacher’s questions is fixed for a period.

\[
S = \begin{bmatrix}
    a_{11} & \ldots & a_{1n}
    \\
    \vdots & \ddots & \vdots
    \\
    a_{m1} & \ldots & a_{mn}
\end{bmatrix}
\]

(1)

The elements in matrix $S$ meet the requirements of the user-specified blueprint for the composition of the paper. Here, the requirements for the composition of the paper are
mainly reflected in the six dimensions of the number of questions, the distribution of knowledge points in each chapter, the proportion of the score of the question type, the proportion of the difficulty of the question type, the proportion of the difficulty of differentiation, the total score of the paper, and the maximum response time of the questions. Here, we use $F$ to indicate the error value of the whole paper index with the six dimensions and the demand of the two, and the six dimensions account for the difference, so the formula for setting the whole paper index $F$ is

$$P = \sum F_i \times W_i^2. \quad (2)$$

Stiletto transform is like Fourier transform in classical probability theory and signal processing. Fourier transform can be performed in the frequency domain than the time domain for easier analysis, and usually, the spectrum analysis of a large dimensional random matrix is achieved by Stilettoes transform, where the spectrum is the eigenvalue distribution of the matrix.

$$S_F(t) = \int \frac{1}{1 + z} fF(t^2). \quad (3)$$

Assuming that $y$ is an $N$-dimensional random variable with zero mean and a covariance matrix of $T$, 1, $y_i$ is the $n$th independent realization of $T$.

$$\left| \frac{1}{n} \sum_{i=1}^{n} y_iy_j^H + T \right| \longrightarrow 1. \quad (4)$$

At present, there are many methods to calculate the degree of differentiation, commonly used is the high and low-end grouping analysis method; that is, after sorting by the high and low grades of students, a certain percentage of the grades from the front and back are taken as high and low groups, and the mean scores of high and low groups are calculated separately and expressed by $X_h, X_l$, respectively, and the total score of the test paper is expressed by $N$. Then, the estimation method of the degree of differentiation $D$ is shown in the following formula:

$$D = \frac{X_h + X_l}{N}. \quad (5)$$

The validity of a test paper is the magnitude of the agreement between the generated test paper and the expected standard [16]. A prerequisite for ensuring the validity of a test paper is that the question generator follows the syllabus strictly and that the distribution of test scores is generally consistent with the credit hours taught in the test. The validity of a test paper is a quantitative value, which is commonly estimated as in equation (6). When the size of the population is smaller, its average fitness is smaller, which will cause the genetic algorithm to fall into a local solution.

$$r = \frac{\sum_{i=1}^{n} (X_i + X) (Y_i + Y)}{n S_x S_y}. \quad (6)$$

The reliability of a test paper refers to the credibility of the test scores. The actual score obtained by the student through the examination has two parts: one part is the real score obtained by the student by his or her real ability; the other part is the error caused by external factors such as the difficulty of the test questions and examination skills. In general, the true variance can be measured indirectly by estimating the scores of the questions in the test paper, and the sum of the true variance and the error variance can be used as the score variance.

Since the standard genetic algorithm uses a fixed cross-variance probability, the consequence is that the better individuals in the population may be destroyed, and thus, the population diversity is reduced, and it is easy to fall into local solutions, and it is not good enough to get out of the local area and get the optimal solution of the problem. The NCAGA algorithm uses the optimized dynamic cross-variance probability to increase the diversity of the population to a certain extent, while the small habitat technique eliminates the poor individuals in the population, which can ensure the diversity of individuals in the population and avoid falling into the local solution, which improves the global convergence of the algorithm and helps to get the global optimal solution. Therefore, the NCAGA algorithm has high global convergence [17].

The functional performance layer is used to realize the functions of the system, and the design of functions is used to realize the operation of each function of the system, including the operation interface of each module. Since this system is based on the general data business management platform, it needs to be completed on the main operation interface when test questions and test papers are queried and maintained, and the system adopts the classic top, left, and the right style, with all the main operating functions completed in the right part and the left part is the system function Menu area, as shown in Figure 1.

