

## *Retraction*

# **Retracted: Application of Chinese Classical Garden Landscaping Techniques in Modern Indoor Natural Landscape Design from the Perspective of Virtual Reality Technology**

### **Advances in Multimedia**

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their

agreement or disagreement to this retraction. We have kept a record of any response received.

### **References**

- [1] L. Tian, "Application of Chinese Classical Garden Landscaping Techniques in Modern Indoor Natural Landscape Design from the Perspective of Virtual Reality Technology," *Advances in Multimedia*, vol. 2022, Article ID 4240197, 10 pages, 2022.

## Research Article

# Application of Chinese Classical Garden Landscaping Techniques in Modern Indoor Natural Landscape Design from the Perspective of Virtual Reality Technology

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In the multimedia information comprehensive development of multimedia culture, the traditional technology of many industries and advanced mobile technology develop in concert. Ancient Chinese gardens have a long history. They are rich in content, outstanding in style, and full of characteristics. They have great aesthetic value and are the valuable property of all mankind. This paper discusses the environmental expression, spatial layout, and element combination in traditional garden art. The study of landscape design techniques involves different subjects. Through the developed mobile multimedia information, the traditional garden design is more rich, separation but not blocking, desire to promote first restraint, twists and turns, appropriate scale, borrowing from afar and borrowing from neighbors. The application of these expression techniques in modern interior design is of great significance. By using the ancient gardens of our country to reflect the civilization products of our country in a certain historical stage, the paper traces its development ideas and motives and analyzes the consistency with the corresponding contemporary ideological development. From the perspective of space design, this paper discusses the influence of ancient gardens on contemporary space creation from the aspects of space type, structure form, and space language. How to apply the reference means of ancient Chinese garden design to modern interior decoration through multimedia information so that the interior space can also experience the aesthetic pleasure of “changing scenery” so that the traditional landscape and modern interior decoration can be more fully integrated. This is something designers have to think about. Chinese ancient gardens have always been the focus of domestic design circles. Both the ideas behind it and its own gardening techniques can be used for reference by contemporary interior design. Therefore, the main content of this paper is the foundation of the transformation mechanism of traditional garden in contemporary design through multimedia information. Based on the framework system of contemporary indoor natural landscape or indoor natural landscape as the background, this paper discusses how to use virtual reality technology for reference to the gardening techniques of classical Chinese gardens.

## 1. Introduction

In the limited space, the Chinese classical park adopts the original garden art, integrating the scenery of lakes and mountains with pavilions and pavilions and integrating the artistic beauty of commerce with the creative garden art [1]. Feel the natural scenery of the mountains. In addition, gardens also have extremely valuable historical and cultural heritage [2]. It reflects the traditional architectural style of Chinese gardens and the poems and paintings left by ancient

poets. All these works reflect the rich connotation and essence of Chinese traditional culture [3].

In the west, the famous historian Toynbee once said: “life exists in the deepest part of time: the actions that happen now do not only predict the future, but also depend on the past” [4]. If you deliberately ignore, do not want or erase the past, you will prevent yourself from making wise actions towards the present. In ancient China, there was also an epigram. “Take copper as a mirror, you can correct your clothes; take the ancients as a mirror, you can know the rise

and fall; take people as a mirror, you can correct your gains and losses.” Although this view only discusses the historical understanding of the personal growth process, it has a wide range of general values [5]. The historical development process of discipline research from shallow to deep and its reference and inheritance to discipline research are closely related to scientific research under historical projection [6]. As a field of natural landscape design, interior design is no exception [7].

Overseas, Chinese ancient garden styles with oriental charm also emerge endlessly in some indoor natural landscape designs in eastern and Western countries [8]. Compared with Europe, the United States is particularly prominent in this regard [9]. With the influx of new immigrants and the implantation of culture, the oriental, especially Chinese, traditional indoor natural landscape ideas have been brought into the United States [10]. The weather conditions in California are very suitable for the indoor natural landscape, and the buildings are similar to the wooden houses with the characteristics of the natural landscape in the East, so the people on the west coast of the United States have long recognized this view. Mies, a famous American interior natural landscape architect, whose skillful skills in the interior space design of indoor natural landscapes are reflected in the concept of blurred boundaries between indoor natural landscapes and the environment, proposes organic indoor natural landscapes, flowing spaces, and many other similarities to traditional Chinese gardens method of spatial layout [11]. Therefore, in the West, including Chinese indoor natural landscape architects, in the free-style layout of the room, naturally, many design techniques related to the indoor natural landscape and garden space can be applied [12].

