Application of Big Data Technology in Urban Greenway Design

Shiyao Liu

College of Architecture, Xi’an University of Architecture and Technology Huaqing College, Xi’an 710043, Shaanxi, China

Correspondence should be addressed to Shiyao Liu; liushiyao9078@163.com

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Abstract

With the continuous advancement of big data technology, there are many drawbacks in the past urban greenway design. The environment, population distribution, geographic location, spatial distribution, and other factors affect the greenway design. At the same time, a large amount of historical data is mixed. The systematic arrangement has indirectly led to the fact that urban greenway design does not know how to analyze and use past data. There is always a waste of various resources. While greenways bring many positive impacts, they also have negative impacts: it is difficult for the wild animals in the greenways to move along the predetermined passages, and most animals spread in the greenways in a disorderly manner, so that the greenways accelerate the invasion of alien species and diseases to a certain extent. Using big data technology can enable us to allocate resources more reasonably and accurately. The purpose of this article is to study the use of big data technology to rationalize our urban greenway design. This paper adopts a calculation method that closely combines quantitative and qualitative features to study its features. The local feature analysis algorithm can extract and analyze urban spatial data. Spatial remote sensing image technology can deepen our knowledge and understanding of urban spatial characteristics, conduct data mining, provide all the information of urban space, analyze the content and type, and classify it; then filter and integrate the big data in the greenway planning and design information. The information about greenway planning and design in the big data of Dao Design is digitized. This information can be composed of traditional data and dynamic data. Finally, after scientific analysis, the data is subjected to scenario assumptions, modeling, and output, we applied various analysis results to actual operations, and we obtain the final inspection. In fact, this is also going out from actual work, summing up the experience we have done, and again starting from the perspective of specific practice. Compared with our traditional field investigation before, with the guidance of big data analysis, the experimental results of this article show that under the use of big data technology, the wrong resolution of the SegNet semantic classification algorithm for buildings is 9.6%, and the others are 10.9%, 16%, 20%, etc., which are all greater than 9.6%, so the segNet model has a higher image acquisition accuracy. It can solve the problems caused by the lag of the past questionnaires and the small sample size, improve the accuracy of data extraction through algorithms, find some features and problems of greenway design, and complete the urban greening rate through computer algorithms. Calculation and analysis can better provide the most reasonable method for greenway design site selection and route selection.

1. Introduction

1.1. Background. In recent years, the state of the ecological environment has become particularly important in our hearts. The environment was abandoned in order to develop the economy. Now people are aware of the importance of sustainable development. The theory and application of greenway design are currently in urban construction and ecology. One of the hot research topics in other aspects, a lot of data are generated in the process of economic development. These data can not only be applied to urban greenway design but also reflect the development status of various aspects of the city. In the face of these complex data, how to effectively manage these data and reasonably apply them to urban planning and development has become one of the main problems facing urban greenway design. In the era of big data technology, the advancement of information technology has become an inevitable trend that has played a pivotal role in practical applications and can support the development and optimization of multiple industries [1, 2]. In the future, big data technology will be applied to almost all fields.
1.2. Significance. With the advent of big data, earth-shaking changes have taken place in all walks of life. Focusing on the modernization and development of cities, it is necessary to strengthen the application of information technology in urban planning and design to avoid problems—lack of planning, lack of technology, and no breakthrough in transformation. With the rapid development of science and technology, it has become more and more complicated in urban design. At the same time, urban greenway planning is unreasonable, and problems such as old houses and infrastructure in the city that have not been updated for too long have gradually emerged. This will also become our urban planning. Obstacles in development: the development of cities reflects the progress of our human beings. Using big data technology to assist in the work of urban greenway design can not only improve people’s happiness in life, but also optimize people’s living environment and better adapt to the changes of the times [3]. From development to improving cities and urban functions, in order to develop the economy, some cities do not hesitate to sacrifice the environment to pursue temporary results. Later, they need to use more energy to make up for the wounds at the time. This is why big data technology is used. Come to carry out the importance of urban green road design research.

