Hindawi
Complexity
Volume 2020, Article ID 6620216, 11 pages
https://doi.org/10.1155/2020/6620216

Research Article

Landscape Image Layout Optimization Extraction Simulation of 3D Pastoral Complex under Big Data Analysis

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Received 16 October 2020; Revised 13 November 2020; Accepted 17 November 2020; Published 29 November 2020

Academic Editor: Zhihan Lv

Big data has brought about opportunities for landscape architecture, changing the design thinking of layout optimization simulation, expanding the platform for public participation in layout optimization simulation design, reflecting social and humanistic care, and promoting the integration of discipline cooperation and data. At the same time, it also brings about challenges. The proposal of data theory, the acquisition and analysis of data, and the protection of privacy are all issues that we need to face and solve. First, build a layout optimization simulation program under the background of big data. Follow the procedures of conventional layout optimization simulation, add big data analysis technology to the preliminary analysis, layout optimization simulation design, and later evaluation management, introduce new data processing methods, and build a theoretical framework of landscape optimization simulation methods that integrate new and traditional data. Second, studying the evolution of the landscape image layout of the three-dimensional pastoral complex is different: the overall landscape image layout of the three-dimensional pastoral complex shows a trend of fragmentation and heterogeneity. Among them, the arable land is gradually fragmented, the wetland and water area are simplified in form, the woodland and grassland patches are gradually distributed, the fragmentation is reduced by 76.19%, and the connectivity index is gradually increased. From a spatial perspective, the edge area outside the Fourth Ring Road becomes the most obvious area of fragmentation tendency. Finally, by introducing big data into the landscape layout optimization simulation, a layout optimization simulation method based on big data is constructed and used in the layout optimization simulation of the landscape image layout of the three-dimensional pastoral complex to guide the participatory layout optimization simulation.

1. Introduction

Three-dimensional landscape image layout of pastoral complex is an important guarantee for urban ecological environment. By the urban green land, farmland, forestland, and wetland and the waters together form a complex three-dimensional rural landscape image layout that has important ecological service function, in the maintenance of ecological safety and delay species, reducing the heat island effect and maintaining the social and economic sustainable development playing an important role, and has a decisive influence on land ecological environment. A complex three-dimensional rural landscape image layout of ecological benefit, economic benefit, and social benefit also caused the country to attach great importance to the construction of urban forest and green space construction as the main content; emphasizing the urban forest ecosystem plays an important part in urban development and together with the urban green space system affects the ecological landscape of the city. Farmland, wetland, and water area are also indispensable parts of urban ecosystem, which play an important role in ecological protection and material circulation. Therefore, it is urgent to study the three-dimensional landscape image layout of urban green space, farmland, forestland, and water area and put forward the optimization strategy for the overall urban ecological environment construction and the improvement of ecological benefits.

Theoretical research mainly focuses on the impact of big data on subject teaching, landscape layout optimization simulation process, and the guidance of data analysis on layout optimization simulation. The actual cases mainly focus on spatial structure analysis, human behavior characteristics, and users' emotional evaluation under the background of big data, mainly using remote sensing, bus ride record, taxi GPS track, Weibo positioning data, network text, and so forth. The research scope involves large-scale scenic spot layout optimization simulation, as well as small- and medium-sized green space system and greenway layout optimization simulation. It can be seen that studies on big data in landscape layout optimization simulation are concentrated in local areas, and no complete system has been proposed for the application of big data technologies and methods in layout optimization simulation program. For example, the concept and characteristics of big data are introduced, and the characteristics of big data are linked with the simulation content of landscape layout optimization [1–3].

Combined with practical cases, the application of location service data in landscape layout optimization simulation in various periods was introduced, and the simulation design method of landscape layout optimization based on location service big data was drawn, providing a good reference and research direction for subsequent researchers [4–6]. In the study of population activity, the quantitative analysis method of thermal diagram was used, which provided a practical reference case for the application of big data in the simulation of landscape layout optimization [7, 8]. Taking Beijing forest park as the research object, the word frequency analysis software is used to collect and analyze the network text, so as to obtain the social service value of different forest parks and introduce the network text into landscape evaluation [9, 10]. By collecting mobile phone location data in scenic area, the behavior rules of tourists are studied to provide a basis for layout optimization simulation management and decision-making in scenic area, and the research on tourists' behavior characteristics based on positioning data is a hot research topic at present [11, 12]. Big data plays a prominent role in the study of urban issues, and it is commonly used to study urban internal space, urban activity space, and urban hierarchy. For example, according to the global Internet map, the world's Internet cities are graded by using domain names and number of users [13, 14]. Use Twine: firewall cracking programs to extract the geographic coordinates and text data, and combined with time series model analyzed in different cities of Twitter posts characteristics and distribution of keywords, found that only a few cities that can offer more time keyword search the information they need and get the city level of network activity and the relationship between 15th and 16th. By analyzing the communication information of 25 million users provided by the Belgian mobile phone operator, the social network was established by using the zip code corresponding to the user's mobile phone bill address, and the communication intensity was studied by using the gravity model, and finally the communication connection and hierarchy system between cities were obtained [15, 16]. By combining mobile network traffic data (directional switching vector and overall network traffic data) with social networking site data (Flickr), the spatial analysis method is adopted to reveal the activity hotspots of cities and the travel activities and change characteristics of cities and suburbs in different seasons [17, 18]. Through 8 million Flickr locations and image information the central border in London and Chicago metropolitan areas is determined, using GPS and web tools (can record the time and latitude and longitude, speed, distance, and direction) and connecting with Google maps, to simulate the two cities, 76 tourists in Canberra and Sydney, and the action of trajectory, as well as analysis of tourists travel path, change to the mode of transportation, travel, obstacles, and other characteristics [8, 17, 18]. However, there are few studies on landscape development under the background of big data, and the research on big data focuses on the application exploration and decision support of big data and the application of various big data in landscape layout optimization simulation. Big data has brought about new types of technology and equipment to other industries. For landscape architecture, big data has brought about more changes in planning thinking, allowing professionals to rely more on rational analysis of problems. Planning and design is a problem-solving process. Aiming at complex problems, by analyzing a large number of multiple types of data, it proposes a more suitable solution than traditional data analysis. Only in this way can the planning be more objective and rational.