For the continuation and development of architectural tradition, Mr. Hou Youbin, a researcher in the history of Chinese indoor natural landscape, gave the definition of hard tradition and soft inheritance [13]. The so-called hard tradition refers to the traditional surface structure of the indoor natural landscape, the physical existence of the indoor natural landscape tradition, and the specific form and form of the indoor natural landscape heritage that is condensed on the indoor natural landscape carrier and expressed through the indoor natural landscape carrier [14]. Morphological characteristics [15]. The so-called “soft tradition” refers to the deepest structure of the indoor ecological landscape tradition. The nonmaterialized existence of the indoor ecological landscape includes the traditional values expressed by the hardware heritage of the indoor natural ecological landscape outside the indoor and outdoor natural ecological landscape carrier, the way of life, the way of thinking, the way of action, the philosophical consciousness, the humanistic attitude, the aesthetic interest, the concept of indoor and outdoor natural scenery, the idea of indoor and outdoor ecological landscape, and the creation method design method [15]. There have been many research works on Chinese traditional gardens in China [16]. At present, the discussion on traditional gardens at home and abroad focuses first on the summary of the basic information of traditional gardens, and the second is the discussion on the cultural background of the emergence and evolution of Chinese gardens [17].

Virtual reality technology (also known as “VR” technology) appeared at the end of the last century. It is a new technology that combines visual information technology, artificial intelligence, multimedia technology, control ideas, sensors, and the Internet. The computer-aided information technology is used to carry out three-dimensional simulation of the real scene and at the same time to create a special virtual reality situation with real vision, hearing, and tactile experience. Virtual reality technology has a great impact on many subjects because of its strong fidelity, interaction, and immersion. Many developed countries continue to research and develop this high-tech and expand its scope of use.

EON Studio, an American high-end virtual reality software (launched in 1999), has been recognized as the most real, interactive, and practical virtual reality development software in the world today. Whether it is from a simple system to a complex system or through a large number of virtual simulation applications of virtual reality devices, EON can play a great role.

To sum up, the simulation modeling technology realized by virtual reality method using EON has great practical application significance in indoor natural landscape design.

## 2. State of the Art

### 2.1. Theoretical Basis of Related Research

*2.1.1. Contemporary Interior Design Draws on the Material Basis of Chinese Classical Gardening Techniques.* For the needs of mankind, indoor is also an inclusive environmental space. When human beings move in this space, their activities will be restricted in a certain sense. Therefore, the concept of functional space of contemporary architecture does not all come from the first physical space of architecture. Painting style depends more on the efficiency of resource utilization of users and the definition of internal use object activities. From ordinary joint houses to high-class holiday villas, from ordinary offices to large-scale leisure and entertainment, hotels and catering centers, the origin of architectural behavior also defines human life tastes and preferences [18].

### 2.2. The Theoretical Basis of Contemporary Interior Design Drawing on Chinese Classical Gardening Techniques

*2.2.1. Architectural Typology.* Garden typology is an ideological method to study the spatial form of Jiangnan gardens [19]. In the 18th century, French architecture theorist de Quincy first conceived and developed the application of architectural types and became an important form of modern architecture. The different spatial forms of stability and abstraction, as well as the existence of artificial buildings by Italian artist aldorossi, are essentially the products of human cultural traditions. Parts of a language can be interpreted as expressions, but parts are compiled into forms. The basic structure of language expression can be surface form, type and deep structure, and things recognized in the emotional and cultural sense. Through multimode multimedia, the architecture of different spatial forms will be better presented. Through multimedia technology, architecture

has a more three-dimensional and more intuitive form of expression to human beings.

**2.2.2. Topological Isomorphism Theory.** Topology is a mathematical field developed in modern times, which is specialized in discussing the problem of spatial continuity. It is mainly used to analyze the topological changes of space while keeping the basic characteristics of space unchanged. The topological combination method is to study and refine the spatial topological relations of various architectural traditions by using the topological method and then integrate them into the newly designed architectural works, as one of the important means to express the regionality and reflect the local historical characteristics. As a reference to the traditional architectural landscape space, people can realize the original intention of the design concept by using the topological method in the architectural interior design so that the design space concept is not bound by the design function or space concept of the traditional architecture. In the long-term exploration of the traditional landscape space of Chinese architecture, Mr. Zhu Guangya has concluded that there are three topological connections between garden architecture and landscape space: “centripetal,” “mutual negation,” and “mutual tolerance.” These relationships are formed by the combination of symmetry, alignment, and axis, so they can be used as the theoretical foundation of the design mode in contemporary interior design.

### 2.3. Research Status of Virtual Reality Technology

**2.3.1. Current Status of Foreign Research.** Virtual reality technology originates from the United States, and its main goal is to develop a virtual reality city. The most famous is the virtual city based on Los Angeles and Philadelphia. For a long time, the 3D virtual city model of Los Angeles has been regarded as the most realistic and complete virtual city model. Through the design of real pictures and virtual reality scenes, the designers set up a virtual city model covering the entire Los Angeles area (4000 square miles) with the real city as the background environment.

Germany is the first country to use virtual reality technology in the field of indoor natural landscape. Since the beginning of 1989, many research and development units in Italy have begun to apply the computer-aided design technology to the indoor natural landscape design. Nemecek, a world-renowned indoor natural landscape design software company located in Munich, has designed a realistic virtual reality system using virtual reality devices.