1.3. Related Work. Reading a lot of literature, the research on greenway design has not stopped since the nineteenth century. Previously, because data collection required a lot of manpower, material resources, and financial resources, with the advent of the information age, a series of problems in the design of urban greenways have been improved and promoted to more and more positive aspects. Ye et al. proposed in the era of big data to be an indispensable part of modern urban construction. This research is forward-looking, but because science and technology are not so perfect [4], Liu et al. believe that big data is corroding heat exchangers. High-voltage early warning system, when the machine will fail, is found in the historical data, and the early warning is issued before the failure [5]. In the nineteenth century, there were greenways. After this concept of greenways emerged in various trends, Han et al. studied the process of the combination of Harbin’s tourism resources and the construction of greenways. Create different greenways through different geographical environments and build a tourism resource network of integrated greenway types [6]. But there are still some limitations in the research, and the environment of Harbin is more unique. It is not suitable for large-scale reengraving applications. At this time, a data platform is needed to integrate so that the big data greenway design can better serve the residents. The difference is that the author combines big data technology with greenway design. Through the accuracy and precision of the computer, different urban greenways have been created. Different from them, the authors combine big data technology with greenway design and use the precision and precision of the computer to create different urban greenways so that the urban greenway design is the best and most reasonable [7, 8]. Really do the best in urban planning.

1.4. Innovation. The difference of this article is that the acceleration of urban development, the resources, and the environment in urban greenway design are undergoing complex changes. The data we obtain is also ever-changing, and we analyze these complex data. Data can also achieve cross-use of information, using big data technology to predict and analyze whether these data can be used in which aspects. With the continuous progress of science and technology and the improvement of productivity, we have ushered in the era of big data. All over the world, every minute and every second, massive amount of data is produced, analyzed, and used. Big data contains not only structured data but also a large amount of unstructured data. Compared with traditional data, the data volume is huge, the value is rich, and the acquisition speed is faster. Facing the wave of big data sweeping the world, government statistics departments, as data producers and managers, must actively respond to the opportunities and challenges brought by big data under the new situation and turn pressure into motivation. It reflects the humanization, intelligence, and visualization of big data technology in urban planning. Using the precision and accuracy of computers, we can filter and apply this complex information to the design values of urban greenways, reducing the workload of processing data and improving efficiency. At the same time, computer programming can promote the rationalization and standardization of urban greenway design. In this era of information sharing, the development of cities is constantly affecting us, and accordingly, we are also affecting the development of cities, and we should also contribute our strength to the development of urban greenways. Using the combination of big data technology and greenway design, a distinctive urban greenway is created through the accuracy and precision of the computer. Add more fun to people’s lives. However, there are disputes between maintaining large patches and reducing fragmentation in greenways; the planning and construction of greenways may lead to the homogenization of landscapes and make them lose their own cultural characteristics, etc.

2. Theories and Methods Related to Urban Greenway Design

This paper conducts research through quantitative and qualitative research methods, through qualitative analysis of greenway design and big data development, and through quantitative analysis of data extraction from big data algorithms. (1) Bibliometric method, by reading a large number of relevant documents, we summarize the main characteristics of greenway design, we carry out data processing for relevant documents, and we can make statistics based on the number of years, and then according to this data processing has an important influence on the development of greenway design. The law of change of greenway design and development expressed in the literature is summarized and summarized. (2) Case analysis method is used to collect data on greenway design in various cities at home and abroad, and the diversity of data provides an opportunity for urban greenway design. The cornerstone of
2.1. Application of Information Technology. Geographical information system is a system used to organize data. It is generally used in the construction of urban buildings [10]. It organizes and analyzes the collected data and then applies it to urban planning through analysis. The integrated query shows that, according to the accuracy and practicality of the displayed big data, the problem of information duplication in the previous geographic information is reduced. It broadens the application of geographic information technology and provides a wealth of reference information for urban greenway design. It has a large amount of basic data to measure the effectiveness of the application and the utilization of the project. Reasonably plan urban green road resources, use the integration of big data technology to increase storage capacity and management capabilities, and create effective information management and distribution for the implementation of applications through a greenway to accelerate the application of life information, as an Internet connection, by Green city applications through a greenway to accelerate the application of geographic information technology and provide a wealth of reference information for urban greenway design. It has a large amount of basic data to measure the effectiveness of the application and the utilization of the project. Reasonably plan urban green road resources, use the integration of big data technology to increase storage capacity and management capabilities, and create effective information management and distribution for the implementation of applications through a greenway to accelerate the application of life information.

