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Retraction

Retracted: Evaluation Method of Street Green Landscape Viewing Degree Based on Machine Learning

International Transactions on Electrical Energy Systems

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

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

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

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] T. Wang, M. Liu, and W. Huang, "Evaluation Method of Street Green Landscape Viewing Degree Based on Machine Learning," *International Transactions on Electrical Energy Systems*, vol. 2022, Article ID 2729408, 9 pages, 2022.

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Research Article

Evaluation Method of Street Green Landscape Viewing Degree Based on Machine Learning

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Urban streetscape is a complex and multifaceted landscape system, which is an important part of urban public space system. With the acceleration of the urbanization process, the connotation of street landscape is becoming more and more abundant. It not only has natural and social attributes but also bears the function of protecting the urban ecological environment. However, in recent years, due to the dramatic increase in the size of the urban population, more and more problems have appeared in urban road landscape. To this end, relevant government departments continue to update the design of urban streets and accelerate the construction of urban street landscapes, but urban streets still have problems in terms of function and environment. The viewing degree of street green landscape is also less and less in line with people's aesthetic needs, which is difficult to meet people's life and spiritual needs. In order to change this situation, this paper combined machine learning with the evaluation method of street green landscape viewing degree and conducted experiments on it based on machine learning. The experimental results showed that the evaluation method of street green landscape viewing degree based on machine learning not only made the city more beautiful but also improved the ecological environment of the city. The air quality of the city was improved by 20.96%, which was supported and loved by the general public.

1. Introduction

In recent years, the government has vigorously promoted the creation of ecological cities, one of which is the green road. However, with the acceleration of urbanization, many planning and design efforts have gone wrong. In addition, the evaluation method of street green landscape viewing degree has not been updated, so the traditional evaluation method is still used for street landscape viewing degree, which is very unfavorable to the design and construction of street landscape. In order to solve these problems, this paper studied the evaluation method of street green landscape viewing degree based on machine learning.

The research on the evaluation method of street green landscape viewing degree has been very rich, and many experts and scholars have carried out research on it: In order to improve the quality level of the campus green space landscape and obtain the satisfaction of the green space landscape, Xiang proposed to use the comprehensive evaluation method to construct five levels of urban greening based on the analysis of the current situation of urban greening and used seven evaluation factors to evaluate the green space landscape. [1]. Xunfan took six residential areas as the research objects and used the analytic hierarchy process to establish the evaluation index system of plant landscape in residential areas from the aspects of aesthetic effect, ecological function, leisure service, etc, as well as used the judgment matrix to calculate the index weight [2]. The evaluation criteria of traditional urban park landscape evaluation methods are mostly flood control effect and commercial demand, and the index evaluation is not comprehensive. Therefore, Shi et al. introduced the analytic hierarchy process to evaluate the urban park landscape and analyzed the evaluation methods of urban landscape and urban park landscape, as well as selected infrastructure, landscape aesthetic level, natural ecology, and social culture as the evaluation indicators of urban park landscape [3]. In order to improve the visual landscape quality of urban road greening, Li and Weng used the analytic hierarchy process to conduct a comprehensive evaluation of greening landscape aesthetics on the greening landscape of an urban street to achieve the weight of each evaluation factor. It was calculated that in the defined standard layer, the most important factor was the art of color matching [4]. As resource conservation, environmental protection and people's health have been paid attention to by the whole society, green building of high-rise buildings has become an irresistible trend. In order to accurately evaluate the green construction evaluation level of high-rise buildings, Tang and Chen used the cloud model to achieve qualitative and quantitative conversion and established a comprehensive evaluation level by drawing a comprehensive cloud map [5]. Considering the characteristics of ordinary highways without intermediate zones, in order to better evaluate the greening level of highways and study the greening landscape of highway roads, Yuan et al. used the literature review and comprehensive analysis method to establish a comprehensive evaluation model through the analysis of the highway greening function and further verified the reliability of the evaluation index system [6]. In order to explore the impact of ecological environment evaluation methods on the overall planning environment of towns, Chong et al. used the comprehensive evaluation method to evaluate the carrying capacity of regional ecology and analyzed the pattern changes of regional landscapes by using landscape ecology [7]. It can be seen that the research results on the evaluation method of street green landscape viewing degree have been very mature.