The types of big data involved include cellphone signaling data, satellite positioning data, social network data, and landscape photos. How to mine relevant data under the nonstationary characteristics of big data? Through the investigation of 4950 interviewees on the relationship between the acquisition of high-quality urban green space and the level of leisure and sports activities, it is found that there is no clear relationship between activities and access to green space [19, 20]. Publicly available via the Internet social produce or provide the geographic mark photos, collected from 2100 tourists, 29,443 photographs, with pictures of these geographic staggered build datasets, can help them address these challenges, as well as, for example, destination, traffic layout optimization simulation, and the management development of series of problems such as providing practical use value [21]. Research on the connotation is of three-dimensional rural complex landscape image layout and the relationship between development mode, layout optimization simulation mode and path, industrial layout optimization simulation, and rural revitalization. Based on the analysis of the new urban-rural relationship, the value content, operation mechanism, and guiding strategy of the three-dimensional landscape image layout of pastoral complex are discussed [22, 23]. Layout of a complex three-dimensional rural landscape image, the concept of value, the tertiary industry relations, and operation mode are analyzed in detail; at the same time, summarizing their participation in three-dimensional rural process of landscape image layout project strategy is complex and difficult, and the complex three-dimensional rural landscape image layout in the advantages and problems in the domestic development is demonstrated [24, 25]. The importance of the development of the landscape image layout mode of 3D pastoral complex in the layout optimization simulation design is listed, and the characteristics of the landscape image layout of 3D pastoral complex are systematically analyzed [26]. The construction contents of the "seven systems" and "seven projects" in the layout of three-dimensional pastoral complex landscape images are introduced in detail, and the layout optimization simulation strategies in terms of industrial system, building rural communities, and joint mechanism of interests are proposed [27, 28].

By learning the data collection and processing technology of big data, the processing mode and guiding method of big data are introduced into the landscape layout optimization simulation, and the processing method of big data is added to the conventional layout optimization simulation program, so as to influence the thinking of layout optimization simulation design and improve the objectivity and scientificness. The main procedure is to introduce the technology of big data collection and processing on the basis of field investigation and site data collection, screen and process the data, and establish a database. By quantifying different types of influencing factors, the thousand-layer cake analysis method is adopted to overlay different data to guide the simulation of landscape layout optimization. The landscape layout optimization simulation method based on the influence of big data was applied to the landscape image layout of 3D pastoral complex, and the similarities and differences were found by comparing the traditional layout optimization simulation method and the layout optimization simulation program of the data-based layout optimization simulation method. The layout optimization simulation design of 3D pastoral complex landscape image layout was studied, focusing on the simulation of road, spatial structure, ecological pattern, and industrial layout optimization of 3D pastoral complex landscape image layout under the premise of ecological environmental protection.

2. Big Data Analysis of Three-Dimensional Rural Complex Image Layout Prediction Analysis

The core of landscape pattern optimization of three-dimensional pastoral complex is to realize the optimization of quantity and space. Through quantitative and qualitative research, specific macro and spatial strategies are provided to provide policy and data support for realizing the ideal landscape pattern of three-dimensional pastoral complex. In this study, the system dynamics model and cellular automata model are mainly used as the land simulation and prediction model to carry out the area and space simulation of the landscape pattern optimization of three-dimensional rural complex [29, 30].

2.1. Image Layout Predictive Analysis Modeling

(1) Understand the problem, define the problem, confirm the target, and determine the macro variable factors that affect its change according to the modeling purpose and prediction object. In this study, the three-dimensional pastoral complex is affected by policy regulation and social economy at the macro level, specifically manifested as economic development, population growth, industrial adjustment, land expansion, and so forth. Therefore, the variable factors of the system dynamics model of three-dimensional pastoral complex should reflect these macro factors, and we call these macro social factors and the system that reflects the area of various three-dimensional pastoral as the complex system of three-dimensional pastoral complex.

(2) Draw the causal feedback diagram of the system according to the logical relationship between the target and parameters; the causal feedback graph is mainly expressed as arrows and diagrams according to the interaction between variable factors. In addition, positive and negative signs are used to show the interaction between the two factors. That is to say, we need to visualize the relationship between factors in the complex system of three-dimensional pastoral complex in graphical ways such as arrows and signs.

(3) Describe the relationship between parameters by mathematical formula and establish the system dynamics model. Through debugging in Vensim PLE software, the quantitative relationship between different factors in the 3D pastoral complex system was simulated. By analyzing the interaction mechanism between social economy and the change of the number of covers in three-dimensional pastoral complex, the relationship between them is analyzed mathematically and logically, so as to realize the influence relationship in the whole system.

(4) Test and verify the model. In order to verify the reasonability of the model, it is necessary to debug the model, compare the relationship between the simulated value and the real value, and usually simulate the data of a certain historical period with the data of the past several stages until the simulation results meet the 10% error range.

(5) Establish a system mechanics simulation and prediction simulation platform to predict the future area change of the three-dimensional rural complex, design multiple scenarios, and use the model to select and simulate strategies. That is, by changing the parameters of the model and testing the posteffects of various scenarios, the opportunity and approach to improve the behavior of the complex system of three-dimensional pastoral complex are sought. Through the prediction analysis and comprehensive comparison under different scenarios, the relative optimal scheme for the coordinated development of social economy and three-dimensional pastoral complex is sought.

Cellular automata modeling process can be understood as actual three-dimensional rural complex, construction land, and unused land allocation process, refer to previous high citation rate research, at the same time combined with three-dimensional rural complex in the evolution of the space characteristics, mainly on the basis of land unit is converted to other types of land suitability, neighborhood unit on its transformation, the inheritance of land unit itself and random interference factors to determine, and focus on the transformation between the Mosaic and the three-dimensional rural construction land. The specific modeling process of cellular automata is as follows, as shown in Figure 1.