New York University (NYU) has developed a virtual reality application walk through for indoor natural landscape design. Users can complete the architectural design in the virtual reality natural landscape. In Asia, Japan’s research on virtual reality technology has always been in the leading position in the world, and its key research areas are large-scale 3D games and 3D animation. In addition to the visual virtual reality technology, the Hiroda Key Research Institute in Tokyo also studies the spatial holographic virtual reality technology, which involves the internal roaming of the indoor natural landscape group.

**2.3.2. Domestic Research Status.** Compared with other countries, China’s virtual reality technology started late, and there are considerable differences in technology maturity and application. However, through more than ten years of development, we have also achieved great achievements.

The newly established virtual reality research laboratory of Wuhan University has successively developed various three-dimensional simulations such as the international space station, the Antarctic Zhongshan station, and the Qinghai Tibet Plateau. It has become a world-class teaching and research center of virtual and reality integrated geographical environment recognized in China. The Algorithm Research Institute of Harbin Institute of Technology has also completed and simulated the face synthesis algorithm in the moving environment, including lip motion synthesis and expression generation. They are currently studying human expression and facial movement, as well as the synchronization between intonation and speech.

To sum up, virtual reality technology has promoted the development of indoor natural landscape design at home and abroad. It not only provides a simple and convenient design method for indoor natural landscape architects but also eliminates the communication barriers with users caused by professional quality. The indoor natural landscape design mode and ideas can modify the indoor natural landscape design scheme in real time, conduct scientific and reasonable analysis, and design a better indoor natural landscape scheme.

## 3. Methodology

**3.1. Immune Genetic Algorithm.** In the early 1960s, Professor Holland of the University of Michigan, firstly the basic principle of biogenetics and its relationship with artificial adaptive system are expounded, and then, the genetic algorithm is given. Genetic algorithm is an iterative search algorithm simulating genetic mechanism, which is realized through genetic operations such as gene screening, crossover, and mutation. It has certain limitations under certain special conditions. Therefore, in the optimization problem of TSP (traveling salesman), it often falls into local optimization because of premature convergence.

Immune genetic algorithm is developed by self-adaptive recognition of human natural immune system and elimination of foreign antibodies entering the human body. It is formed by mathematical abstract modeling of the biological immune system’s learning, memory, and adaptive capabilities. A set of unique solving algorithms is integrated into the genetic algorithm. After dealing with the collision detection problem, we can further abstract the problem mathematically and convert it into a parameter as the binding signal of the antibody, and then, we can get an effective antibody by simulating human immunity. Then, genetic operations such as exchange and mutation are used to study the mathematical calculation, and finally, the optimal solution of the problem is obtained. The research focus of immune genetic algorithm is that the determination of vaccine method can meet the requirements of specific conditions, and the method is improved by using immunological

screening of vaccination. The former is to increase the affinity to achieve the diversification of antibodies, while the latter is to avoid premature convergence caused by algorithm fading. This method has the following two important characteristics. First, it inherits the genetic computing method of "random development, survival of the fittest," which makes it have excellent global retrieval characteristics. Secondly, after the vaccination, it greatly reduces the individual aging and instability in the complete random optimization process and the fluctuation problem in the iteration process. In addition, it also greatly reduces the retrieval of the unprocessed part in the complete random operation, thus greatly reducing the amount of operation, thus improving the overall calculation efficiency.

Based on the practice of different papers and the actual situation of polyhedron collision analysis, this paper makes two amendments to the immune genetic algorithm: one is to optimize the results to be processed by real number coding to reduce the estimated number. It ensures the convergence of the calculation and reduces the computational complexity. The calculation flowchart is shown in Figure 1.

**3.2. Immune Operator.** The immune operator consists of three stages: immune selection, vaccine extraction, and vaccination. If the affinity for the offspring is less than that of the parent, it means that the individual has aged, and the individual corresponding to the parent will be updated at this time. If the calculation result of the affinity for the children is higher for the parents, the children will also update the parents in the next iteration. The purpose of acquiring epidemic situation is to analyze the characteristics of new individuals with high affinity retained from the first  $n$ -negative generation individuals, so as to obtain common characteristics and effective characteristic information in the optimal individual sites as epidemic situation  $K$ . Vaccine injection is to integrate the acquired epidemic  $K$  into individuals to generate new individuals. The key job of immunology operators is to study how to obtain and inject vaccines. The flow is shown in Figure 2.

**3.3. Mathematical Modeling of Polyhedra.** A polyhedron containing a finite set of points  $\{x_1, x_2, \dots, x_n\}$  can be represented as

$$\{x_1, \dots, x_n\} = \left\{ \sum_{i=1}^m \eta_i x_i \mid x_i \in s, \eta_i \geq 0, i = 1, \dots, m; \sum_{i=1}^m \eta_i = 1, m \in N_+ \right\}. \quad (1)$$

$N_+$  is the set of all positive integers.