By establishing a new data processing model to deal with. The big data relationship breaks through the traditional causal relationship and is related; the correctness and accuracy of big data may be at risk, and due to the vague ownership, there is also a privacy risk. Big data technology can be widely used in various industries, and various industries continue to provide him with first-hand information, as shown in Figure 1:

2.2. Application of Big Data Technology Basis. Big data has gradually become an important basis for research in the field of urban planning and green road design. In areas established with high urbanization, the main tool for optimizing urban space is the renewal and optimization of space based on reserves. The corner of large-scale economic data based on large-scale economic data, big data on health data, types of big data, and various types of big data, such as big data in the geospatial field, will be standardized design in the field of planning, urban economy. The relationship between population and population health and cultural self-esteem and the relationship between urban vitality planning and dynamics and its interaction mechanism [16]. From an intermediate and microperspective, using high-quality data and data of street scenery to evaluate the landscape and usability of various spatial locations in the city, it is possible to create favorable practical ideas to increase the city and development in terms of its subjective view of landscape perception of the level of environmental justice horticulture. Since the barriers to obtaining big data are destroyed, the barriers to data based on data modeling the relationship between population and modeling of cities, land, buildings, transportation, industries, and the increase in data accuracy and accuracy have increased the dussiness. The development of processing technology and the field of urban green, creating a planning decision model field is an important future direction [17]. Reasonable greenway design can not only bring about ecological changes but also continue to provide us with many conveniences. As shown in Figure 2, the model can plan various possible spatial strategies for future cities in the green field of developing countries and provide scientific advice for decision-making, such as the establishment of an urban green system and other procedures [18]. In short, the application of large-scale data in green planning projects still has huge potential. Designers and researchers must strengthen the mining and research of big data according to modern characteristics and needs so that they can more effectively influence urban planning and urban planning and construction.

2.3. Semantic Model. The overall architecture of SegNet is shown in Figure 3. The network model is mainly composed of an encoding network, a pixel-by-pixel classifier, and a decoding network. Each convolutional layer is followed by a batch specification layer and a ReLU activation function. The coding network transforms high-dimension into low-dimension and realizes the transition from high-dimension to low-dimension. The coding network can get more translation invariance features through multiple large operations, but it also loses the basis of subdivision, such as the boundary information of the feature map. Therefore, it is necessary to write down the maximum pooling request information in the encoding process, keep the position of the maximum feature value, and then extract the input feature map from the maximum pooling index information.

Ensure that boundary information can be preserved. The decoding network uses the maximum pooling index information of the corresponding feature layer saved during the downsampling of the encoder to project the low-resolution feature map to the high-resolution feature map, achieving the conversion from low-dimensional to high-dimensional [19]. Using the maximum pooling index
in the decoding process has several advantages: first, it optimizes the boundary contour description; second, it reduces the number of parameters, and third, it can be practiced end-to-end; the sampling method can also be applied to any encoding-decoding network. In the last decoder, the high-dimensional feature representation vector is output as the input of the trainable Softmax classifier.

