Waterfront Recreational Landscape Planning and Ecological Protection Based on Cloud Computing and Neural Network Evaluation

Yang Cao

Abstract With the improvement of material quality of life and the acceleration of daily rhythm, more and more people hope to enjoy the rare leisure. Since then, a number of dynamic prediction models have been put forward by scholars at home and abroad, including representative models, such as numerical model, grey system model, catastrophe theory model, time series model, neural network model and so on. In the case of the adaptation of the test parameters, all kinds of prediction models can play a good performance. Cloud computing and neural network analysis can effectively provide evaluation accuracy. This paper puts forward the principles, strategies and methods of landscape planning based on the knowledge of plant community, ecology and aesthetics. This paper analyses the ecological allocation of waterfront recreational sites in the Pearl River Delta region and makes SBE evaluation. The results show that the bigger the SBE average value of landscape allocation is, the more popular it is. It can reflect the best ecological model which is in line with both ecology and aesthetics. It can provide scientific basis and technical reference for plant landscape construction of waterfront recreational sites.

Keywords Waterfront landscape · Cloud computing · Neural network · Data processing

1 Introduction

With the development of urbanization, waterfront attracts people's attention with its unique spatial charm. The recreational space built on the waterfront space is one of the best places for people to carry out recreational activities. Urban waterfront recreational space has occupied a very important position in modern urban space. The concept of "waterfront" is very broad. Rivers, springs, pools, lakes, seas and surrounding land in nature, or artificial urban waters, namely surrounding land, which belong to the category of "waterfront". Waterfront is the boundary between water and land. The shoreline formed by the land-water interfa presents different forms

Y. Cao (✉)
Haikou College of Economics, Haikou 571127, Hainan, China
e-mail: caoyang12@163.com; caoyangedu@163.com

C. Huang et al. (eds.), *Data Processing Techniques and Applications for Cyber-Physical Systems (DPTA 2019)*, Advances in Intelligent Systems and Computing 1088,
https://doi.org/10.1007/978-981-15-1468-5_213

of topography, such as concave, convex and flat, and forms rich natural landforms. There is no definite conclusion about the concept of waterfront plants, which is commonly known as coastal plants, waterfront plants and aquatic plants. Therefore, waterfront plant landscape is one of the most important components of waterfront landscape. The ecological value and social and economic value of resources are invaluable wealth for sustainable development. More in-depth research and more scientific development should be carried out on it.

2 Principles and Strategies of Waterfront Recreational Landscape Planning

2.1 Design Principles

Sustainable development and utilization of urban waterfront is a comprehensive project to create healthy natural, social and economic benefits, retain historical context and create a beautiful city image. Making certain design principles is one of the important bases to ensure the realization of these goals [1].

(1) Respecting and protecting nature

Ensuring the integrity of river ecosystem is the premise of recreational space construction in waterfront areas. We can only play the natural ecological role of both sides, restore the ecological function of rivers, respect the law of natural development, maintain ecological balance and protect biodiversity. Only in this way can we build riverside recreational space, therefore, we can guarantee the sustainable development of landscape corridors [2].

(2) Inheriting history

We need to pay attention to the historical and cultural evolution of waterfront areas, protect the integrity of history and those artificial structures full of cultural implications. In the process of construction and development, we need to excavate the elements of historical features and cultural characteristics, embody the characteristics of regional history and culture, and integrate traditional culture into the design.

(3) Sustainable development of man and nature

First of all, the new concept of harmony must be deeply rooted in the hearts of the people. Secondly, in the design of waterfront urban landscape belt, we should make full use of the characteristic landscape, retain the original natural elements, and shape the unique image of the waterfront area. Finally, we should make sustainable development and utilization of river resources. Wetlands have abundant biological resources, which are natural resources for water purification; rivers have a large number of beaches, farmlands, pastures, fruit forests, etc., which provide abundant land resources for agriculture and animal husbandry; rivers are vast, unshielded, and have

abundant wind and solar energy resources. Although the provision of these resources is renewable, we should adhere to the combination of river resources development and protection, and maintain the scientific, orderly and sustainable utilization of resources development for the benefit of future generations and sustainable development [3].

2.2 Design Strategy

(1) Ecological strategy

Wetland is the most valuable ecosystem in the world, which is closely related to human survival, reproduction and development. Wetlands have important functions such as maintaining water source, purifying water quality, storing flood and preventing drought, regulating climate and protecting biodiversity, and are known as the "kidney of the earth". Wetland is an important part of ecological corridor, and also an important basis for sustainable development of rivers. In the construction of recreational space, the designer fully combines geographical and environmental advantages, uses appropriate artificial means such as bio-purification canal to restore the wetland space, and achieves the function of purifying the water body. At the same time, the designer creates a wetland park with local characteristics [3].