The statistical results of stakeholders' power dimension of pastoral complex projects are shown in Table 1. It can be seen that the government, social capital, operators, and farmers' cooperatives rank the top four in the power of pastoral complex projects construction, while users, scientific research institutions, financial institutions, and suppliers of materials and equipment rank the bottom four. It is worth noting that financial institutions and users bear more risks in project construction but have less power. This part of project stakeholders is the vulnerable group mentioned in many studies. Farmer cooperatives rank the third in the risk dimension, but their power somewhat decreases. This is because the resources invested by farmer cooperatives may not reach equilibrium with their power, which will lead to the problem of uneven distribution of benefits in the process of project construction and operation. Since the operation stage of the project is relatively important, the operator has more power over the project. The mean and variance are calculated using the formulas in [19].

Pastoral complex is a multifunctional spatial gathering and combination of agricultural production, residence, leisure, and entertainment in a certain regional space and realizes integrated management of spatial layout optimization simulation, construction, and operation. Urban government is the main body of simulation and construction management of spatial layout optimization of pastoral complex. It mainly guides and restricts each participant through policy support and simulation management of spatial layout optimization, as shown in Figure 2.

2.2. Spatiotemporal Evolution Analysis of Three-Dimensional Pastoral Complex Pattern. Normalized difference vegetation index (NDVI) is defined as the ratio of the difference between the values of near-infrared band and visible red-light band and the sum of the values of the two bands: $\mathrm{NDVI} = (\mathrm{IR}-r)/(\mathrm{IR}+R)$. For TM data, the numbers of near-infrared bands and visible red-light bands correspond to the fourth band (TN4: 0.76–0.9 URN) and the third band (TN3: 0.63–0.69 μm), respectively. NDVI calculation formula is as follows [31]:

$$\mathrm{NDVI} = \frac{\mathrm{TN4} - \mathrm{TN3}}{\mathrm{TN4} + \mathrm{TN3}}. \tag{1}$$

As the NDVI value calculated by the above formula is between 0 and 1, in order to match the 8-bit radiation resolution of Landsat, the result is transformed and stretched, so that its gray value is within [0, 255].

Through to the central city in 1992, 2000, 2008, and 2016, four times each type of three-dimensional rural complex remote sensing interpretation results, by Arcmap statistics, get the three-dimensional rural complex interpretation data statistics (Table 2, construction land and unused land) and the three-dimensional rural complex area change contrast figure (Figure 3, construction land and unused land).

It can be seen from Table 2 and Figure 3 that, during the research period from 1992 to 2016, the total area of the three-dimensional pastoral complex in the central city and the area of a single three-dimensional pastoral complex such as grassland, woodland, cultivated land, wetland, and water area all changed to different degrees, and the overall change was relatively obvious. In general, during the study period, the cultivated land and woodland area of the central city always ranked first and second in the area of the three-dimensional pastoral complex, while the wetland, water area, and grassland always ranked second. In 1992, cultivated land was the dominant type of three-dimensional pastoral complex in the central city, but in 2000, the dominant position of cultivated land was slightly reduced. In 2008, woodland became the dominant type of three-dimensional rural complex in the central city, but the advantage was not obvious. In 2016, woodland has become an obvious dominant type of three-dimensional pastoral complex.

Overall, Table 3 shows that, from 1992 to 2016 (study period), the central city's total area of the three-dimensional rural complex had a declining trend; the reason is that forestland, arable land, grassland, and wetland and water appear in different periods of time, and the three-dimensional rural complex type area reduction is higher than the increase, so the total area of the three-dimensional rural complex declined from 1992 to 2016. From the analysis of the area change of different types of three-dimensional pastoral complex, the area of three-dimensional pastoral complex in the central city of Beijing has been undergoing significant dynamic change. The continuous decrease of the overall area of the three-dimensional pastoral complex, the decrease of the large area of cultivated land, the fluctuation of woodland area, and the increase and decrease of the small area of grassland, wetland, and water area have become the typical characteristics of the area evolution of the three-dimensional pastoral complex in the central city since 1992. In the past 24 years, people have changed the way of land use in the central city through urban construction, which will affect the three-dimensional rural complex pattern of the central city. With the expansion of construction land area, the cultivated land area in the central city of Beijing decreases, and the land productivity decreases. With the increase of grassland area and fluctuation of woodland area, the landscape of the study area will become more fragmented, which will not be conducive to the maintenance of biodiversity in the study area and even affect a series of ecological functions such as heat island mitigation and stormwater retention. Therefore, it is necessary to further study the three-dimensional rural complex pattern in the central city of Beijing.

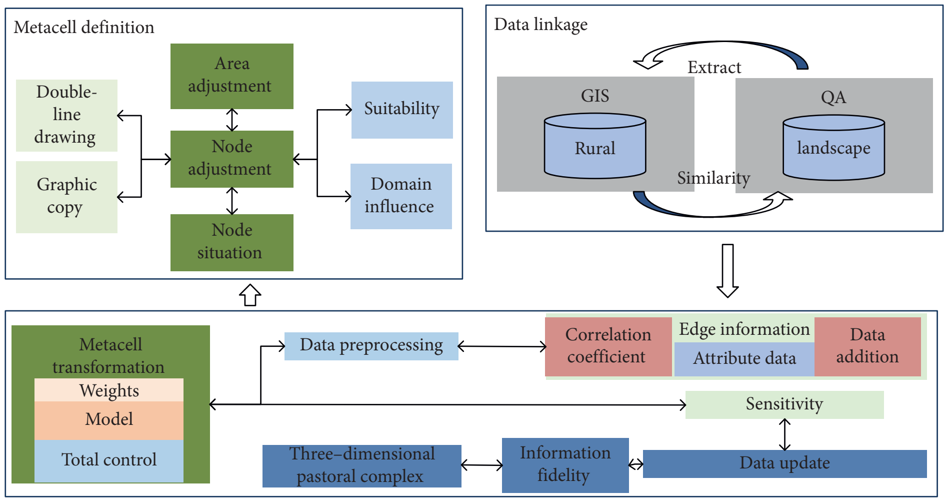

FIGURE 1: Modeling process framework of cellular automata model.

TABLE 1: Data analysis of stakeholder power.