2.4. Local Characteristic Analysis Algorithm. When using the local characteristic analysis algorithm, the important characteristics of the data stored in cloud computing in the scattered data can be obtained [20]. The important characteristic that can be obtained is that when the large-capacity data is scattered and stored, we can set it as the basic data. The computer network will have a certain delay, and the algorithm will not be affected by the network delay. Compared with the importance of the data in adjacent fields and the feature value of the data, the data can be found using the plane, the best classification, comparing a large amount of data stored in the computer, using the best classification of the plane, dispersing in the cloud computing big data classification of duplicate data in storage devices [21]. Convert the data classification problem to the best plane solution problem.

\[
p(F) = \sum_{j=1}^{r} f_j - \frac{1}{2} \sum_{j,k=1}^{r} f_j f_k w_j w_k (l_j \cdot l_k),
\]

where \( p(f) \) is the quadratic discriminant function, which is the product of two vectors, \( w \) is the classification threshold, \( w_k \) and \( w_j \) are the classification thresholds representing the two vectors of \( l_k \) and \( l_j \), and \( f \) is the weight vector. \( R \) is the largest vector, and the optimal classification plane must meet the following conditions:

\[
\begin{align*}
\sum_{j=1}^{r} f_j &= 0, \\
f_j &\geq 0 \quad j = 1, 2, 3 \ldots p.
\end{align*}
\]

If the features in the data in the big data distributed storage under cloud computing produce nonlinear transformations, then the dot product in the optimal classification function should be replaced by the inner replacement [22]. Then the optimal classification plane solves the problem and the transformed result can be obtained as shown in

\[
p(f) = \sum_{j=1}^{r} f_j - \frac{1}{2} \sum_{j,k=1}^{r} f_j f_k w_j w_k (l_j \cdot l_k). 
\]

Formula (4) is the optimal classification function of

\[
g(y) = \text{sgn} \left( \sum_{j=1}^{r} f_j w_j m(l_j \cdot l_k) + c' \right).
\]

The final extraction of data classification leads to the distributed storage of big data in cloud computing. At present, the conversion of these two classifications generally leads to one-to-many and one-to-one classifications [23]. Considering the difficulty of big data distributed data in cloud computing and a large number of characteristic values of the data, the conversion operation of data classification in big data distributed storage in cloud computing should be performed using a separate classification. Through such classified data, we can better extract data about greenway design [24].

In order to obtain the best data distribution strategy, the cost formula is to integrate the overall information of each
item, which can evaluate the communication cost of the data. The cost formula used in this article is as follows:

$$\text{sum} = g(y) \sum_n \cos t(n_j).$$  \hspace{1cm} (5)

Among them, the sum is the communication cost corresponding to the entire data distribution; $g(y)$ is the classification result of the redundant data in the big data distributed storage under cloud computing obtained in the previous section, $\cos t(n_j)$ is the communication cost corresponding to the distribution of the data fragment $n_j$. Its calculation formula is shown in the following formula:

$$\cos t(n_j) = t_s(n_j) + t_w(n_j).$$  \hspace{1cm} (6)

Among them, $s$ and $w$ represent different things, and the corresponding classification and communication cost of the
data segment $n_j$ allocation strategy are described by $t_s(n_j)$ and $t_w(n_j)$, and its calculation formula is as follows:

$$t_s(n_j) = \sum \sum_{d_k} \text{delay}(d_k, d_c) \min,$$

(7)

$$t_w(n_j) = \sum \sum_{d_k} \text{delay}(d_k, d_c),$$

(8)

where $d_k$ is the site where things $s$ and $w$ appear, and the site where the fragment $n_j$ is saved in the allocation strategy is set to $Sc$ [25]. When the allocation strategy has redundancy, $Sc$ is not unique, and the corresponding value of delay $(d_k, d_c)$ is not unique either [26]. Formula (7) $\sum \text{delay}(d_k, d_c)$ is the minimum value; formula (8) $\sum \text{delay}(d_k, d_c)$ replaces the sum of numbers.