In recent years, due to the rapid development of machine learning and the wider application of machine learning, many people have studied it: Raissi and Karniadakis proposed a new paradigm for learning partial differential formulas from data and introduced hidden physical models. They were essentially data-efficient learning machines capable of expressing fundamental physical laws using nonlinear partial differential formulas, which could be applied to learn partial differential formulas and discover problems in system identification or data-driven [8]. State-of-the-art light and electron microscopes are capable of acquiring large image datasets, but quantitative evaluation of data often involves manual annotation of structures of interest and this process is time-consuming. To overcome this problem, Ignacio investigated a new machine learning tool that could train a classifier and automatically segment the remaining data [9]. Machine learning is a technique used to identify patterns that can be applied to medical images. Although it is a powerful tool that can aid in medical diagnosis, it can also be misused. To solve this problem, Erickson et al. used machine learning algorithms to systematically learn and analyze image features to classify images [10]. To quantitatively investigate how machine learning models leak information from individual data records, Shokri et al. performed membership inference on the target model and used the machine-learned inference model to identify the prediction difference between the trained and untrained inputs by the target model [11]. To meet people's needs, next-generation wireless networks must support ultrareliable, low-latency communications, and provide real-time, intelligent management to many Internet of Things devices in a highly dynamic environment. In this context, Chen et al. provided a comprehensive tutorial and introduced the main concepts of machine learning, especially the potential application of artificial neural networks in wireless communication [12]. Currently, methods for predicting cardiovascular risk fail to determine whether some people would benefit from preventive treatment. To solve this problem, Weng et al. was committed to investigating whether machine learning could improve the accuracy of cardiovascular risk prediction by exploiting the complex interactions among risk factors [13]. In order to enhance the resilience of machine learning, Bhagoji A N proposed and studied strategies that combined various data transformations, and reduced dimensionality by analyzing "anti-whitening," as well as evaluated and demonstrated the feasibility of linear transformation of data as a defense mechanism during the classification and training phases [14]. It can be seen from this that the research results on machine learning are very mature, and there are people studying it in various aspects.

Figure 1: Schematic diagram of green streets.

It can be seen from this that the research results on machine learning and the evaluation method of street green landscape viewing degree have been very rich, but few people have combined them for research, which has led to a very lack of research in this area. In order to enrich the research content in this area and provide a more practical and effective reference for the evaluation method of street green landscape viewing degree, this paper studied the evaluation method of street green landscape viewing degree based on machine learning.

2. Evaluation Method of Street Green Landscape Viewing Degree Based on Machine Learning

2.1. The Concept of Green Street. At present, the definition of green street is as follows. Green street refers to the street in the urban landscape that conforms to the principles of landscape ecology, which can provide urban residents with a