Project stakeholder	Mean	Variance	Sorting
Government (S1)	4.454	1.072	1
Farmers' cooperatives (S2)	3.878	1.232	3
Financial institution (S3)	2.735	1.243	10
(S4) by the designer	3.612	1.013	11
Contractor (SS)	3.836	1.205	6
The supervisor (S6)	3.856	1.401	7
Research institutes (S7)	2.678	1.012	4
Operator (S8)	3.977	1.075	5
Consulting party (integrated)	3.229	1.124	12
Material and equipment supplier (S10)	3.234	1.322	9
The user (S11)	2.515	1.093	8
Social capital (S12)	4.127	1.024	2
Demolition party (S13)	3.304	1.315	13

3. Image Layout Optimization Method for Three-Dimensional Rural Landscape Based on Big Data

As an emerging research direction, big data attracts increasing attention. In 2018, there were 25,745 Chinese literatures with big data as the theme, with a sequential growth rate of 21.40%. The study covered ten disciplines, and landscape architecture was not surprisingly affected. Big data in landscape architecture caused a wave of simulations and researches on layout optimization through quantitative information and played a role in providing new technologies or new methods in each stage of landscape layout optimization simulation. In the early analysis of landscape layout optimization simulation, big data mainly introduces new survey methods, expands the data collection methods, and broadens the data collection scope. The additional relevant information provides the foundation for comprehensive, high-precision, and high-granularity research. For example, the data about the characteristics of the users and the emotional information were added to the data collection, and the positioning information was collected through the network. The research of layout optimization simulation stage focuses on the analysis stage, which is mainly used to discover and mine the relationship between related elements. New data commonly used in layout optimization simulation include location communication data, network text data, and network photos. Positioning because traffic data can reflect the space location and individual behavior, widely used in space function of identification, analysis and use of space structure, road layout optimization simulation of space related problems, such as analysis, as well as the crowd gathers the characteristics of space and time, population distribution, behavior related to human activities such as analysis. Social network is an important channel for public participation layout optimization simulation design due to its wide coverage, fast propagation speed, and good interoperability. Network text data is generated with the development of social networks. By quantifying text and seeking public attention, interest points, and emotional evaluation, it can be used to analyze the advantages and disadvantages of site management and to build an evaluation system. Online photos could not only reflect location data but also reflect the current situation of the site. Superimposing this kind of big visual data on the map can evaluate the space quality, street greening, and road landscape, which is of positive significance to improve the landscape. In the later stage of layout optimization simulation design, big data mainly enriches the feedback platform of the public and establishes an online communication network for the public, layout optimization simulators, and decision-makers through social networks and mobile terminals. Based on the above research, the simulation design framework of landscape layout optimization under the background of big data can be simplified as shown in Figure 4.

First, draw a CAD axis Map, import the CAD Map into the space syntax Depthmap software, use the Convert Drawing Map function to transform the Graph into a layer of Axial Map that can be recognized by the software, and then use the software's Run Graph Analysis function to perform topological calculation on the axis Graph and finally obtain the accessibility Analysis Graph (See Figure 5).

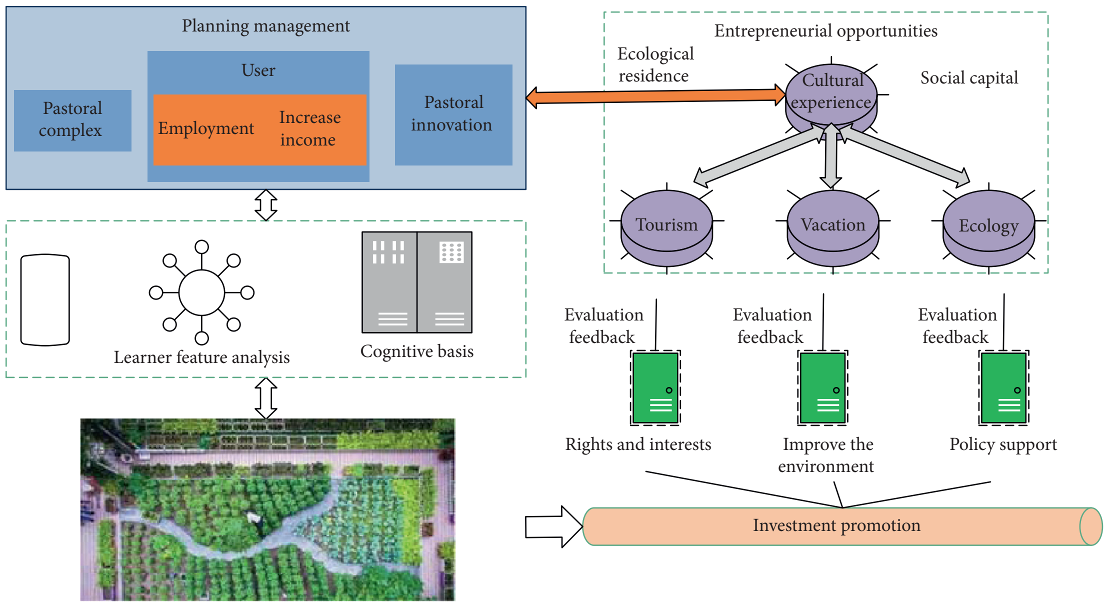

Figure 2: Organizational framework and operation mechanism of multiagent pastoral complex.

Table 2: Statistical table of land type interpretation data [20].

In the class	1992		2000		2008		2016	
	Area	Percentage	Area	Percentage	Area	Percentage	Area	Percentage
Grass	1838	1.68	1918	1.75	2093	1.92	2247	2.07
Arable land	32253	29.62	21172	19.45	10453	9.61	6252	5.73
Construction land	54538	50.08	70498	64.73	80493	73.88	84812	77.85
Woodland	16418	15.06	12403	11.38	14563	13.36	14175	13.02
Wetlands and waters	3866	3.54	2928	2.68	1321	1.22	1437	1.31
Unused	18	0.02	11	0.02	9	0.01	6	0.01

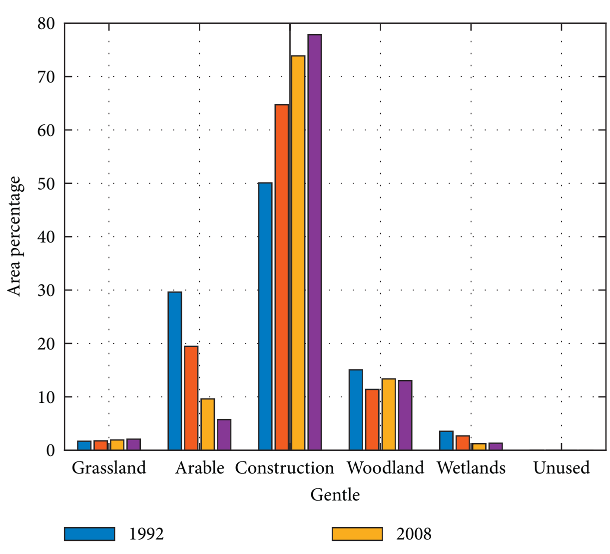

Figure 3: Comparison chart of land use area change in the central city from 1992 to 2016.

