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Research Article

Multidimensional Nonlinear Landscape Planning Based on Parameter Feature Extraction and Multimedia Technology

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The development of information network and digital technology has improved people's quality of life. Parametric design can reflect the thinking logic of users and the level of computer-aided design. Taking parameter features as the research object, this study makes multidimensional nonlinear landscape planning with multimedia technology. The application of multimedia technology will pave the way for the reference of computer design program, lead to multidimensional nonlinear landscape image analysis, sample and analyze it, and change the parameter characteristics through simulation to realize the optimization of landscape design. The research data show that the landscape correlation degree is 0.344–0.724. The similarity coefficient is between 0.433–0.645. The contribution level is between 0.323–0.774. The ambiguity factor is between 0.555–0.433. In this study, by simulating the spatial vision of the scene and changing the parameters, we can find the best scheme and get good results. Verify the real validity of the experimental data.

1. Introduction

The information revolution has developed to this day, and the world is facing the deterioration of the environment, the depletion of resources, and the increasingly complex human settlements. How do human beings solve these problems through new communication technologies, digital media, software, and design systems in the new era to re-understand? In our world, it is undeniable that parametric design techniques are having a profound impact on architectural design, urban planning, and landscape design, enabling design learning and project design to be increasingly distributed, interdisciplinary, and collaborative. How should designers face this situation and adjust design strategies? It will surely become one of the important issues of this era. With the continuous development of society, digital media reflects its powerful power in social life. It penetrates into every aspect of our life and sweeps the world like a tornado [1]. Life is full of digital signals and digital technology. As the main bad environment space of our life, urban landscape is inevitably affected and impacted by digital technology with its high sensitivity to science and technology [2]. Information technology crosses national boundaries and nations, making all corners of the world closely connected due to the development of information network. In the information age, a market model and enterprise model different from that in the industrial age have been formed [3, 4]. Mankind began to transform from industrial civilization to information civilization. The intervention of digital multimedia technology has changed people's traditional habit of obtaining information and cultural lifestyle. The exchange of human culture is becoming more and more frequent. The cultures of different countries, regions, and nationalities spread each other through the network platform of multimedia technology. People's aesthetic and world outlook began to be impacted and changed [5]. At present, there are many theories on the media and multimedia itself, as well as the study of society, culture, and art from the perspective of media, and gradually pay attention to the use of media and multimedia theory to study architectural design; especially, the research on the involvement of multimedia digital technology in architectural design has attracted more and more attention. At present, urban landscape is more studied in ecology, regional culture, local spirit, and art, but relatively few [6] of urban landscape theory in multimedia. At present, the multimedia and architectural design research is more in depth and mature. Therefore, research on this subject can be combined with the results of multimedia technology, architectural research, and research experience. The concept of the multimedia technology is shown in Figure 1.