Let the shortest time between  $a$  and  $B$  of these two polyhedrons be  $Minda, B, x, y$ , and then  $a, B$  any point in two regular polyhedron models then

$$Ming_{A,B} = \left\| \sum_{i=1}^m \lambda_i x_i - \sum_{j=1}^n \sigma_j x_j \right\|. \quad (2)$$

In  $\sum_{i=1}^m \lambda_i = 1$ ,

$$\sum_{j=1}^n \sigma_j = 1, \lambda_i \geq 0, \sigma_j \geq 0 (i, j = 1, \dots, n) \quad (3)$$

is a point on model  $A$ , is a point on model  $B$ , and  $\sigma_j$ , respectively, satisfy the following conditions:

$$\text{s.t. } \sum_{i=1}^m \lambda_i = 1, \lambda \geq 0, i = 1, 2, \dots, m \quad (4)$$

$$\text{s.t. } \sum_{i=1}^m \sigma_i = 1, \sigma \geq 0, i = 1, 2, \dots, m \quad (5)$$

In this way, the problem of solving the shortest distance between models can be abstracted as a constrained nonlinear problem. When  $Minda$  and  $B$  are equal to zero, the modes have no conflict. When  $Minda$  and  $B$  are equal or equal to zero, the mode conflicts. The constructed mathematical model can know the finite coordinate points in the two samples  $a$  and  $B$ . Therefore, the time complexity of seeking the optimal solution becomes the main problem of calculation. Therefore, it is suggested in this paper to optimize the data by immune genetic algorithm.

**3.4. Immune Genetic Algorithm Solution.** The calculation method of immune genetic algorithm is as follows. Node optimization problems in polyhedron mainly include the following minimization problems:

$$\begin{cases} \min f(x(1), x(2), \dots, x(p)), \\ a(j) \leq x(j) \leq b(j), j = 1, 2, \dots, p. \end{cases} \quad (6)$$

Among them,  $x(j)$  is the  $j$ th optimization variable,  $[a(j), b(j)]$  is the value range of  $x(j)$ ,  $P$  is the number to be optimized, and  $f$  is the objective function.

The operation object of the immune genetic algorithm is the antibody encoding, and each antibody corresponds to the solution of a problem, so the encoding space of the antibody and the solution space are a one-to-one mapping relationship, which can be encoded as follows:

$$x(j) = a(j) + u_0^* (b(j) - a(j)) (j = 1, 2, \dots, n). \quad (7)$$

After coding, the  $j$ -th optimization variable  $x(j)$  whose initial value interval is  $[a(j), b(j)]$  can be corresponded to the real number  $y(j)$  in the interval  $[0, 1]$ ; we set  $y(j)$  which is called gene. The computational form of the problem solution formed by the combination of genes corresponding to all variables of the target problem

$$(y(1), y(2), \dots, y(p)). \quad (8)$$

We call it an individual. Through such real number coding, the value interval of the target problem variable is unified to  $[0, 1]$ .