The area of each land type within the layout optimization simulation range provided by multiple planning is summarized. According to the ecological capacity of each land type provided by the layout optimization simulation standard of scenic and historic interest areas, the ecological capacity of the land type within the site is defined as shown in Table 4. According to the above formula, the daily space capacity is about 58,100 people, and the annual space capacity is 21,218,500 people.

The area algorithm is adopted to obtain the following formula of tourist mental capacity:

$$\mathrm{Cd} = \frac{B}{B_s} \times \frac{R}{r} \tag{2}$$

In the previous equation, Cd is the psychological capacity of tourism, B is the total area of sightseeing, B_s is the per capita area of sightseeing, and R and r, respectively, represent the service time and visitor's stay time. The minimum sightseeing area per capita is 50 people. The total area of the site is 9,986,900 m^2, so the daily psychological capacity is 459,300 people, and the annual psychological capacity is 167.68 million people.

It can be seen from Table 5 that, among the three factors, ecological capacity is the smallest, which becomes the determinant to limit the environmental capacity of the site. In layout optimization simulation, the development red line

Table 3: Dynamic attitude of land area change of various types.

In the class	1992–2000		2000–2008		2008–2016	
	Area of change	Dynamic attitude	Area of change	Dynamic attitude	Area of change	Dynamic attitude
Grass	81. 82	0.57	175.43	1.15	154. 35	0.91
Arable land	−11083.4	−4.4	−10718.32	−6.64	−4201.66	−5.03
Woodland	−4016.62	−3.07	2158. 63	2.17	−385. 11	−0.34
Wetlands and waters	−935. 94	−3.04	−1607.14	−6.87	116. 09	1.12
Construction land	15960.29	3.64	9993.23	1.76	4319.31	0.65
Unused	−6. 08	−4.72	−1. 93	−2.42	−2. 88	−4.47
Three-dimensional pastoral complex	−15964	−3.68	−9993	−3.26	−4315	−1.92

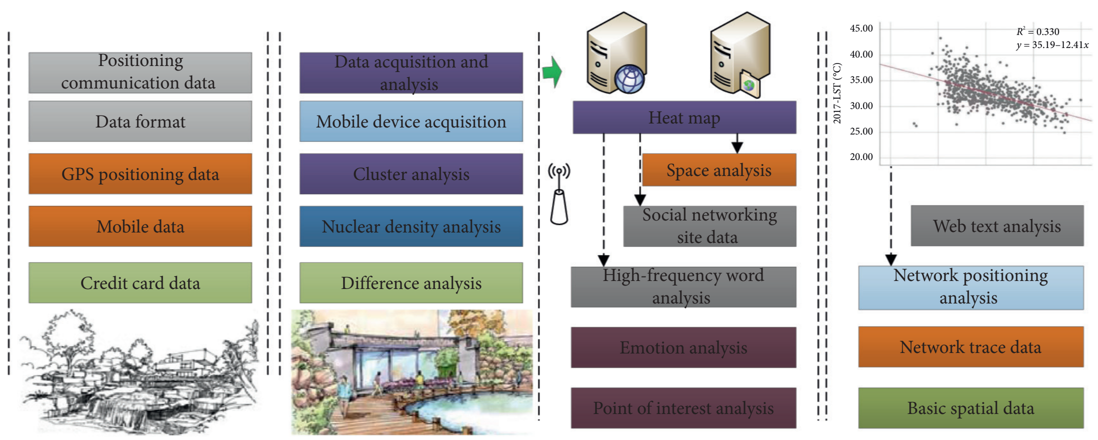

Figure 4: Frame diagram of landscape architecture layout optimization simulation design method based on big data.

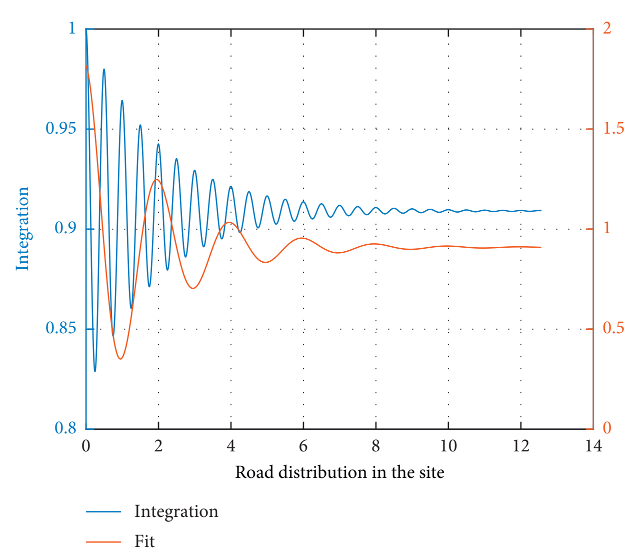

Figure 5: Broken line diagram of road axis conformity.

Table 4: Summary of the project land area and ecological habitat.

Land use types	Area	Ecological capacity
Land for scenic facilities	9.76	102
Rural construction land	124.85	103
Cultivated land (including general and basic farmland)	366.64	505
Class IV protected woodland	4A6.50	1255
River and lake surface	11.28	504

Table 5: Environmental capacity of the project.