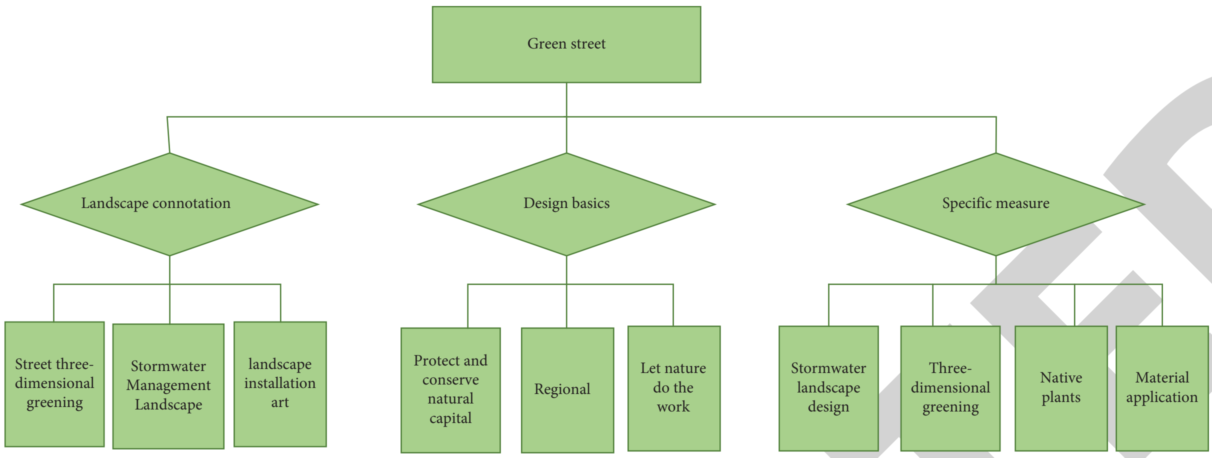

Figure 2: Landscape connotation, design principles, and specific measures of green streets.

streetscape for living and leisure. It also has special environmental benefits compared to traditional streets [15]. Figure 1 is a schematic diagram of a green street. As shown in Figure 2, the connotation of green street landscape is centered on the rainwater management landscape, which includes street greening, landscape installation art, and other landscape connotations. The basic principles of green street construction include preservation and conservation of natural capital, regionality, and natural work. The specific methods include urban rainwater landscape design, three-dimensional greening, native plants, and material application.

2.2. The Function of Green Street. The green street has many special functions such as urban sediment and flood management, air purification, temperature regulation, dust and noise avoidance, and energy conservation. It is an important part of the urban ecosystem and the integration of ecology, function, and aesthetics in a street pattern adapted to the landscape. Green streets not only contain the natural, social, and human nature of streets in the traditional sense but also play a role in protecting the urban ecological environment. The traditional street design just beautifies and embellishes the urban environment, while the green street conforms to the current trend of sustainable development and low-carbon development, which is a "green" street with real practical value [16]. Figure 3 shows the plan of an event city in Pudong, whose green streets are a combination of ecology, function, and aesthetics. A green street is also a functional aggregate, with multiple functions such as urban transportation, regional characteristics representing the city, and urban stormwater management. As shown in Figure 4, in the reconstruction and design of green streets, it is necessary to take the hydrological core and take the green street itself as a link of ecology, region, and humanities so as to form a very stable composite ecosystem.


Figure 3: Plan of Pudong activity city.

2.3. The Importance of Streetscape. Streetscape is a key factor in the external image of a city and is the basic structure of urban planning and planning. Urban streets are not only roads for urban traffic but also important spaces for residents' activities [17]. The types and scales of urban streetscapes are diverse, and the behavior of observers is also quite different. As shown in Figure 5, urban streets as public spaces can add convenience and fun to people's lives. As the goal of urban street development, green street has the characteristics of multidisciplinary and multi-influencing factors. A scientific evaluation system is needed to determine the development degree of green street. Therefore, based on machine learning, this paper develops a method for evaluating the viewing degree of street green landscape, which plays a role in evaluating and monitoring the development of urban green streets, and can effectively promote the sustainable development of urban green streets [18].

2.4. The Role of Machine Learning in Street Landscape Assessment. In the field of streetscape assessment, traditional intelligent technology requires manual design of operating rules, while machine learning technology has a strong learning ability, which can capture hidden rules and predict unknown data. The streetscape assessment work is to find out the law of its change through the analysis of the site condition and then to intervene and guide it through the method of planning and design so as to make it develop in a specific direction. Therefore, machine learning has great