The designer uses the ecological purification function of natural embankment, combines the unique spatial characteristics of the embankment and maintains the ecosystem, completes the transition between water and land through non-rigid embankment, and creates a unique landscape of the embankment.

(2) Landscape strategy

Landscape composition of planned river course mainly includes four categories: ecological wetland, urban recreation, urban movement and ecological pastoral. On the basis of ecosystem restoration, designers create recreational landscape with special features, which mainly consists of river courses, ecological protection and greening, landscape and other landscape systems that constitute cross-strait space [4].

According to the characteristics of different riverside areas, we set up different themes of recreational space. In different spaces, through the common development of different biological communities, the whole system constitutes a good relationship between species, and harmonious coexistence. These include animals and plants, aquatic organisms, terrestrial organisms and birds, artificially cultivated species and rare species, and so on.

Different recreational space, according to different ecological conditions, we create different vegetation environment. Tree ecological corridors provide wildlife access to urban green space. An open space network of waters and natural land allows people and wildlife to cross ecological corridors [5].

(3) Cultural strategy

Planning should take historical relics as the soul of recreational space design, protect historical and cultural resources, establish "open-air museum" system, and form

urban public "spiritual space" and cultural space [6]. Designers need to combine historical relics with recreational space in order to increase the recognizability and regional uniqueness of recreational space. Combining with other regional cultures, the designer strengthens the influence of regional history and culture on urban space.

(4) Functional strategy

Different regions should construct suitable recreational space according to the actual situation [7]. For example, the recreational space in urban section is mainly to improve the quality of living space in waterfront area. We should pay attention to the choice of recreational content and the good passage between recreational space and urban space. The recreational space in rural areas should fully consider the characteristics of agricultural landscape, combine recreational space with new agriculture, and how to promote the construction and development of rural areas while attracting people [8].

(5) Space strategy

Recreational space in different locations of waterfront also has its own characteristics [9]. Designers need to adapt to local conditions and choose a suitable spatial model for local topographic characteristics for design and construction. We make full use of the spatial characteristics of riverbed, beach, embankment and bank to create a waterfront recreational space with rich spatial levels and full of interest.

(6) Activity strategy

In order to enhance the attractiveness of corridor space and promote close links between cities, we have organized a series of activities to expand the publicity of recreational space in waterfront areas and attract people by means of artificial activities, such as holding marathons, hiking conferences and other recreational activities [10]; relying on the open recreational space in river beach areas to hold kite competitions.

3 BP Neural Network Model

3.1 BP Neural Network

In the BP neural network (see Fig. 1) algorithm uses data samples to constantly repeat the learning to meet the set error range, so as to establish the data model. The training process is divided into two stages: forward propagation and reverse communication. The first phase: the data matrix of the sample is processed through the input layer and the hidden layer to the output layer [11]. The second stage: the data matrix that fails to obtain the expected value is also reversed by layer by layer and adjusts the difference between the actual output value and the expected output value. These two stages are used to adjust the weights. The use of Luxenberg Marquardt

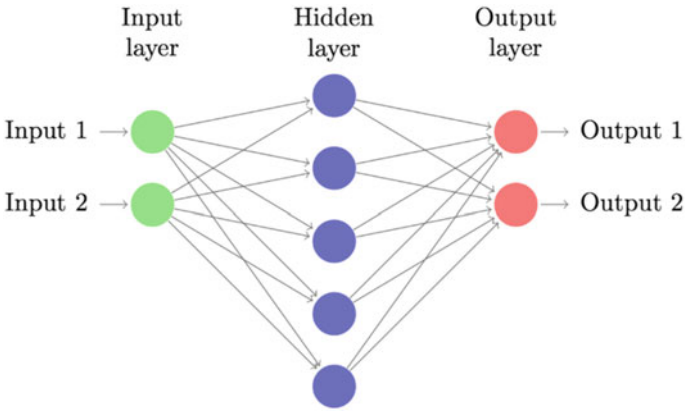

Fig. 1 BP neural network

optimization algorithm (LM algorithm). The algorithm adopts the approximate two order derivative information, which is suitable for small and medium scale networks, and the convergence speed and convergence precision are stronger than other algorithms [12]. The input layer and the output layer are set as the related water quality parameters. The actual measured concentration value of the I neuron in the output layer at the t moment is (T), the expected output value is (U), and the n is the number of the output layer neurons. When the t BP network error function E(T) is less than the pre given error value, the network training stops and obtains the neural network prediction model.