	Ecological capacity, Ce	Space capacity, Cs	Tourism psychological capacity, Cp
Daily capacity	5.47	5.82	45.94
Annual capacity	2003.09	2121.86	16769

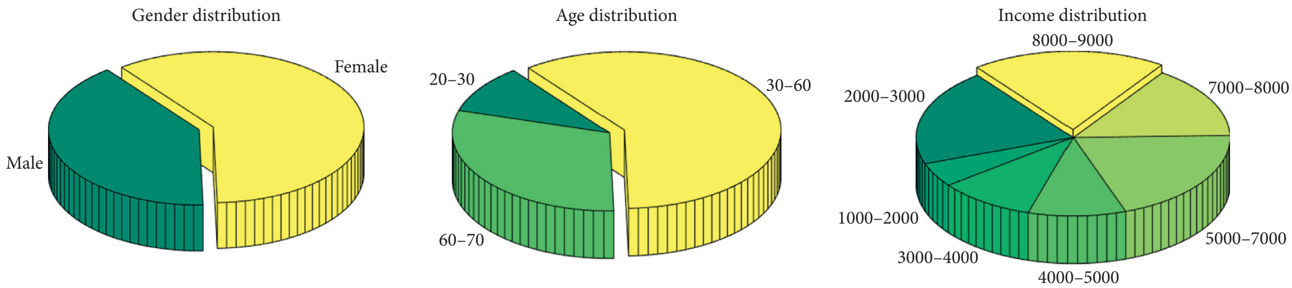

Figure 6: Gender distribution, age distribution, and income distribution.

should be the ecological capacity of 54,700 people per day and 20,309,900 people per year.

4. Experimental Verification

Based on the use of big data, this paper conducts a questionnaire to collect basic information of people and their concerns about the pastoral complex. This survey was conducted by WeChat. A total of 65 questionnaires were received, and respondents were distributed in 11 provinces and 1 municipality directly under the central government. The survey content is divided into two parts: one is the basic information of respondents, and the other is the detailed investigation of the construction of pastoral complex. The first part includes basic information such as gender, age, education, occupation, and income and also registers basic information related to tourism, such as the frequency of travel, destination, duration of travel, and fellow travelers. According to the survey results, as shown in Figure 6, the gender distribution of the respondents is more women than men, mainly between 30 and 60 years of age. Most of them have a bachelor's degree and a graduate's degree, and most of them are college students and company employees. Most people go out for an average of two to three times a year, three to four days each time, mainly to scenic spots and tourist cities, and most people go out with friends and family.

The investigation on the content and interest points of pastoral complex is carried out from eight aspects, namely, tourism motivation, types of pastoral complex, elements of pastoral complex, tourism commodities, activities, accommodation forms, simulation points of layout optimization, and regional location. Among the 65 respondents, 64 indicated that they would like to travel to the countryside or take a vacation. Most of them travel to the countryside mainly for rural sightseeing, entertainment, relaxation, and cultural experience. Among the six different types of pastoral complexes, sightseeing and comprehensive and cultural communication pastoral complexes are favored by people. In the nine different elements, natural scenery, local food, farmland landscape, local culture, and living environment are the key points of people's attention. Local specialties, folk customs products, creative cultural products, and agricultural products account for more than 60% of the tourism commodities. Among the 8 kinds of activities, pastoral tourism, folk custom activities, cultural experience, and farming experience account for up to 50 percent. In the form of accommodation, the proportion of home stay, shared farm, and characteristic hotel is more than 50%. For the elements of pastoral complex, tourism commodities, activities, accommodation forms, and tourism motivations, the proportion of person-time is adopted, as shown in Figure 7.

As for the project positioning of building a healthy and nourishing rural complex with urban backyard garden, all respondents expressed that it was reasonable, as shown in Figure 8. The project positioning of the survey rationality evaluation highlights the characteristics of the site, mainly because the project positioning combines local resources; in response to national policies, development under environmental protection conditions can also drive local development: implementation feasibility is higher.

According to the classification of S and *R*, public participation can be divided into three types and eight levels, from false (nonfalse) participation to substantive participation, and the degree of participation gradually increases (see Table 6). At present, the level of conventional participation is mainly informed participation, and the level of participation is relatively shallow. In this paper, a participatory layout optimization simulation design program is established by collecting big data and investigation. In the preliminary analysis, the opinions of villagers and netizens were investigated. In the layout optimization simulation fully consider the opinions; after the layout optimization simulation is completed, people's ideas will be understood in the form of video and questionnaire. The level of public participation includes informed participation, cooperative participation, and decision-making participation, which greatly improves the level of participation.

The participatory layout optimization simulation method is introduced in the layout optimization simulation of rural complex, which is helpful to build the communication platform. Everyone has different choices due to

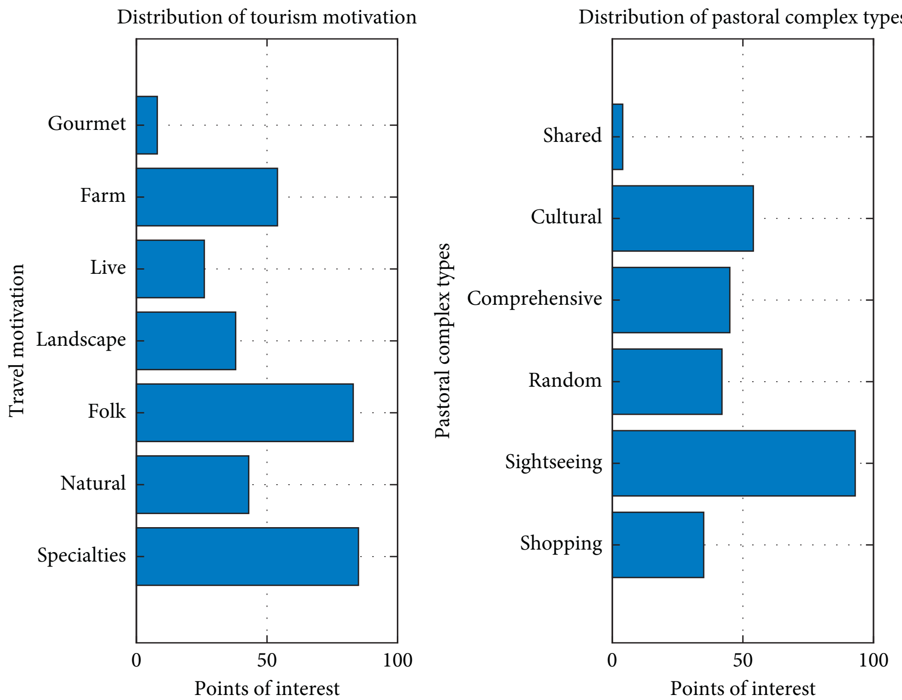

Figure 7: Distribution of tourism motivation and distribution of pastoral complex types.