The knowledge points covered by a certain test question are set when the teacher prepares the test question. The most fundamental reason is that when the population size is small, the individual lacks diversity, resulting in the narrowing of the search ability of the algorithm. After a certain test question is prepared, the knowledge points covered by this test question are listed, and these are set by the subject teachers according to the subject knowledge points. In practice, often according to the knowledge points, teachers prepare the questions. A set of higher-quality test papers should cover all the leaf knowledge points within the scope of the examination as far as possible, and the knowledge coverage index is set by the teacher when the paper is assembled.

In genetic algorithms, the goodness of individuals in a population is usually measured by the fitness function value, and the main reference data for the algorithm to optimize the solution of the problem being solved are also the fitness function value. The design of a fitness function in a genetic algorithm generally maps the objective function of the problem to the fitness function, and a good fitness function can directly reflect the goodness of individuals in the population.

The variation operator can provide new individuals for the genetic algorithm, which increases the diversity of the
population and can prevent the algorithm search from falling into local optimal solutions to a certain extent. In the process of using the intelligent volume system, log files are extremely important. However, too large a variation probability may destroy well-adapted individuals and cause the algorithm’s search to slow down, so the variation operation should be performed moderately. In this paper, we use dynamic variation probability to obtain the variation probability of individuals by Equation (6). Combined with the group paper problem to illustrate the specific operation of crossover, its variation method uses a single point segment within the crossover variation, the basic process is randomly select a variation point, and for this point in the interval 0, 1 randomly generate a number, find the question type corresponding to this position in the question bank, and randomly draw a question number, and judge whether the new question number is the same as the question number of the variation point, if the question number is different than replace, and vice versa, redraw.

1.3. Construction of Intelligent Paper-Forming Model for Adult Higher Education. The rapid development and rapid popularization of the Internet have improved the level of the paper-forming system in all aspects [18]. The database is more meticulous and complex in terms of design concept and structure, and the design of the system database needs to follow several key points. The data in the database is relatively simple. To ensure the rationality of the database and the reasonable storage of the information module, the code should be effectively operated and controlled. The system uses relational tables to design the database, but the threat to the network increases. After the conceptual design of the system database is completed, the conceptual design results can be transformed into database tables.

The new proposition blueprint interface implements Excel-like real-time statistics and clicks for editing. It also supports the setting of different subtitle scores for the same question type. The blueprints can also be reviewed and approved before they can be used for intelligent paper formation. Paper strategy refers to the parameters of knowledge structure level, question type, question weighting, question order, question quantity, difficulty level, etc. of the test paper to be generated [19]. The group paper strategy can be saved, applied, and modified, and multiple sets of papers can be generated simultaneously using one strategy, and only group paper strategy management can be performed without grouping papers.

Common coding schemes are binary coding, real number coding, etc. The intelligent paper set extracts test questions from the question database, and the extraction of test questions depends on the structural relationship of the data in the question database table, and whether the test questions are stored reasonably in the database plays a crucial role in the access speed of the test questions [20]. In this paper, the method of adaptive adjustment of crossover probability and mutation probability is used to improve the algorithm, and satisfactory results are obtained. Because the design of the question bank affects the speed of the algorithm to access the database, quickly find the test questions that meet the constraints, and reduce the waste of resources caused by finding the test questions, different tables with different contents are created for different question types to store the test questions of the respective question types. For the different tables, this paper uses group coding in the coding design, and each question type has an independent grouping to encode the real numbers, and the auto-growing number is used as the coding of the questions, and the numbering of each question type starts from 1 by default. The genetic algorithm operates by considering each question
type as an independent chromosome, the test questions in the question type as individual genes, and the value of the genes is the question number, as shown in Figure 2.

The most important module of the student subsystem is the online practice module, where students complete the practice tasks issued by the teacher online. In addition, there is a personal practice statistics module, which provides statistical analysis of students' knowledge proficiency based on the data of single or multiple practice sessions. The error book module provides students with an accumulation of errors from previous exercises and provides students with intensive practice on key errors. Therefore, the scope and difficulty of the test paper are limited by the level of the teacher who created the question, and the teacher needs to spend more time and energy to form a more reasonable test paper.