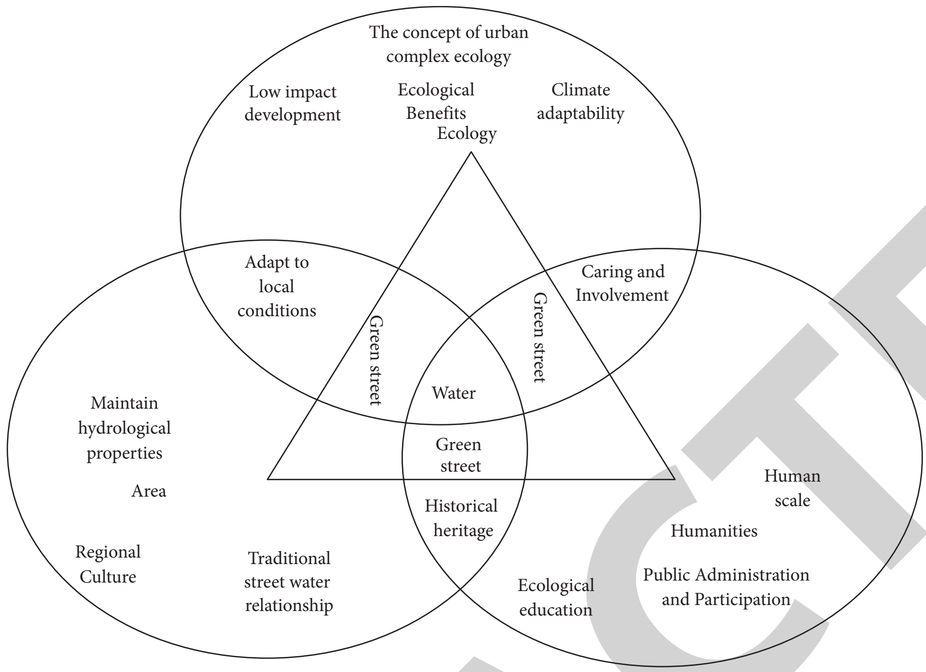

FIGURE 4: Functions of green streets.

FIGURE 5: Schematic diagram of urban green streets.

potential in the field of street landscape evaluation [19]. As shown in Figure 6, machine learning analyzes all aspects of the site and makes appropriate planning to build a beautiful streetscape. In addition, machine learning is a method that is good at inducing rules from a large amount of data and can solve various problems in different road landscape planning and design. As shown in Figure 7, according to the three stages such as information extraction, analysis and evaluation, and planning and design in the workflow of street landscape planning and design, the application methods of machine learning in street landscape can be divided into site information extraction, landscape analysis and evaluation, and self-generating system based on deep learning.

3. Application of Machine Learning Algorithms in Viewing Methods

3.1. Support Vector Machine Algorithm. Support vector machine is an algorithm used for classification in machine learning. In recent years, the development of support vector machines is very rapid, and the theoretical system is constantly improved, as well as it also plays its unique advantages in dealing with various problems. In addition, support vector machines continue to expand their application fields, and function fitting is applied to many fields in machine learning, which opens the door for the rapid development of support vector machines. Today, this algorithm has also been successfully applied in many fields [20].

In the case of meeting the needs of data classification, the support vector machine classifies the data set and finds the best classification hyperplane so as to achieve the optimization of the linear classification of the data. In the two-dimensional data space, if the sample group can be divided by a linear function, it can be called linearly divisible. At this time, the classification linear function can be expressed as

$$f(a) = w^n a + x, \tag{1}$$

where a represents the sample vector, w represents the normal vector of the sample vector, and x represents the offset constant.

In the sample set, each training sample contains an input vector a_i and a classification label s_i ($i = 1, 2, 3, \ldots, N$; N is the number of samples). The ith training sample can be denoted as $D_i = (a_i, s_i)$. In this way, the distance ς_i between the sample point and a certain hyperplane can be obtained by

$$\varsigma_i = s_i(w^n a_i + x) = |f(a_i)|. \tag{2}$$

By normalizing Formula (2), the Euclidean distance between the sample point and the hyperplane can be obtained as

$$\varsigma_i = \frac{1}{\|w\|}|f(a_i)|. \tag{3}$$

Figure 6: Schematic diagram of site planning.

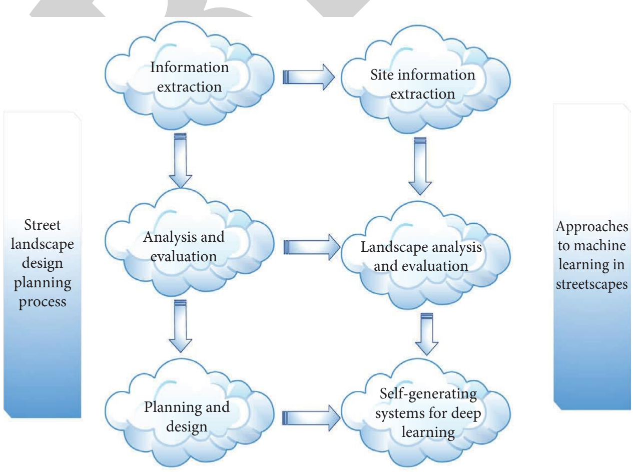

Figure 7: Application of machine learning in streetscape.