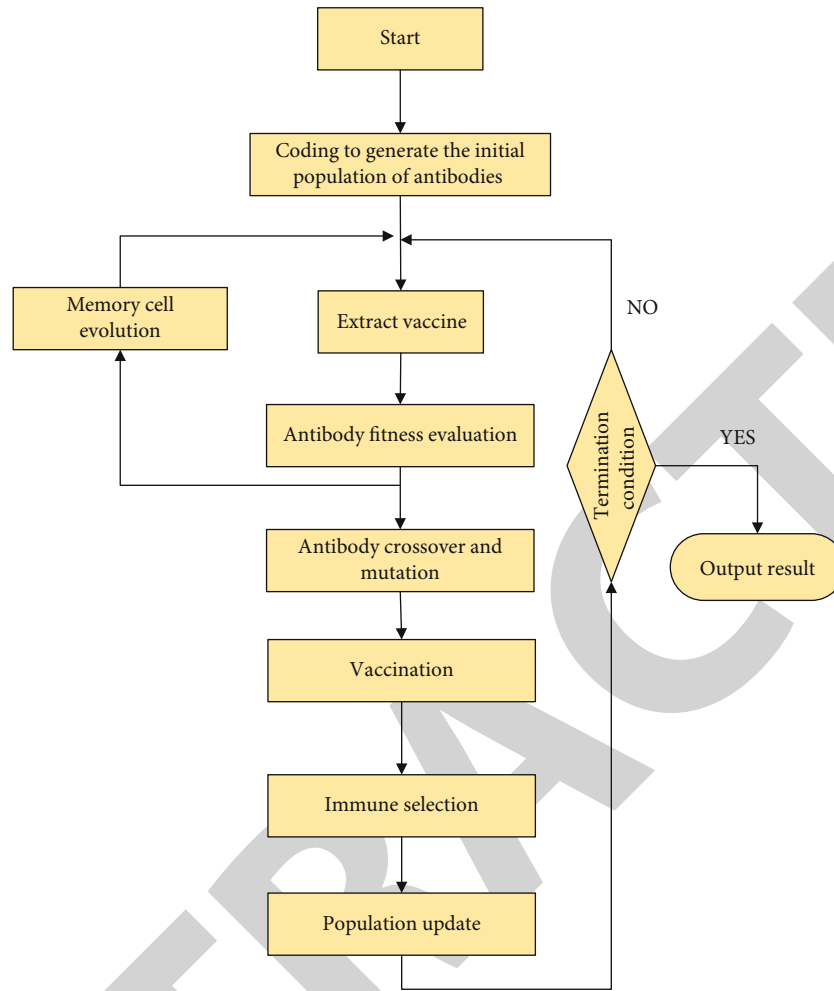


FIGURE 1: Flowchart of immune genetic algorithm.

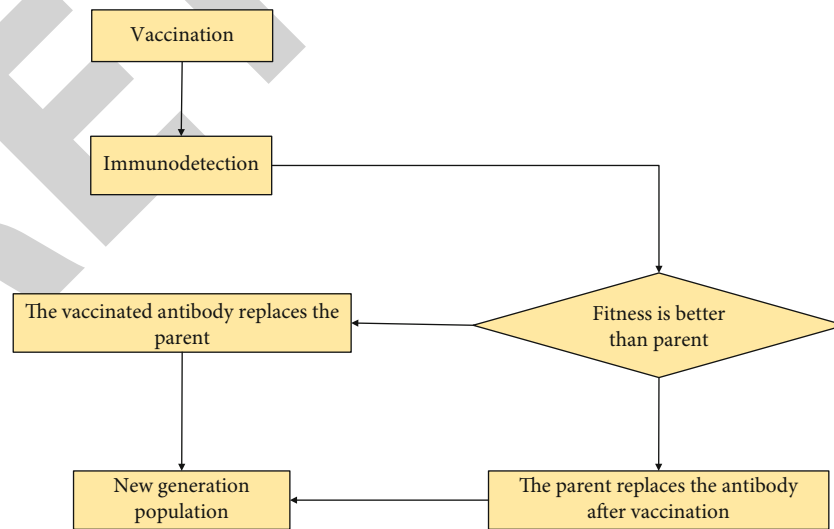


FIGURE 2: Immunoselection process.

In the case of satisfying the nonlinear constraints, let the population size be  $n$ , the number of generated  $n$  groups in the  $[0, 1]$  interval will be random, and each group has  $m$ , that

is,  $u0(j, i)$ . Take  $u0(j, i)$  as the parent individual value  $y(j, i)$  of the initial population, and replace  $y(j, i)$  to obtain the optimized variable value  $x(j, i)$ , and then, obtain the

TABLE 1: The simulation results of the algorithm when the population is 500, 1000, and 2000.

Population algorithm	500		1000		2000	
	Convergence time	Shortest distance	Convergence time	Shortest distance	Convergence time	Shortest distance
General genetic algorithms	3.7548	$1.59e-032$	11.5631	$157e-032$	21.7176	$1.47e-032$
Traditional collision detection	3.8811	$1.86e-032$	12.5147	$1.77e-032$	21.9774	$1.67e-032$
Immune genetic garlic dealer	3.4431	$1.64e-032$	11.5324	$1.33e-032$	21.6243	$1.34e-032$

TABLE 2: The simulation results of the algorithm with 200, 400, and 800 iterations.

Algebraic algorithms	500		1000		2000	
	Convergence time	Shortest distance	Convergence time	Shortest distance	Convergence time	Shortest distance
General genetic algorithms	3.0121	$1.37e-032$	11.2253	$1.37e-032$	19.5687	1.39
Traditional collision detection	3.4231	$1.67e-032$	11.8264	$1.68e-032$	19.0131	$1.70e-032$
Immune genetic garlic dealer	3.0051	$1.36e-032$	11.1136	$1.35e-032$	19.5643	$1.36e-032$

corresponding objective function value  $f(i)$ , and then, arrange them in descending order, and then, the latter individuals are dominant individuals. The smaller the overall size, the smaller the search range, and the shorter the average calculation time of each iteration, and vice versa. Generally, the initial population size is about 100-300.

Gene extraction will be carried out from the outstanding individuals in the previous step, the affinity of each gene will be evaluated, the optimal set of genes will be selected, and the average value of their genes  $\gamma(j)$  will be calculated as vaccine  $K$ .

The affinity function in this paper is to transform the previous generation of individuals into individuals  $xj(i)$  and substitute  $\min |f(x)|$  ( $x \in D$ ,  $f$  is the objective function,  $x$  is the high-quality individual, and  $D$  is the feasible domain solution); it can be to get  $f(i)$ . The larger the value of  $f(i)$ , the smaller the affinity value of the individual is, and vice versa. Finally, the affinity function is defined as

$$F(i) = \begin{cases} \frac{1}{f^2(i)} f(i) \neq 0, \\ M \max f(i) = 0(1, \dots, m). \end{cases} \quad (9)$$

$M$ max is a large enough positive number,  $N$  is the preliminary search algebra, and  $N$  can be flexibly set according to the size of  $M$ , generally set to 5~20.