2. Literature Review

In view of this research problem, *f* Moslemi and others put forward the "metaphysics of virtual reality," which deeply explores the essence of digital technology and virtual reality with philosophical speculation. In the field of practice, some avant-garde researchers have combined computer language with genetic engineering and biomedicine and achieved experimental results such as the so-called "intelligent evolution space." Accordingly, many famous architectural professional media have also opened up special columns for the application of digital technology in architectural design [7]. Han et al. believe that RS is the fastest acquisition method with the largest coverage of spatial information. It can track the complex topographic features of the landscape, vegetation, and hydrology from time to time, which can ensure the accuracy and authenticity of landscape data. GPS is a modern tool for rapid and precise positioning of spatial entities. It is widely used in the drawing of maps in landscape design: GIS is a powerful weapon for spatial information integration, analysis, and processing. It can analyze and process the collected information, which is conducive to expert system decision-making. It is a powerful intelligent analysis and processing system. The combination of these three can provide strong support for landscape design, as shown in Figure 2 [8]. Huang et al. made a preliminary study on the media characteristics and interactivity of architecture from the perspective of the role of digital multimedia technology in architectural design. Liu Yudong's theoretical research on "digital architecture" of Taiwan Jiaotong University not only focuses on the design method of digital technology but also puts forward the interactive problem of digital architecture [9]. Shahmansouri and Misra discussed the relationship between multimedia media and architecture for the first time in the field of architecture and analyzed and obtained the concept of architectural interactivity. The conclusion of the study is that the ultimate goal of interactive architectural design is the efficient circulation of information [10]. Zhu et al. believe that the characteristics of high efficiency and intelligence of digital multimedia technology have played a great role. The integration of CALS and GIS technology has formed a virtuous circle development mode from paying attention to information technology to developing and applying information technology to verifying information technology and then to developing information technology [11]. Sun et al. have studied the interactive performance of digital multimedia technology in planning and design in practice, which provides a favorable demonstration for the interactive participation of multimedia technology in the landscape design [12]. Zhou et al. integrated the technology and operation mode in traditional landscape architecture design and then incorporated it into the field of urban design. In practical operation, they used parametric software to try to establish an operating system based on abstract relationship in the city and build an entry state spanning different scales [13]. Xu et al. believe that the current landscape design is most obviously affected by parameterization in terms of landscape architecture and structures and have been practiced in the direction of low-level construction, for example, the practice of low parameter landscape design. In the design, the parametric design method is applied to the design stage of structural nodes, and the "low technology" construction process is adopted to complete the construction, so as to achieve the final expected effect [14]. Shi et al. explained the meaning of concepts related to landscape design and parameterization and expounded the essence and realization of parameterization. This study focuses on how to combine parameterization and landscape design on a small-scale basis, including introducing the design process, parameter setting, application methods, and specific aspects of application in landscape [15]. Zhang et al.'s study focuses on the parametric design method and focuses on the microlevel of small-scale landscape, such as the translation of parameters and rules of structures and sketches and the construction process of parametric logic. Explore the effect of parameterization in the landscape design through actual design and analysis [16]. Based on the previous relevant academic reports and theoretical analysis, this study takes the parameter characteristics as the research object to make multidimensional nonlinear landscape planning with multimedia technology. The application of multimedia technology will pave the way for the reference of computer design program, lead to multidimensional nonlinear landscape image analysis, sample and analyze it, and change the parameter characteristics through simulation to realize the optimization of the landscape design.

3. Methods

3.1. Expansion of Multimedia Technology to Design Program. The first step of the landscape design process is to collect the geographic environment information of the selected target plot, including the location, general area, three-dimensional shape, and elevation analysis. In the past, the way for the landscape design to collect the above information was field investigation and search around relevant places. Now, only by virtue of geospatial information technology, it can accurately locate the above information, and at the same time, it can additionally grasp the terrain and population visits of the current plot. The application of digital multimedia plays the same role in the selection of landscape design site. The investigators achieved the effect of automatically recording the environmental characteristics by using the intelligent numerical control of the computer and the preset statistical program and then simulated the scene with VR technology and collected it for standby. When the selection of land parcel is involved, the scene is reproduced to lay the foundation for this step [17].