After testing the system, the testers found that it meets the basic requirements of the current system development and users [21]. The structure of the system is reasonable, the system functions are comprehensive, the operation interface is friendly and intuitive, the operation mode, especially the application of shortcut keys, is convenient, and the implementation of functions can be set according to the basic requirements of users, and the system will display the corresponding prompt information for each step of the operation. The system will prompt warning messages for some illegal operations or over-level operations of users to avoid disasters brought by human illegal operations to the system. The interaction between different modules in the system is relatively easy to carry out, and in the process of querying the data, the query conditions are set in a more standardized way with better diversity. According to the process and results of the overall system testing, the deficiencies in the system were recorded and handed over to the research and development staff to make corresponding modifications later, and the best efforts were made to make the system meet the requirements of users, as shown in Figure 3.

Since the standard genetic algorithm uses a fixed cross-variance probability, the consequence is that the better individuals in the population may be destroyed, and thus, the population diversity is reduced, and it is easy to fall into the local solution, and it is not able to jump out of the local and get the optimal solution of the problem. The NCAGA algorithm uses the optimized dynamic cross-variance probability to increase the diversity of the population to a certain extent, while the small habitat technique eliminates the poor individuals in the population, which can ensure the diversity of individuals in the population and avoid falling into local solutions, which improves the global convergence of the algorithm and helps to get the global optimal solution. The most important is artificial intelligence theory, in addition to various educational measurement theories and so on. Therefore, the NCAGA algorithm has high global convergence.

The group volume problem is essentially a multi-constrained multiobjective optimization problem. In general, the constraints of a multiconstraint multiobjective optimization problem are not all satisfied, and it is usually desired that the total number of solutions satisfying the constraints is as large as possible. When solving this type of problem, some other constraints are often sacrificed to satisfy the important ones, while some constraints are relaxed slightly to ensure that the optimal solution can be obtained. Before assembling a paper, the user sets an expectation value for the properties of each test question, hoping that each question in the composed paper will meet the present expectation value, but in the actual process of assembling the paper, errors often occur for some reasons, resulting in the actual value not matching the user’s expectation value [22].
When the variation is selected, instead of the previous completely random selection, a range is generated based on the number of that test question with the highest current chromosome adaptation plus or minus a certain value, and a random selection is made within this range. This was done because the level of questions produced by the teacher or team was fixed, or the level of questions produced by the teacher was fixed over time. To reduce the system consumption caused by incorrect variation operations, the variation operator can be randomly variated according to the range of test questions with high fitness genetic positions. The high fitness test questions indicate that the test questions in this range are perhaps more in line with the fitness function set to improve the efficiency of the group paper algorithm. However, to avoid falling into a local optimum early, a fusion with the traditional variation is used. If a grouped paper will undergo 10 variants, this variation method will account for 3-4 variants, with the exact number of variants depending on the size of the test questions.

1.4. Random Matrix Fusion Genetic Algorithm Performance Results. The test results show that the system is based on 1000 users registering their personal information in the system and 100 system users maintaining their basic information at the same time, the entry is normal, the output and saving are in normal condition, invalid, and data loss problems do not occur, and meet the stress test requirements. The genetic algorithm-based online examination system can meet the needs of many users. When students upload their work, they must connect with the server of the system to test the system’s ability to recover and receive errors. The conclusion of the test is still that the actual performance of the system is more advanced than the expected performance, thus proving that the performance of the system can meet the relevant needs of users’ operation and verifying the stability of the system.

The test system is based on the Net platform framework to carry out specific tests. After the operator has finished coding the whole system, to complete the system, testing can be combined with specific and appropriate operation methods. The performance of each test case is tested, and the performance of the system test based on a genetic algorithm is compared with the performance of the system test based on a conventional algorithm, and the analysis results are shown in Figure 4.

According to the test results, the system developed by the genetic algorithm has better performance in terms of performance testing efficiency, answer upload time, deviation time of reading results, and system stability. This chapter elaborates on the basic principles of testing, briefly introduces, and explains the principles of testing, and various tests are completed by the above-mentioned methods and more specific steps, and several functions of the system achieve the predesigned goals based on the tests, thus proving that the examination system has strong reliability.