In order to extract appropriate data to study urban greenway design, we need to choose a more stable process. The first step is to calculate the overall fitness value and display it in descending order. The number obtained is $ik$; then set a parameter to $1/ik$, and then use formula (9) to gradually calculate the selection probability of each individual in order, where the number of each individual is $b$ [27].

$$c_b = c_0(1 - c_0)^{j-1} \frac{1}{1 - (1 - c_0)^{ik} c_b}.$$  

(9)

In order to improve the accuracy of data acquisition and in order to acquire data related to greenway design, the sparse principal component method is used to acquire database feature data graphs. Suppose that $\mu_{drt}$ represents the result of extracting the $j$-th feature data sample, and $h(j')$ represents the principal component of the extracted $j$-th feature data, and $c_{j'ty}$ represents the contribution rate of the principal component of the correct feature data by the following formula:

$$s_{wer} = \frac{\mu_{drt} \odot h(j')} {c_{j'ty}}.$$  

(10)

Among them, the higher the value of $s_{wer}$, the higher the accuracy of the corresponding feature data extraction.

$$\omega_{tp} = \frac{s_{wer} \times \lambda_{fj} \times \lambda_{j'ty} \times H(i')}{C_{FTY}},$$  

(11)

$$\beta_{wp} = \frac{s_{wer} \times \lambda_{j'ty} \times H(i')}{C_{FTY} \times \mu_{drt}}.$$  

(12)

It can be seen from equations (11) and (12) that the lower the value of equations (11) and (12), the more accurate the data we extract.

3. Taking the Scene to Understand the Urban Greening Distribution Experiment

3.1. The Purpose of the Experiment. In recent years, more cities have joined the ranks of green space construction, and urban greenways have gradually become the focus of attention and research in many disciplines such as landscape planning and design, ecology, and urban planning and design. In order to make urban greenways better serve the citizens and improve the livability and happiness index of urban residents, it is necessary to analyze and study the evaluation of the suitability of greenways by tourists and to find out the factors that affect the suitability of greenways, in order to adjust the greenway. The focus of road planning and construction is to give better play to the landscape, social and ecological benefits of urban greenways. In the era of big data information, data sources and analysis methods are constantly updated. The latest data types and data required by urban planning, greenway design, and various industries can be found on the Internet to complete data analysis out [28]. Big data used in urban planning can also be applied to green space planning and design, including mobile-level data, social network data, map service POI data, data generated by public participation, and flow sensor data. Even if the data sources are the same, the goals and key issues to be solved are different. The real-time nature of data generation. The data obtained according to big data technology is all real-time. This article divides the data into real-time data collection and later activity information data upload and analyzes the data characteristics and application methods to provide urban greenway design. Big data has become a wave of the times sweeping the world. All over the world, massive amounts of data are being produced, shared, and used at any time. Many developed countries have formulated big data development strategies. As a government functional department that produces, manages, and publishes statistical data, government statistical agencies must conduct research, think, and actively respond to the impact and challenges brought about by big data. They must objectively analyze and effectively formulate methods and strategies for using big data in government statistics, improve statistical production methods, and promote the development of statistical productivity.

3.2. Subjects. The research scope of this article is 400 square meters in the total planning area of Chongqing Central Ring Road. From 2000 to 2020, the urban greening rate has increased from about 20% to 45%, and the per capita public green space has increased by 6 times compared with 2000. Although the central and metropolitan cities, especially the construction of internal environmental greening projects, are still entering the stage of repaying this historical old account, due to the high population density and rapid development capacity of the central area of Chongqing, research on this high-density area can provide guidance for the reasonable planning of the quality of green space in the high-density area of the city.