The minimum distance between each sample point is set to 1; thus, the geometric distance between hyperplanes can be expressed as $2/\|w\|$, and the geometric distance and $\|w\|$ are inversely proportional. If the hyperplane geometric spacing is maximized, then $\|w\|$ must be minimized, which is equivalent to minimizing $\|w\|^2/2$. Since the minimum interval between sample points is 1, there is the following formula:

$$s_i\left(w^n a_i + x\right) - 1 \geq 0. \quad (4)$$

Therefore, the solution of the optimal hyperplane can be equivalent to minimize $\|w\|^2/2$ under the constraints of Formula (4). It is worth noting that in a real case, the sample set may have an outlier. Due to the existence of outliers, the classification hyperplane cannot reasonably divide the samples, which has an adverse effect on the classification hyperplane. At this time, a slack variable $\{\vartheta_i\}_{i=1}^{N}$ needs to be introduced to reflect the degree of deviation between the sample points and the ideal classification conditions. When $0 < \vartheta \leq 1$, the sample point classification is on the correct side of the classification hyperplane; when $\vartheta > 1$, the sample point classification is on the wrong side of the classification hyperplane. In this way, if the target sample set $\{(a_i, x_i)\}_{i=1}^{N}$ is an indivisible problem, its optimal principle can be transformed into

$$\min \frac{\|w\|^2}{2} + C\sum_{i=1}^{N}\vartheta_i, \qquad (5)$$
$$\begin{cases} s_i\left(w^n a_i + x\right) \geq 1 - \vartheta_i \\ \left(i = 1, 2, \ldots, N; \vartheta_i \geq 0\right) \end{cases},$$

where, C is the penalty coefficient, which is a parameter representing the degree of penalty for misclassification and can be determined by empirical value or grid optimization. If C is too large, it is easy to cause overfitting; if C is too small, it may lead to a decrease in fitting accuracy.

3.2. Principal Component Analysis Algorithm. Principal component analysis is a data dimensionality reduction method based on machine learning, and it can transform large amounts of data into smaller ones. At the same time, it can also reflect the information of the original data to the greatest extent. The principal component analysis method can not only reduce the dimension of the data but also can effectively solve the problem that some indicators cannot accurately reflect the data.

3.2.1. Principal Component Analysis Model. g is set as the data matrix, and x is the variable index. Each row of the data matrix represents an observation, and each column represents a variable indicator. Among them, there are p variables $g_1, g_2, \ldots g_p$, and the linear combination of these variables is shown in Formulas (6)–(8):

$$F_1 = x_{11}g_1 + x_{12}g_2 + \cdots + x_{1p}g_p, \qquad (6)$$

$$F_2 = x_{21}g_1 + x_{22}g_2 + \cdots + x_{2p}g_p, \qquad (7)$$

$$F_3 = x_{p1}g_1 + x_{p2}g_2 + \cdots + x_{p}g_p, \qquad (8)$$

where, if p comprehensive indicators $F_1, F_2, \ldots F_p$ are obtained, the above matrix transformation must meet the following conditions:

$$x_i' = \left(x_{i1}, x_{i2} \ldots, x_{ip}\right), \qquad (9)$$

$$x_i' x_{ip} = 1, \qquad (10)$$

$$x_{i1}^2 + x_{i2}^2 + x_{ip}^2, \quad (i = 1, 2 \ldots, p). \qquad (11)$$

3.2.2. Basic Steps of Principal Component Analysis. The general steps of principal component analysis are as follows:

① The covariance matrix $\sum$ of the original data is calculated.