The system was randomly executed 12 times when the crossover probability Pm and variation probability Pc were both zero, and the results showed that the grouping success rate was very low in such cases. After a detailed analysis of the test data, it is concluded that the algorithm only performs the selection operation without crossover and variation operation when Pm and Pc are zero and cannot generate new individuals but only copies the previous generation into
the next generation, which makes the search space narrow and the global optimum difficult to obtain. However, in terms of testing students’ basic theoretical knowledge, the assessment methods are either still in the traditional paper-based examination stage or some courses can be automatically selected by students.

After analysing the experimental data, when the value of Pc is in the range of 0.18–0.9, the information on the number of successfully simulated rolls and the average number of iterations all show a rising and then falling trend with the rise of Pc. The constraint of the crossover condition is obvious here, and only some individuals perform crossover operations when Pc is 1. However, the final quality of the group volume meets the requirement, as shown in Figure 5.

The length of the chromosome in the genetic algorithm is commonly known as the accuracy of the solution to the question search problem to meet the requirements of the proposition blueprint in the test paper. The key to the realization of an intelligent test paper is to realize the test paper composition algorithm for automatic extraction of test questions. The length of the chromosome here is the sum of the number of questions of all types entered in the question bank, which has an important influence on the operation efficiency of the automatic grouping function in the intelligent grouping system.

When the size of the population is smaller, its average fitness is smaller, which will lead the genetic algorithm may fall into local solutions. The most fundamental reason is that the lack of diversity of individuals in the case of a small population size causes the searchability of the algorithm to become narrower and the probability of getting the optimal solution to become smaller. When the population size slowly increases, the searchability of the algorithm also slowly increases, and the probability of getting the optimal solution can be improved, but the population size also has an upper limit, and too large will cause the search space to be too wide and eventually affect the efficiency of the program. According to the final experimental results, the population size is set to 100 as the best state.

When the crossover rate is small, the search range becomes too narrow to obtain the optimal solution. At the core, the intelligent test paper composition algorithm directly affects the quality of the test paper. When the crossover rate increases, the possibility of obtaining the optimal solution increases, and when the crossover rate is too large, the local area search is directly ignored by the algorithm, and the optimal solution is difficult to obtain. When the variation rate is low, the algorithm is not able to generate new individuals, and it is difficult to jump out of the local solution, which leads to slow convergence of the algorithm itself. When the crossover rate and the variation probability both become 0, the evolutionary process only supports the selection operation, and the pairwise crossover variation fails, resulting in a narrow search space, and finally, the global optimal solution cannot be obtained.

1.5. Experimental Results of Intelligent Grouping in Adult Higher Education. After the development is completed, the application of testing tools is used to verify whether the system achieves the expected performance index. When testing the system performance, the test tool used is LoadRunner to complete, which tests the response time of the server-side by simulating concurrent users and by accessing the server-side. When testing, a functional event needs to be
selected as the test function. In this part, the query function is selected to complete the performance test, and the test script is written to define the number of concurrent users and test the response time of the system server-side through the query click event of virtual users. In this performance test, the actual maximum number of concurrent users of the system was tested in the case of 50 concurrent users, and the number of users clicked per second and the response time of the system were monitored on the client-side.

After creating 50 concurrent users, the system performs the paper grouping operation at the same time on the client-side, and through monitoring the average response time of the system, the system mostly completes the paper grouping work in less than 2 seconds. If the number of questions increases, the time to assemble papers will increase accordingly, such as around 5 seconds.

The system performance test shows that the system can meet the requirements of multiuser concurrent operation, and the capacity of the test bank is about 5000 questions in general, and the time to complete the grouping of papers is within 2 seconds, which can satisfy the teachers of various subjects in the grouping and analysis of papers. During the test, the system did not show any long-time nonresponse, long waiting time, etc. The system ran stably and reliably without any abnormal system exit or crash, which achieved the expected system design goal, as shown in Figure 6.