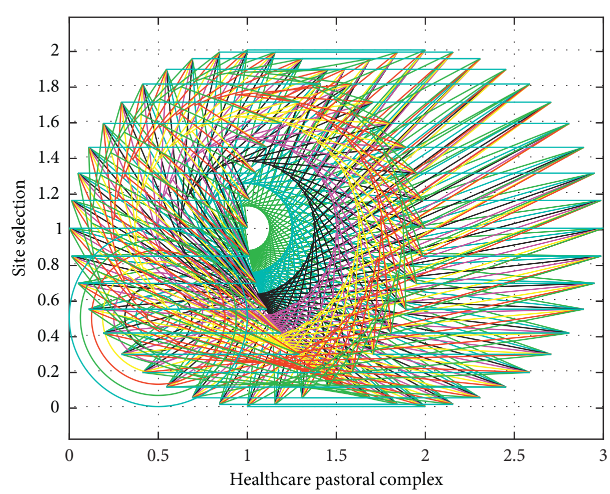

Figure 8: Proportion chart of rationality evaluation of project positioning.

Table 6: Public participation levels of SR.

Level of public participation		
Public participation	False participation	Operational participation Educational participation
	Symbol in	Informed participation Consultative participation Restricted participation
	Substantial participation	Cooperative participation Representative participation

different living environment, education level, working environment, and so forth. Participatory layout optimization simulation can provide a platform for communication, which can be used to express ideas and guide layout optimization simulation. It is also a platform for mutual learning. Professionals have professional knowledge reserves but lack the understanding of site information. Although the public have no professional knowledge, they have a good grasp of the site information, especially the cultural aspects that cannot be consulted on the Internet or in the literature. The communication between the two is conducive to a comprehensive understanding of the site, as well as layout optimization simulation design with cultural characteristics of the scheme.

5. Conclusion

The landscape layout optimization simulation design based on the background of big data can apply big data and big data technology to every stage of layout optimization simulation. In the preliminary analysis, big data provides layout optimization simulation with a wider range of more comprehensive basic data and information about crowd concerns. In addition to the new data, it also introduces a lot of analysis methods, such as regression analysis, factor analysis, emotion analysis, time series analysis, and nuclear density analysis, providing a channel for in-depth mining of the information behind the data. In the late stage of layout optimization simulation, the visual presentation mode enables more people to understand the intention and effect of layout optimization simulation. In combination with the public feedback platform of big data, modification suggestions are provided for layout optimization simulators. In the process of constructing layout optimization simulation framework, the authors found that although big data brought about changes in layout optimization simulation thinking, update of analysis methods, new technologies, and other influences, big data mainly played the role of supporting analysis in the whole layout optimization simulation. We should embrace the impact of big data with an open mind and at the same time be rational in its use. Rationally view the positioning of big data in layout optimization simulation; Face up to the difference between rational and perceptual analysis methods and combine them; only in this way can the power of big data be brought into play. Against the background of big data, a simulation program for layout optimization of pastoral complex is constructed, in which the application of big data in pastoral complex mainly focuses on the early analysis and the late feedback. In the early analysis, the global consciousness of big data plays a huge role in the analysis of the overall layout, which enables the layout optimization simulator to consider the site in a larger scope. At the same time, based on big data analysis, it can understand and master the interest points and basic features of the public, which is conducive to providing targeted activities. On the basis of previous analysis, the influence of big data on layout optimization simulation is mainly focused on spatial analysis and layout optimization simulation, such as function partition, spatial structure layout optimization simulation, and spatial quantization. Big data plays a guiding role. The greater influence of big data on layout optimization simulation of rural complex lies in that it provides a communication platform for layout optimization simulation designers, farmers, and decision-makers, deepening the degree of participatory layout optimization simulation. Affected by professional optimization of the 3D pastoral landscape, research time and way of thinking, the depth and breadth of model construction, research methods, and problem-solving ideas are obviously insufficient, and the angle of innovation is not enough, which may lead to certain problems in research bias.

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 known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This work was supported by 2019 National Office of Philosophy and Social Sciences Ethnology project: the evolution of the Miao Ethnic Costume Culture and the Transformation of Contemporary Innovation in Wuxi Valley (Project no. 19BMZ083).

References

[1] Y. Yang, D. Z. Luk, H. Zhou, C. Yan, D. Zhou, and X. Zeng, "Layout decomposition Co-optimization for hybrid E-beam and multiple patterning lithography," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, vol. 35, no. 9, pp. 1532–1545, 2016.

[2] M. R. Amer, S. Yousefi, and S. Todorovic, "Monocular extraction of 2.1D sketch using constrained convex optimization," *International Journal of Computer Vision*, vol. 112, no. 1, pp. 23–42, 2015.

[3] Q. Yu, Y. D. Yue, M. FangKai, H. Ma, Q. Zhang, and Y. Huang, "Optimization of ecological node layout and stability analysis of ecological network in desert oasis: a typical case study of ecological fragile zone located at Deng Kou county(inner Mongolia)," *Ecological Indicators*, vol. 84, no. 1, pp. 304–318, 2018.

[4] S. Yamauchi, S. Yamasaki, and K. Yaji, "Multidisciplinary layout design optimization method using multi-fidelity analysis model inspired by the explicit method (application to layout design problem considering a heat dissipation characteristic)," *Transactions of the Jsme*, vol. 83, no. 855, pp. 320–337, 2017.

[5] M. Galun, I. R. Basri, and I. Yavneh, "Review of methods inspired by algebraic-multigrid for data and image analysis applications," *Numerical Mathematics: Theory, Methods and Applications*, vol. 8, no. 2, pp. 283–312, 2015.