② The solution of the eigenvalue of matrix $\sum$ is $m_1 \geq m_2 \geq \ldots \geq m_p > 0$, and the corresponding unit eigenvector is $x_1, x_2, \ldots x_p$. The ith principal component is $F_i = x_i' g$, and the variance of the ith principal component is m, $i = 1, 2, \ldots p$.

③ Finally, the variance contribution rate of each principal component is calculated as

$$\vartheta_i = \frac{\vartheta_i}{\sum_{j=1}^{p}\vartheta_j}, \quad i = 1, 2, \ldots, p. \qquad (12)$$

The size of the variance contribution rate of each principal component reflects the size of the original information contained in the component, and the principal component's representation of the size of the confidence is gradually weakened. Finally, the cumulative variance contribution rate of the variance of the first n principal components is calculated as

$$\varpi_n = \frac{\sum_{i=1}^{n} m_i}{\sum_{j=1}^{p} m_j}, \quad n < p. \qquad (13)$$

Among them, it is ideal when the cumulative variance contribution rate reaches more than 85%. At this time, the original p variables can be replaced by n principal components.

④ The score calculation of the sample on the n principal components is observed by

$$F_i = x_{11}g_1 + x_{12}g_2 + \cdots + x_{1p}g_p, \quad i = 1, 2, \ldots, m. \qquad (14)$$

If the above four steps are satisfied, the principal component analysis can be performed by converting the original p dimensional data into the reduced n dimensional data.

4. Experimental of the Evaluation Method of Street Green Landscape Viewing Degree Based on Machine Learning

4.1. Experimental Method. In order to conduct a more detailed and effective study on the evaluation method of street green landscape viewing degree based on machine learning, this paper conducts experiments on the evaluation method of street green landscape viewing degree based on machine learning. This experiment selects two cities, A and B, both of which have relatively developed economic levels and complete infrastructure. However, the traditional evaluation method of street green landscape viewing degree is still adopted in the local area, which leads to the low viewing degree of street green landscape. There is little green vegetation in the street, which is not only uncharacteristic but also lacks cultural heritage. In addition, the planning of

Table 1: Citizens' awareness of machine learning and the support for this experiment.

Reply Number of people in the project	Do you know anything about machine learning?	Are you satisfied with the current green landscape sign of the street?	Do you think this experiment can make a difference to the streetscape?	Do you support this experiment in your city?
Yes	82	64	135	132
No	112	128	56	42
Uncertain	6	8	9	26

streetscape is also very unreasonable, which has affected the daily traffic of citizens. Every rainy season would always affect the drainage of rainwater, resulting in a large amount of water on the ground. It not only reduces the viewing degree of the street green landscape but also creates inconvenience to the daily life of citizens. This experiment plans to conduct a one-year experiment on the evaluation method of street green landscape viewing degree based on machine learning in city A, and city B also retains the traditional street green landscape viewing degree evaluation method. After the experiment, the air quality, traffic convenience, and citizens' satisfaction with the two cities are compared. Before the experiment is carried out, a questionnaire is also conducted on 200 citizens of city A to understand their cognition of machine learning and the support for this experiment so as to ensure that the experiment can be carried out smoothly, and the results of the survey are shown in Table 1.

As can be seen from Table 1, although more than half of the people have no understanding of machine learning, more than half of the people are very dissatisfied with the current design of the green landscape of urban streets. They hope that there would be a new way to measure the viewability of street green landscape to change the status quo, so nearly two-thirds of the people support this experiment and believe that this experiment can improve the green landscape viewing of the city streets. Therefore, the experiment is carried out very smoothly.

4.2. Analysis of Experimental Data. In order to compare the experimental results after the experiment, relevant data such as air quality, traffic convenience, and citizens' satisfaction with the city are also collected in cities A and B before the experiment. It is assumed that the city's air quality, transportation convenience, and citizens' satisfaction with the city are scored out of 100 points. The higher the score, the better the air quality, and the more convenient the transportation is, as well as the higher the citizens' satisfaction with the city. Figure 8 shows the air quality, traffic convenience, and citizens' satisfaction with the cities in cities A and B before the experiment.