Arrange the parent individuals in ascending order of affinity value, and select the last  $N$  as excellent individuals. A function  $P_i$  that is inversely proportional to the affinity function value  $f_i$  is established and to satisfy the relation  $P_i$  and  $P_1 + P_2 + \dots + P_i = 1$ . From these excellent individuals,  $P_i$  individuals are selected according to probability so that a total of  $2M$  excellent individuals are selected to form a new population, which is called  $U_c(I, j)$ .

A certain pairing mechanism is used for linear combination to generate new individuals, and the crossover probability is generally 0.4~0.8. Let  $M$  pairs of individuals successfully paired after clone selection, denoted as  $U_c(I, j)$ , where any pair  $(U_c(j, i_1), U_c(j, i_2))$  satisfies the following linear conditions:

$$U_c(j, i) = \begin{cases} u_{x1} * u_{oc}(j, i_1) + (1 - u_{x1})u_{oc}(j, j_2)u_x < 0.5, \\ u_{x2} * u_{oc}(j, i_1) + (1 - u_{x1})u_{oc}(j, j_2)u_x \geq 0.5. \end{cases} \quad (10)$$

In the formula,  $d + (v)$  is the out-degree of the node, and  $d - (v)$  is the in-degree of the node. The total number of out-degrees, in-degrees, and edges of all nodes in the network is equal.

For the established new population  $u_c(i, j)$ , mutation operation is performed with a certain probability  $p_m$ . If  $p_m$  is too low, the algorithm will converge locally. However, once  $p_m$  is too low, the population algorithm will be attacked, and the algorithm will become a random search algorithm. The  $p_m$  value is usually set to 0.001~0.1, and the number of mutations generated is  $u_c(i, j)$ . The calculation method is as follows:

$$U_p(j, i) = \begin{cases} u(j)u_x < p_m, \\ u_c(j, i)u_x \geq p_m. \end{cases} \quad (11)$$

In the process of group evolution, the immune memory mechanism is used to record the excellent individuals generated in each iteration and eliminate the individuals with poor affinity so that the algorithm can develop towards the optimal solution.

TABLE 3: The simulation results of the algorithm when the population is 500, 1000, and 2000.

Population algorithm	500		1000		2000	
	Convergence time	Shortest distance	Convergence time	Shortest distance	Convergence time	Shortest distance
General genetic algorithms	3.5634	0.9962	11.4583	0.9817	21.8796	0.9907
Traditional collision detection	3.9887	0.8876	12.007	1.5564	21.9976	0.7569
Immune genetic garlic dealer	3.3276	0.8931	11.2213	0.9612	21.5412	0.9457

TABLE 4: The simulation results of the algorithm with 200, 400, and 800 iterations.

Algebraic algorithms	500		1000		2000	
	Convergence time	Shortest distance	Convergence time	Shortest distance	Convergence time	Shortest distance
General genetic algorithms	3.0514	0.9122	11.2403	0.9569	19.6679	0.9907
Traditional collision detection	3.1281	0.9213	11.4658	100131	19.9436	0.9574
Immune genetic garlic dealer	3.0217	0.8451	11.20273	0.9774	19.5981	0.9631

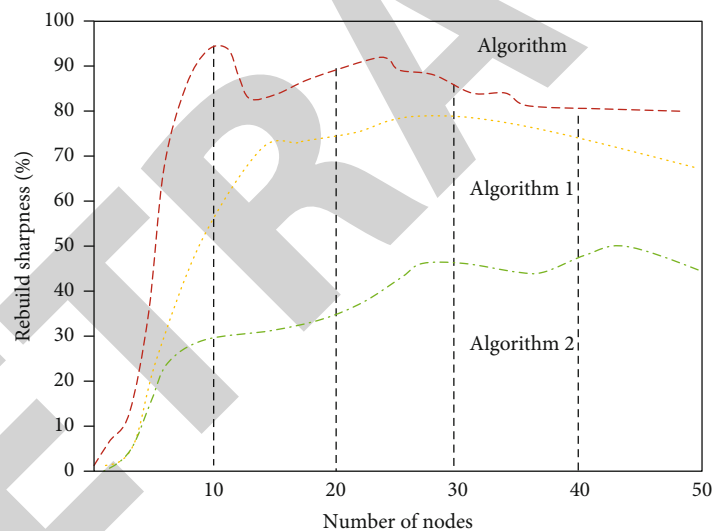


FIGURE 3: Experimental comparison results.

Vaccination is based on prior knowledge to modify the genes of some individuals so that the new individuals are larger rate to become an excellent individual.