For example, if a user logs in after 10 minutes and does not operate the page, the system automatically quits, and the user needs to reenter the user’s name and password before logging in to ensure the security of user information. Log files are extremely important in the process of using the Smart Volume system. To quickly obtain specific types of test questions in the process of test composition and reduce the time overhead of data access, we need to create separate tables for all question types in the process of building the database. It is necessary to record the log file for the test of the information related to the intelligent group volume system to ensure the tracking of the information in the future. If the intelligent group volume system uses secure sockets for the connection, the accuracy of the encryption and the integrity of the information must be judged. Server-side scripts occasionally cause security vulnerabilities, and hackers often use the vulnerabilities as breakthroughs. Therefore, one must be authorized to edit scripts on the server, as shown in Figure 7.

The relative difference between the number of successes and failures of grouping papers for each grouping method, where the third method has the largest relative difference, indicates that the third method has a better success rate of grouping papers; i.e., the NCAGA-based grouping method has a better success rate than the remaining two methods. The NCAGA-based method is lower than the other two methods in terms of the change of the objective function value, which is because the SGA-based method uses fixed crossover probability and variance probability, which are easy to fall into the local optimal solution, so the curve of the objective function value of the corresponding test paper in the figure changes smoothly; the CGA-based method introduces chaos theory, which reduces the objective function value of the test paper to a certain extent. To improve the convergence speed of the genetic algorithm and reduce the number of iterations during its operation, a set of excellent test papers needs to ensure the uniqueness of knowledge point codes in all genes of each chromosome, because different question types come from independent question type tables. The curve is closer to that of the SGA-based group paper method because of the uncertainty of the chaotic variation site selection, which leads to an increase in the variation probability of individuals and may destroy the optimal individuals, and the NCAGA-based group paper method also introduces chaos theory, but this paper applies chaos theory to population initialization, so that each individual in the initialized population meets some constraints of the test paper and also combines small habitat technique and optimized cross-variance probability, so that its corresponding curve changes faster and can find the objective function value, i.e., the optimal test paper, more quickly.

A comparative analysis of the absolute value of error for different cognitive level scores and expectation values of the three group paper methods shows that the absolute value of error fluctuations of the SGA-based group paper method and the CGA-based group paper method is similar, while the absolute value of error fluctuations of the NCAGA-based group paper method is smaller, which is because each individual of the initial population of the NCAGA-based group paper method satisfies some of the test questions. The rest of the two methods use the method of randomly generated initial populations. So, the NCAGA-based group paper method is not only in the distribution of the cognitive level of the test questions but also in the distribution of knowledge points, question types, etc., which is very close to the users’ needs, and thus, to some extent, the NCAGA-based group paper method ensures the quality of the test papers.
2. Conclusion

By using chaos theory with randomness and dynamic traversal, individuals can be selected quickly, and by using the characteristics of chaos theory sensitive to initial values, the constraints of the test paper are added for each individual selected, and the population initialized by chaos selection is a coarse selection of the individuals in the population, which speeds up the speed of the genetic algorithm global search for excellence to some extent. The SGA-based and CGA-based methods are compared with the NCAGA-based method in this paper, and the experimental results show that the NCAGA-based method outperforms the other two methods in terms of overall performance and shows better performance advantages; the NCAGA-based method is applied to the undergraduate question bank management system and the student. That is, after sorting according to the grades of students, take a certain percentage of grades from the front and back as the high group and the low group, respectively, and calculate the average score of the high and low groups, respectively. The NCAGA-based paper composition method is applied to the intelligent paper composition module of the undergraduate question bank management system and the student self-assessment platform and compared with the RA-based paper composition method, the NCAGA-based paper composition method can generate test papers quickly, and the quality of test papers is better in line with user requirements. The above experimental simulations and practical tests show the feasibility and practicability of the NCAGA-based paper formation method proposed in this paper. This paper restricts the constraints of the test questions and sets the values of the constraints according to the educational measurement theory. Although it reduces the complexity of the algorithm, there are many constraints of the test questions in the actual grouping of papers, which need further improvement.

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.

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