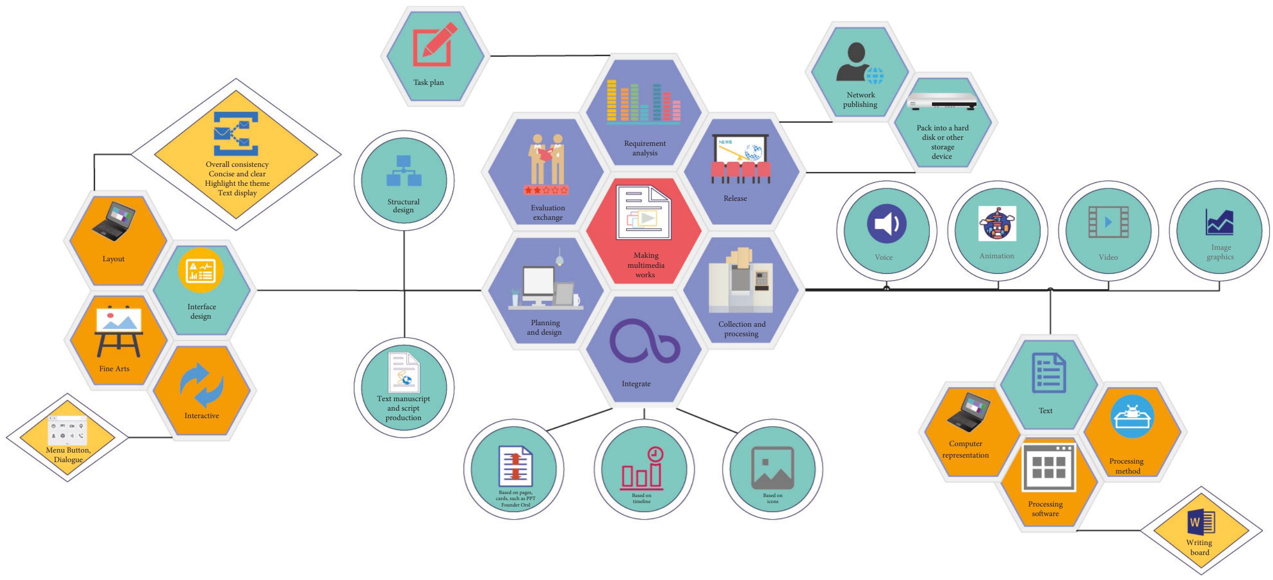

Figure 1: Concept diagram of multimedia technology.

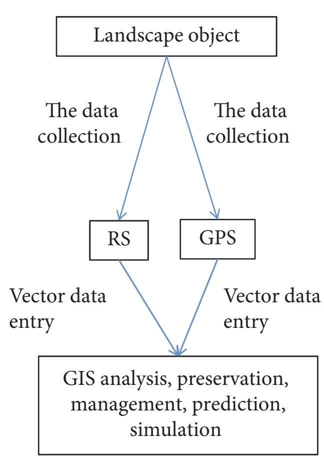

Figure 2: Flowchart of collection and processing of landscape information by 3S system.

3.2. Multidimensional Nonlinear Landscape Image Analysis. In this process, the known landscape images are segmented, and a dynamic parametric model of multidimensional nonlinear landscape images is constructed by discriminating the appropriate degree control and the fusion of different plates. The data are used as a reference point for fuzzy-related properties to collect the best image and feature distinction, using the pixel feature point region reference method, and to process and merge the image data accordingly. Below is an invariant phase model of the geometric moments of a multidimensional nonlinear landscape image:

$$\mathrm{Dif}\left(C_1, c_2\right) = \min_{v_i \in C_1, v_j \in C_2, \left(v_I, v_j\right) \in E} W\left[\left(v_i, v_j\right) + f_e\right]. \tag{1}$$

In the above model, Fe represents the sampling point of a multidimensional nonlinear landscape image. The space was modeled using a visual planning approach, $F_E = \mathrm{In}I/\mathrm{In}D$, parameters were simulated, and models related to the landscape design were created. Various block models have been combined and adjusted according to the gradient to generate edge information for multidimensional nonlinear landscape maps, as shown below:

$$\begin{aligned} G_n(n, m, t) &= \frac{\partial u(n, m, t)}{\partial n}, \\ G_m(n, m, t) &= \frac{\partial u(n, m, t)}{\partial m}. \end{aligned} \tag{2}$$

In the above formula, length and width were taken as two variables in the gradient direction, the central pixel point is (I, J), and $X_{i,j}$ means the edge pixel distribution point of landscape rational distribution. The optimal parameters for the nonlinear landscape design of the multidimensional landscape are calculated using the image visual distribution method, and its length in the landscape image is represented as follows: $F = n_{\max} - n_{\min}$. The width is expressed as $X = m_{\max} - m_{\min}$, and the height is expressed as $T = d_{\max} - d_{\min\,\mathrm{O}}$. To model multidimensional nonlinear landscape parameters, different blocks of the model are distinguished by block region alignment and data aggregation techniques. The spacing is calculated as follows:

$$Y_{i,j} = \mathrm{med}\left(N_{i-1,j-1} \ldots N_{i,j} \ldots N_{i+1,j+1}\right). \tag{3}$$

Then, there are

$$F_{i,j} = \begin{cases} 1, \left|x_{i,j} - m_{i,j}\right| \geq t, \\ 0, \left|x_{i,j} - m_{i,j}\right| < t. \end{cases} \tag{4}$$