## 4. Result Analysis and Discussion

**4.1. Experimental Data and Environment.** Two polymorphs A and B were randomly selected and tested in two different states of impact and nonimpact, respectively. It is helpful to evaluate the stability of immune genetic algorithm. In the test, the general genetic algorithm and the traditional collision test are simulated, and the average results of the two methods are compared to determine the test results. The test conditions are Windows 764 bit control system and Intel Core i5-2410M@2.30 GHz data processor and four GB

memory. The specific data of the experiment include the following: the initial population number is 500, 1000, and 2000, the variation probability PM is 0.008, the crossover probability PC is 0.006, the initial search algebra  $N_0$  and the best individual nex are each ten, and the iteration time is 200, 400, 600, and 800 generations.

**4.2. Experimental Results and Analysis.** The coordinates of the vertices of the two polyhedrons A and B that have collided are as follows.

Object A:  $x_1(21,47,66)$ ,  $x_2(67,89,43)$ ,  $x_3(77,83,67)$ ,  $x_4(41,81,82)$ ,  $x_5(77,31,19)$ .

Object B:  $y_1(77,33,1)$ ,  $y_2(3, 3, 18)$ ,  $y_3(0,31,27)$ ,  $y_4(0, 3, 22)$ ,  $y_5(10, 7, 11)$ .



The above vertex coordinates are calculated and solved by using immune genetic algorithm and general genetic algorithm, and the results are shown in Tables 1 and 2.

The coordinates of the vertices of the two polyhedrons A and B that have not collided are as follows.

Object A:  $x1(-31, 17, -6), x2(123, 88, 53), x3(-9, 14, 22), x4(-33, 156, 32), x5(18, 27, 10)$ .

Object B:  $y1(54, 72, 61), y2(123, 99, 18), y3(142, 71, 47), y4(0, 3, 2), y5(19, 17, 21)$ .

Similarly, immune genetic algorithm and general genetic algorithm are used to calculate and solve the above vertex coordinates, and the results are shown in Tables 3 and 4.

It is not difficult to see from the test results that the immune genetic algorithm has a faster convergence rate in terms of time complexity than the other two calculations and is more accurate in terms of calculation accuracy in the shortest time. When the total time and the number of iterations change, the results will not fluctuate significantly. In the calculated time average convergence curve and affinity curve, people can also clearly find that with the extension of the duration the curve tends to be gentle and converges to a certain value so that the optimal prediction solution can be obtained faster through the convergence rate. However, in general, the improved genetic algorithm will have faster solution speed and more accurate conclusions when dealing with the multicell collision detection problem. The application of immune genetic theory can solve the problem of multicell collision detection.

From Figure 3, it can be seen that the clarity calculated in this paper is always better than the traditional reconstruction calculation. The resource management cost of this algorithm is relatively low, but it greatly improves the utilization rate of network resources. It can share and transmit data with various resource platforms. It has perfect computing function, excellent characteristics, and resource data protection mechanism. The user can operate more freely. It has application protection and good stability. Therefore, the calculation in this paper has strong computing power, which can better analyze the image and realize image reconstruction.

The 5-fold cross-validation method was used to verify the multiobjective hybrid genetic algorithm parameter optimization evolution process in this method. The results are shown in Table 5. Analysis of Table 5 shows that when the multiobjective hybrid genetic algorithm is used to determine the architectural indoor space environment design scheme, there is a big difference between the optimal objective function value in the early stage of evolution and the average objective function value. The difference is small compared to the function value. This shows that in the early stage of the evolution of the multiobjective hybrid genetic algorithm, the relative fitness function values of different chromosomes are highly consistent, which can avoid the premature problem of the algorithm. In the later stage of evolution, the fitness function value is greatly improved, which significantly improves the convergence speed of the algorithm.

In Figure 4, the convergence curve of the population average offset (i.e., the average solution in each generation) and the minimum offset (i.e., the optimal solution in each

TABLE 5: Parameter optimization evolution process.

Evolutionary algebra	Optimal objective function value	Average objective function value
0	0.044	0.065
4	0.024	0.056
8	0.018	0.051
12	0.006	0.042
16	0.003	0.030
20	0.003	0.018
24	0.002	0.013
28	0.002	0.013
32	0.001	0.004
36	0.001	0.005
40	0.001	0.004

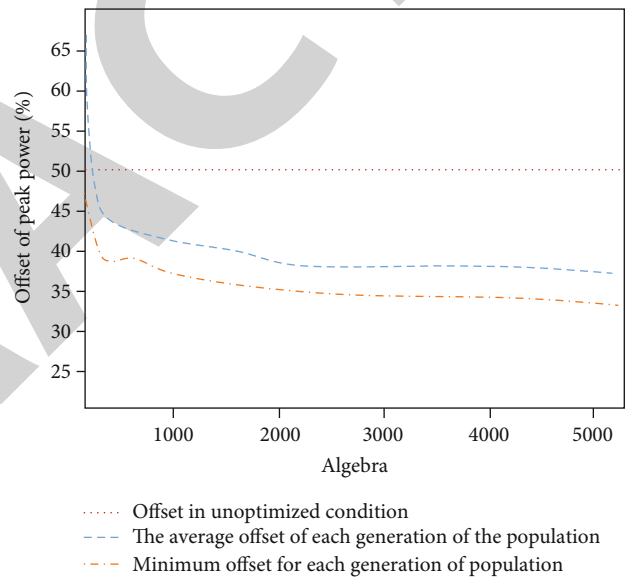


FIGURE 4: Convergence curve of algorithm for optimization operation.