[6] P. Buccella, H. C. Stefanucci, R. IskanderMoursy, J.-M. Sallese, and M. Kayal, "Methodology for 3-D substrate network extraction for SPICE simulation of parasitic currents in smart power ICs," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, vol. 35, no. 9, pp. 1489–1502, 2016.

[7] S. Koranne, "Design and analysis of silicon photonics wave guides using symbolic methods," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, vol. 34, no. 3, pp. 341–353, 2015.

[8] S. M. Wang, S. Ma, and W. Y. Duan, "Seakeeping optimization of trimaran outrigger layout based on NSGA-II," *Applied Ocean Research*, vol. 78, pp. 110–122, 2018.

[9] T. Liu, J. H. Zhu, and W. H. Zhang, "Integrated layout and topology optimization design of multi-component systems under harmonic base acceleration excitations," *Structural and Multidisciplinary Optimization*, vol. 59, no. 5, pp. 1053–1073, 2019.

[10] R. Chen, V. K. Singapura, and V. K. Prasanna, "Optimal dynamic data layouts for 2D FFT on 3D memory integrated FPGA," *The Journal of Supercomputing*, vol. 73, no. 2, pp. 652–663, 2017.

[11] J. Lim and K. M. Lee, "Design of electromagnetic actuators using layout optimization with distributed current source models," *IEEE/ASME Transactions on Mechatronics*, vol. 20, no. 6, pp. 1–10, 2015.

[12] P. Buccella, C. Stefanucci, and J. M. Sallese, "Simulation, analysis, and verification of substrate currents for layout optimization of smart power ICs," *IEEE Transactions on Power Electronics*, vol. 31, no. 9, pp. 53–67, 2016.

[13] A. Chvála, J. Marek, A. Šatka et al., "Analysis of multifinger power HEMTs supported by effective 3-D device electrothermal simulation," *Microelectronics Reliability*, vol. 78, pp. 148–155, 2017.

[14] C. Sun, W. J. Zhao, and W. Huang, "New insight into complex mode matching method for modeling and simulation of surface-emitting grating couplers," *Journal of Lightwave Technology*, vol. 37, no. 3, pp. 839–844, 2019.

[15] C. J. Smith, M. Gilbert, and F. Derguti, "Application of layout optimization to the design of additively manufactured metallic components," *Structural and Multidisciplinary Optimization*, vol. 54, no. 5, pp. 1297–1313, 2016.

[16] L. Meng, J. Wu, and J. Dong, "Spatial differentiation and layout optimization of rural settlements in hill ecological protection area," *Transactions of the Chinese Society of Agricultural Engineering*, vol. 33, no. 10, pp. 278–286, 2017.

[17] L. He and M. Gilbert, "Rationalization of trusses generated via layout optimization," *Structural and Multidisciplinary Optimization*, vol. 52, no. 4, pp. 677–694, 2015.

[18] S. Peng and J. An, "Prediction and verification of risk loss cost for improved natural gas network layout optimization," *Energy*, vol. 148, no. 4, pp. 1181–1190, 2018.

[19] M. I. Alam and R. S. Pant, "Multi-objective multidisciplinary design analyses and optimization of high altitude airships," *Aerospace Science and Technology*, vol. 78, no. 6, pp. 248–259, 2018.

[20] J. Y. Han, Y. M. Kim, Y. L. Rhie, S. H. Ahn, H. Choi, and M. H. Yun, "Design optimization of control layout for naval mfc (multi-function console) using A modified layout analysis method," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, vol. 59, no. 1, pp. 1351–1355, 2015.

[21] O. L. Sgrott, D. Noriler, and H. F. Meier, "Cyclone optimization by COMPLEX method and CFD simulation," *Powder Technology*, vol. 277, pp. 11–21, 2015.

[22] X. Shang, J. Zhou, and F. Zhuo, "Analysis of crack for complex structural parts and simulation optimization during hot forming," *International Journal of Advanced Manufacturing Technology*, vol. 80, no. 1-4, pp. 373–382, 2015.

[23] Y. Chen, H. W. Wang, and S. H. Zhang, "Forging process design and simulation optimization of a complex-shaped aluminium alloy component," *Materials Science Forum*, vol. 941, pp. 784–789, 2018.

[24] G. Liuzzi, V. S. Lucidi, and V. Piccialli, "Global optimization of simulation based complex systems," *Uncertainty Management in Simulation-Optimization of Complex Systems*, vol. 59, pp. 173–202, 2015.

[25] A. Rheinlaender, U. Leser, and G. Graefe, "Optimization of complex dataflows with user-defined functions," *ACM Computing Surveys*, vol. 50, no. 3, pp. 38.1–38.39, 2017.

[26] H. Kulhari, M. K. D. Pooja, and A. S. Chauhan, "Optimization of carboxylate-terminated poly (amidoamine) dendrimer-mediated cisplatin formulation," *Drug Development and Industrial Pharmacy*, vol. 41, no. 2, pp. 232–238, 2015.

[27] R. J. Park and S. H. Byun, "Optimization of a neutron long counter design by monte carlo simulation," *Health Physics*, vol. 117, no. 3, pp. 300–305, 2019.

[28] H. Z. Zhang, X. Liu, and W. J. Yi, "Reinforcement layout optimization of members under complex stress states and multiple loading cases," *Journal of Hunan University (Natural Ences)*, vol. 41, no. 9, pp. 42–47, 2014.

[29] R. Brogna, J. Feng, and J. N. Srensen, "A new wake model and comparison of eight algorithms for layout optimization of wind farms in complex terrain," *Applied Energy*, vol. 259, pp. 114189–114202, 2019.

[30] Y. D. Sun, Q. R. Chen, and W. J. Sun, "Numerical simulation of extrusion process and die structure optimization for a complex magnesium doorframe," *The International Journal of Advanced Manufacturing Technology*, vol. 80, no. 1-4, pp. 495–506, 2015.

[31] M. Freitag and T. Hildebrandt, "Automatic design of scheduling rules for complex manufacturing systems by multi-objective simulation-based optimization," *CIRP Annals*, vol. 65, no. 1, pp. 433–436, 2016.