As shown in Figure 8, the air quality, traffic convenience, and citizens' satisfaction with the city are basically the same in these two cities. The air quality just passes the pass line, and the convenience of transportation is not high, only more than 50 points. This would inevitably lead to citizens' dissatisfaction with the city, so citizens' satisfaction with the city is also very low, and a new evaluation method of street green landscape viewing is urgently needed to change this status quo.

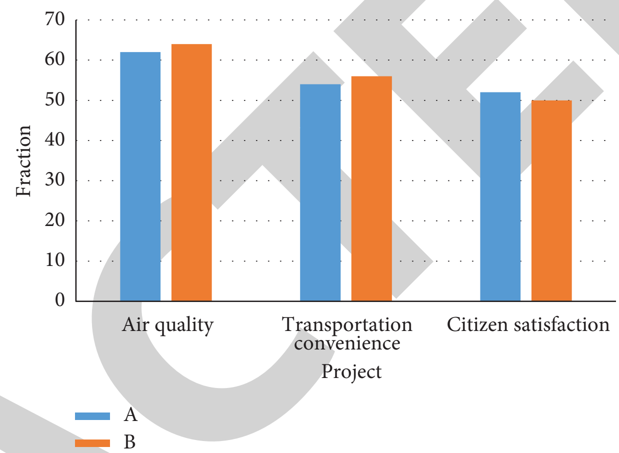

Figure 8: The air quality, accessibility, and satisfaction of citizens in city A and B.

4.3. Analysis of Experimental Results. After a year of experimentation on the evaluation method of street green landscape viewing based on machine learning in city A, great changes have taken place in city A. Compared with before, the green vegetation of the street has not only increased a lot, but also combined with the cultural characteristics of the place, which is very literary. In addition, the green landscape of the street is designed according to the city's topography and transportation facilities, so it is very neatly arranged without affecting the city's transportation system and drainage system and also highly useable. Therefore, the air quality and transportation convenience of city A have been greatly improved, and citizens' satisfaction with the city has naturally increased. However, city B, which still uses the traditional evaluation method of street green landscape viewing degree has not changed much compared to before. During the experiment, this paper also collects data on changes in air quality and traffic convenience, and the satisfaction of citizens with the city each month in the two cities, and the changes are shown in Figures 9–11.

From Figures 9–11, it can be seen that the air quality of city A, which has carried out the experiment of the evaluation method of street green landscape viewing based on machine learning, has improved a lot in this year compared to the previous year. In the next few months, it has stabilized at about 75 points, which is about 20.96% higher than before the experiment. In addition, this method combines the streetscape with the city's topography and road conditions, so the city's traffic is much more convenient than before, which greatly facilitates citizens' travel activities. Due to the improvement of the city's air quality and traffic, as well as the

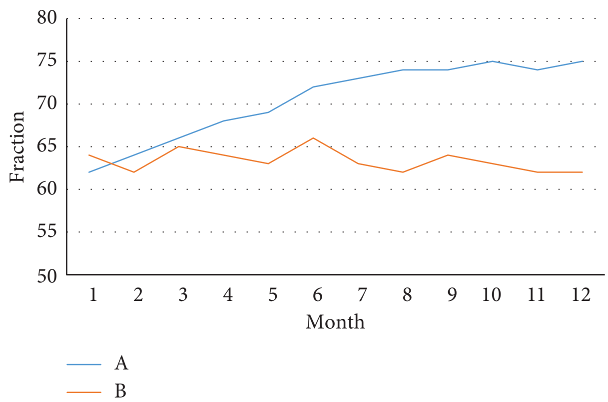

Figure 9: Changes in air quality in two cities A and B each month.