generation) is further given, and it can be seen intuitively the final solution phase. Compared with the improvement of the offset in the unoptimized case, it also shows the rapid convergence characteristics of the genetic algorithm. A satisfactory solution can be searched for about 1000 generations, and it can be very close to the final solution by 2000 generations (that is, the final solution of the population) determined optimal solution.

The related programs were tested using the Lib SVM 3.23 toolbox and GAOT toolbox. Since RBF is a kernel function, in order to adopt the sample standard, the personnel of Guilin Institute of Electronic Science and Technology made the relevant signal WAV software. Nineteen samples six were used in the test, and 196 samples were used for the first time, including 96 line-of-sight WAV files and 100 non-line-of-sight WAV files. One hundred and forty were randomly selected for training; 56 were tested. The second time, 1000

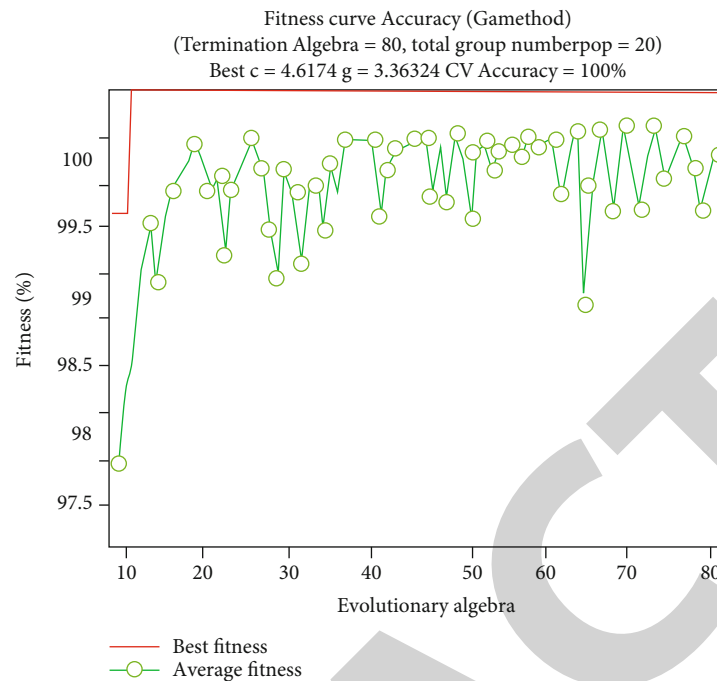


FIGURE 5: The changing trend of the fitness function values of the two algorithms.

samples were used, including 500 line-of-sight and non-line-of-sight WAV files, of which 700 were trained and 300 were tested. In addition, the samples used in the first training will also be added to the assessment of the final training, where “” represents the change of fitness in the original algorithm and “\*” represents the change of fitness during the calculation and optimization in this paper, as shown in Figure 5.

## 5. Conclusion

Chinese classical gardens are typical artistic representatives of ancient architecture in my country, and their achievements have always amazed people, and they have created different landscapes with unique landscaping techniques and unique cultural connotations. Chinese classical gardens are different from Western gardens. No matter in terms of Western landscaping theory and landscaping concept or specific techniques, Chinese classical gardens all reflect their unique creativity. Chinese classical gardens are composed of mountains, water, flowers, trees, buildings, etc., and their overall effects and humanistic feelings are unique. The landscaping ideas and landscaping techniques of Chinese classical gardens play an important guiding role in the design of modern residential areas. This dissertation is a concrete example of the application of virtual reality technology in architectural design. It combines architecture with multimedia information by using virtual reality technology and multi-multimedia information method. This thesis is a concrete case of the application of virtual reality multimedia information technology in architectural design. It combines architectural theory with computer technology by using virtual reality multimedia information technology and computer-aided design. The main content of this chapter is

to deal with and analyze the modeling problem of 3D space. Finally, virtual reality multimedia information technology is used to realize the 3D representation of virtual architecture model. For this reason, the author of this chapter first deeply studies the key technology of virtual building reality and collision detection and makes a modification on the basis of traditional algorithms. The experimental results also prove the superiority of this algorithm. Different architectural scales will inevitably produce different aesthetic psychological experiences for the garden and the interior. How to coordinate and master the problem of size and choose an appreciation point in the indoor space is an important topic that must be carried out in the future.

## Data Availability

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

## Conflicts of Interest

The author declares that there are no conflicts of interest.

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