For multidimensional nonlinear landscape partitioning control and feature tuning, an appropriate framework approach is used. Planar pheromones for nonlinear landscape design are identified by designing models suitable for multidimensional nonlinear parametric landscape models as $G(x, y, t)$, in which

$$u(x, y, t) = G(x, y, t). \tag{5}$$

Multidimensional nonlinear landscapes should be taken in multiscale space, and nonlinear landscapes should be planned for according to the results [18]. The positional properties of the pixels were analyzed one by one to compare the similarity of the multidimensional nonlinear landscape images. In this process, the spatial region-specific design expressions are

$$F = \widetilde{p}(x, y) = p(x, y)\left(\frac{v(x)}{v(y)}\right)^{1/2}. \tag{6}$$

We design the multidimensional nonlinear landscape parameters, represent the nearest neighbor phase sites with the X matrix, determine the entropy mass distribution set, and derive the pixel covariance function according to the decomposition scheme:

$$\begin{aligned} p(x, y) &= \frac{k(x, y)}{v(x)}, \\ v(x) &= \sum_{y} k(x, y). \end{aligned} \tag{7}$$

The affine-invariant area of the image divides pixel I into reference points. Depending on the number of observations included in the training package, the training function may be interesting according to the theory $0 \leq w(i, j) \leq 1$ and $\sum_{j\in\Omega} w(i, j) = 1$, and the parameter distribution matrix of the multidimensional nonlinear landscape design is obtained. Initialize the a priori shape as follows:

$$D = \begin{pmatrix} I_x^2 I_x I_y \\ I_x I_y I_y^2 \end{pmatrix}. \tag{8}$$

Then, rebuild the area. Obtain parametric simulation data from the design; the parameter vectorized property was obtained by the RGB property decomposition method [19].

3.3. Multidimensional Nonlinear Landscape Design Optimization. The method used for the parameterized segmentation of the model is the RGB feature decomposition method, which deletes the fuzzy matching feature in the picture quantity. Its range is within and around the area locked by the landscape image. The estimated value is

$$XLY[g(e)] = \sum_{j\in\Omega} s(n, n) g(d). \tag{9}$$

According to the learned measurement knowledge, the multidimensional reconstruction parameters of multidimensional nonlinear landscape images meet the characteristics of uniform distribution, so the pixel sequence meets $n \in N(0, \sigma_n^2)$. The second-order moment of multidimensional nonlinear landscape design is deduced through parametric model structural analysis [20, 21]:

$$\mu_{pq} = \sum_{M=1}^{M} \sum_{N=1}^{N} (X - \dot{x})^p (Y - \dot{y})^q f(X, y). \tag{10}$$

The first moments m_{01} and m_{02} represent the edge fuzzy feature quantity in the multidimensional nonlinear landscape map. After the block melting operation, it can be found that the peripheral model region of the landscape design is consistent with the normally distributed [22]. The results of the fine breakdown of the landscape image are as follows:

$$\begin{aligned} & I_1 \frac{n_{20} n_{02} - n_{11}^2}{n_{00}^4}, \\ & E_m^{ij} = \sum_{k=0}^{255} e_{mk}^{ij}, e_{mK}^{ij} = \begin{cases} -p_K \log p_k, p_k \neq 0, \\ 0, p_K = 0, \end{cases} \end{aligned} \tag{11}$$

where p_K is the vectorized dimension of the spatial material, $m = 1, 2, \ldots, N$. The parametric model [23] is used for unpacking multidimensional nonlinear landscape phenomena. The multidimensional nonlinear landscape design is based on parametric modeling methods, and the set of vector quantification of multidimensional nonlinear landscape images is as follows:

$$P_{i,j}(Q) = \begin{cases} \dfrac{w_{i,j}}{w_i}, n \neq m, e_{i,j} \in Q, \\ 0, n \neq m, e_{i,j} \notin Q, \\ 1 - \dfrac{\sum_{j:\, e_{i,j}\in A} w_{i,j}}{w_i}, n = m. \end{cases} \tag{12}$$

The parameterized segmentation of the multidimensional nonlinear landscape model is carried out by the block template matching method, and the parameterized model of the multidimensional nonlinear landscape design is deduced. The distribution results are as follows:

$$n(j) = [n_1(J), n_2(J), \ldots, n_m(J)], i = 1, 2, \ldots, m, \tag{13}$$

where k is the sampling node of multidimensional nonlinear landscape data and $n_i(J)$ is data flow. The model flowchart is shown in Figure 3.