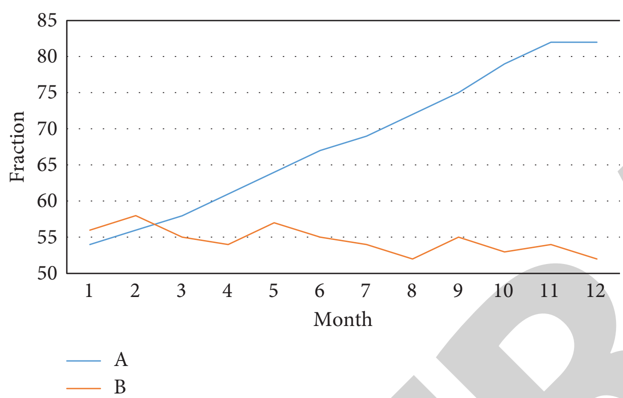

Figure 10: Changes in the monthly traffic convenience of the two cities in A and B.

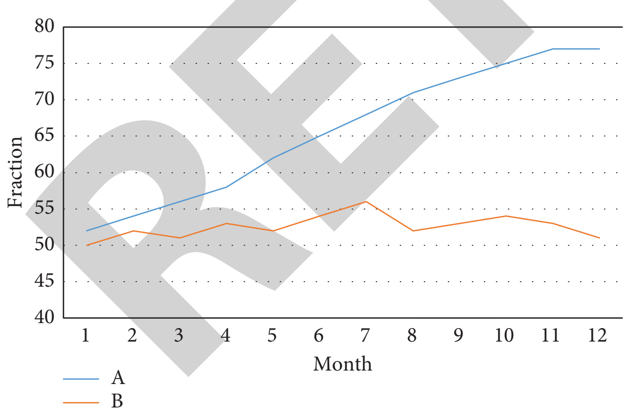

Figure 11: Changes in the monthly satisfaction of citizens in the two cities A and B.

street green landscape viewing, the city's residents are naturally more satisfied with the city than before. However, the air quality, traffic convenience, and citizens' satisfaction in city B, which are still using the traditional evaluation method of street green landscape viewing, fluctuate only slightly and not improve much.

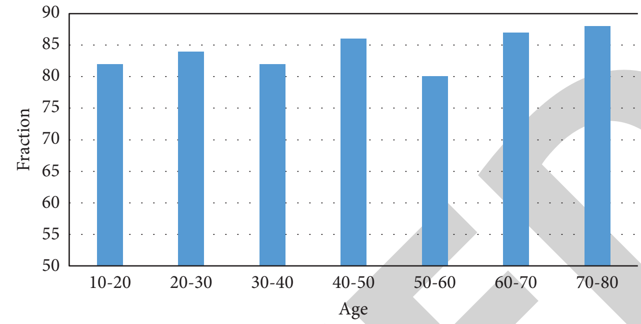

Figure 12: The scoring results of this experiment at different ages in city A.

5. Experiment Summary of Landscape Viewing Degree Evaluation Method Based on Machine Learning

In order to further ensure whether the evaluation method of street green landscape viewing degree based on machine learning is accepted by people and whether it is practical, after the end of this experiment, people of all ages in city A would be asked to rate this experiment. The full score is 100 points, and the average of the scores of each age stage is taken, as well as the scoring results are shown in Figure 12.

As shown in Figure 12, this experiment is liked by citizens of all ages, and their scores are basically above 80. It can be seen that the evaluation method of street green landscape viewing degree based on machine learning has strong practicability. The introduction of machine learning, an intelligent exploratory data analysis method driven by data, can not only provide new solutions and method support for street green landscape design but also supply a practical diagnosis for the current situation and problems of the personality representation of the streetscape and provide targeted and operable guidance for the realization of the streetscape's characteristics from the inside out.

6. Conclusions

Since street green landscape is an important part of urban ecology and urban landscape, the scientific evaluation of street green landscape viewing degree has always been a frontier direction pursued by academia. In recent years, machine learning has been gradually applied to the analysis and evaluation of street green landscape, and some results have been achieved at this stage. However, the evaluation method of street green landscape viewing degree based on machine learning has not been widely used and popularized, and the method is not perfect at the technical level, so the current urban street green landscape is still unsatisfactory. To make the city more comfortable and beautiful, people from all walks of life need to work together to promote the use of machine learning-based street green landscape viewing evaluation methods and technology updates.

Data Availability

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Conflicts of Interest

The authors declare that there are no conflict of interest with any financial organizations regarding the material reported in this manuscript.

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