3.3. Experimental Procedure. The research is completed and executed in 5 stages. As shown in Figure 4, first, through the acquisition of Baidu Street View api, the data of Chongqing Central Street Road Network is extracted and based on the street view road network data, the location of the sampling location, geographic coordinates, and other data and the
sight direction determined by each adjusted location, and then finally passed the use of Baidu Street View API [30]. httpurl in order to obtain a large amount of street view data, and then process the data of each street view by using data sorting and image segmentation technology based on machine learning related algorithms to eliminate seasonal factors that easily affect the interpretation of the video ratio. Extract the video recording visibility of each sampling point. Then, using spatial network analysis tools to quantify the behavior and accessibility of daily commuting areas. In this way, the route and plan of the greenway design can be calculated [31].

4. Test Experiment Analysis

4.1. Semantic Model. From classic classification algorithms to basic learning algorithms and semantic classification algorithms, the Kappa coefficient, overall accuracy, and F1 values of buildings after classification continue to improve, as shown in Figure 5. The SegNet semantic classification algorithm is used in high spatial resolution remote sensing image buildings. To perform the extraction of objects, the PSPNet semantic classification algorithm [32]. The Kappa, overall accuracy, and F1 value of the classification using the SegNet semantic classification algorithm are all changing in a good direction; the segNet model is lower than the Kappa, overall accuracy, and F1 value of the other five classification algorithms, and the obtained graphics are consistent.

The SegNet semantic classification algorithm has the lowest error resolution for buildings, which is 9.6%. The lower the value in this semantic classification model, the better the recognition ability. When there is no building test experiment, his error rate is the lowest, so this algorithm performs better than the other five algorithms in recognition of buildings in high spatial resolution remote sensing images, as shown in Figure 6.

Among the six models, segnet’s overall accuracy% is the highest, followed by iso, and Kappa is not much different, as shown in Figure 7. However, in general, the differences between these six models are not very large. According to the first few test charts, we can conclude that the comprehensive strength of segnet is better, so we choose the segnet semantic classification model.

4.2. Experimental Results. The results in Table 1 show how to use remote sensing satellite images to investigate the green coverage rate can simultaneously improve the ecological coverage rate of urban greenway design, rationalize, and optimize the greenway design. In terms of policy guidance,
these indicators are conducive to the planning and implementation of large-scale parks and are conducive to increasing the proportion of green space, while the public may ignore common greenways [33]. In addition, ecological evaluation indicators can provide decision-making support for comprehensive urban ecological evaluation and are a necessary supplement to existing planning guidelines and controls, which are conducive to the implementation of “planning-oriented planning guidelines and controls.” In summary, the combination of human-oriented greenway design and satellite image-based green space ratio can increase the proportion of green space in the overall planning and green space system planning. In terms of planning and guiding the design of urban greenways, continue to encourage and guide them to make more reasonable designs for urban planning.

The characteristics and core issues of the application of big data in the field of greenway design and satellite image-based green space ratio can increase the proportion of green space in the overall planning and green space system planning. In terms of planning and guiding the design of urban greenways, continue to encourage and guide them to make more reasonable designs for urban planning.

The characteristics and core issues of the application of big data in the field of greenway design and satellite image-based green space ratio can increase the proportion of green space in the overall planning and green space system planning. In terms of planning and guiding the design of urban greenways, continue to encourage and guide them to make more reasonable designs for urban planning.

The following conclusions can be drawn. By collecting the latest data, we can understand in real-time what citizens are in the urban space. How to distribute and use the real needs of greenways can assist in planning site selection, understand residents’ travel, and assist in greenway route selection. Through the number of tours on the tourism website, public participation in greenway planning in tourist areas can be increased. The original intention of the design is to build a better city to serve the people, and the use of big data technology is to enable us to use urban green space more reasonably. It is of great theoretical and practical significance to deeply study the generation and current situation of big data and master the technical characteristics of big data and the application methods in government statistics.

5. Conclusions

The research and methods in this article still have certain limitations. First, Baidu’s street view image data is obtained by street view collection vehicles and drones. In addition, the walking space of some residents is not
Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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