4. Results and Analysis

The experiment was designed by using Matlab simulation. The pixel scale of the model is 100–600, the pixel scale is 300×300, and the measurement module is 100 [24]. The number of iterations was 1200, and statistical analysis of the relevant parameters is shown in Figures 4–7.

By analyzing the descriptive statistical analysis results obtained in Figures 4–7, collect multidimensional nonlinear landscape images, through virtual scene space visual planning, and change the parameter characteristics through simulation to realize the optimization of landscape design. Test the regression analysis value, inspection value, and other parameters, and the results are shown in Table 1.

By analyzing the data in Table 1, it can be seen that the multidimensional nonlinear landscape design parameter

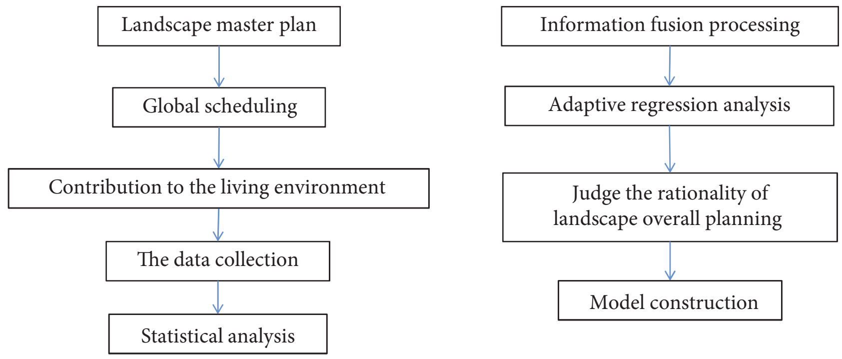

Figure 3: Implementation process of landscape design.

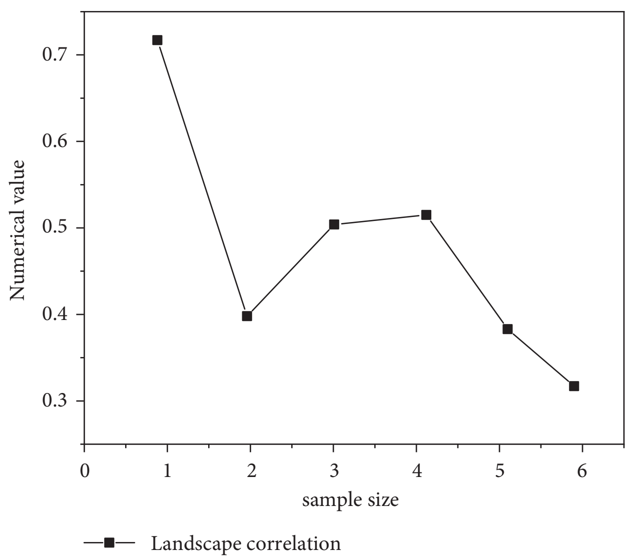

Figure 4: Landscape correlation results of sample pixels.

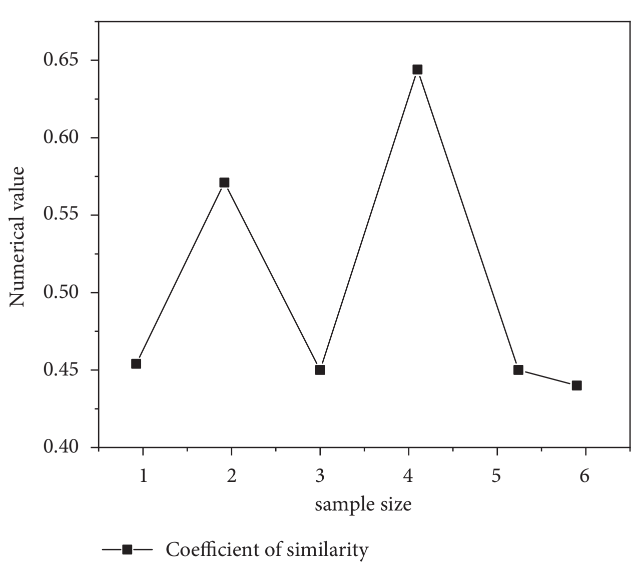

Figure 5: Similarity coefficient results of sample pixels.

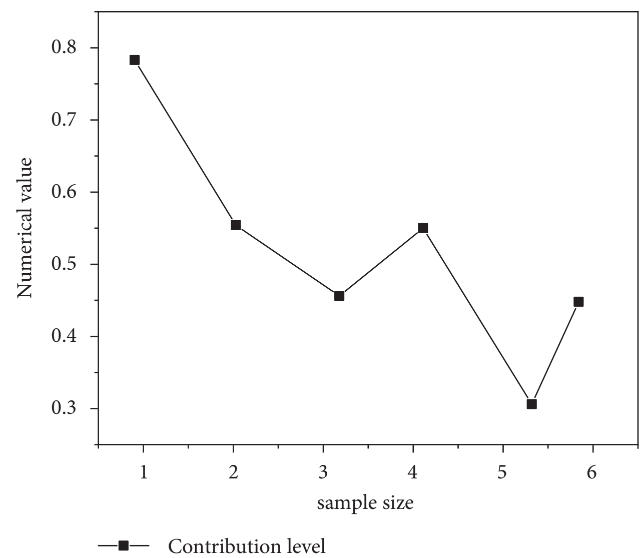

Figure 6: Contribution level results of sample pixels.

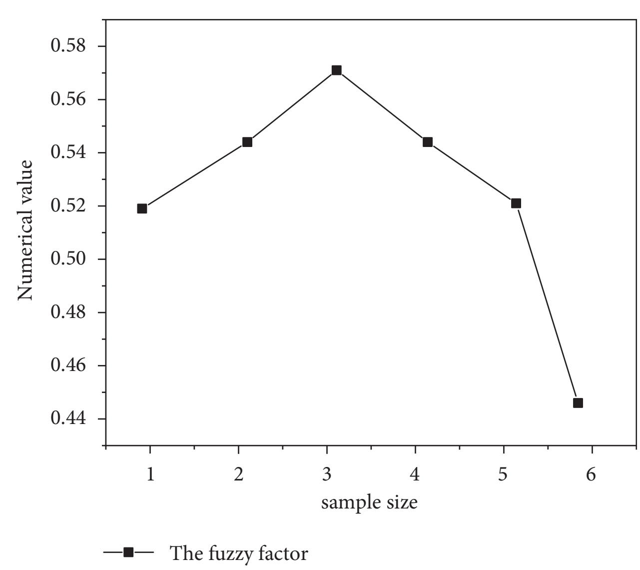

Figure 7: Blur factor results of sample pixels.

Table 1: Regression analysis value and test value.

Variable name	Mean value	Average value	F test value
Landscape planning structure	0.455	1.423	0.465
Habitat satisfaction level	0.745	0.534	0.564
Environmental risk coefficient	0.476	1.667	0.256
Ecological improvement level	0.453	1.554	0.645
Landscape construction scale	0.576	0.554	0.376
Decision evaluation value	0.356	0.576	0.645
Overall planning and allocation efficiency	0.554	0.554	0.354
Regression standard deviation	0.576	0.735	0.654

characteristics obtained by the method adopted in this study are better, the parameter distribution fusion is more uniform, and the degree of fit is higher.

5. Conclusion

Taking parameter features as the research object, this study makes multidimensional nonlinear landscape planning with multimedia technology. The application of multimedia technology will pave the way for the reference of computer design program, lead to multidimensional nonlinear landscape image analysis, sample and analyze it, and change the parameter characteristics through simulation to realize the optimization of landscape design. And good results are obtained. To optimize the multidimensional nonlinear landscape design, the results show that the landscape correlation degree is 0.344–0.724. The similarity coefficient is between 0.433–0.645. The contribution level is between 0.323–0.774. The blur factor is between 0.555–0.433. On the basis of the research in this study, the following contents need to be further studied. For the deep learning-based prediagnosis method, it can be used for more application objects, and the generality of the method can be evaluated through the actual application effect.

Data Availability

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

Conflicts of Interest

The author declares no conflicts of interest.

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