The pile foundation is more and more widely used in modern civil engineering, especially in the area with less bearing capacity of the foundation in the southeast of China [13]. The deep pile foundation plays a very important role in transmitting the load of the superstructure. In the stage of geotechnical engineering investigation, it is possible to predict the bearing capacity of pile foundation early and more accurately not only to select the suitable design parameters of pile foundation [14], but also to save the cost. It can also save a lot of time for the follow-up period. The prediction of the bearing capacity of pile foundation can be divided into two kinds: the stress control method and the displacement control method. The former is made up of the maximum stress of the interaction between pile and soil to determine the bearing capacity. The latter is derived from the load settlement displacement curve of the pile foundation. The stress control methods include load transfer method, numerical simulation method, static sounding (CPT) method and pore pressure static penetration (CPTU) method.

3.2 LM Algorithm

It is a very important thing to predict the vertical bearing capacity of pile foundation in geotechnical engineering. The prediction model of BP neural network provides a scientific basis for the environmental protection of drinking water source in Shanxi reservoir [15]. By comparing with the field static load test, the load response curve of the pile foundation with higher correlation coefficient is obtained. In view of the shortcomings of the existing research, based on the standard BP neural network algorithm and adding a momentum factor, a modified BP neural network model is established. The vertical bearing capacity of single pile is predicted. The data matrix of pH value, permanganate index, total nitrogen, total phosphorus and chlorophyll a was established on the basis of the emergency monitoring data during the outbreak of algae in Shanxi reservoir. Taking the geological exploration report completed by Zhenjiang Institute of Surveying and mapping as the engineering background, the 4 indexes (cone resistance, cone friction, shear wave velocity and pore water pressure) measured by the seismic cone penetration test (SCPTU) were taken as input parameters.

Using MATLAB R2015b GUI visual interface module, the sample space of emergency monitoring data is divided into training samples, verification samples and test samples, and BP neural network model of Shanxi reservoir is established [16]. This predicts the concentration of chlorophyll a during the algal outbreak of Shanxi reservoir. The bearing capacity of the pile foundation is the output parameter. Compared with the traditional prediction method, it is found that the modified BP neural network algorithm can effectively predict the vertical bearing capacity of the pile foundation with high precision (Fig. 2).

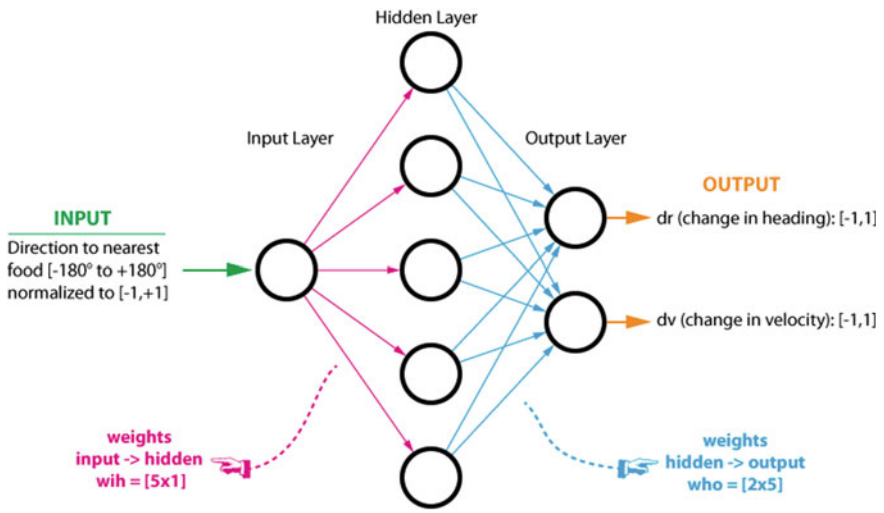

Fig. 2 BP neural network algorithm

4 Evaluation of Waterfront Recreational Landscape

4.1 Evaluation Method

In order to get a model reflecting the aesthetic quality of plant allocation landscape in waterfront recreational sites, this paper uses Scenic Beauty Estimation (SBE) to evaluate the aesthetic quality of plant allocation landscape in waterfront recreational sites [17].

4.2 Judgment Process

The article uses the indoor evaluation method, we invite the public to watch slides for evaluation. The scoring criteria are 5 points, namely 0, 1, 2, 3 and 4. The larger the value, the more beautiful the landscape; the smaller the value, the worse the landscape. Scores specifically represent the degree of landscape: 0—very poor, 1—poor, 2—general, 3—good, 4—very good.

4.3 Standardization of Score Value

We used PPT to obtain the SBE value of landscape. Calculating process: Researchers arbitrarily select a slide as a "benchmark" and calculate the standard deviation of the baseline to adjust the starting point of SBE measurement. The calculation formula is as follows:

$$\mathrm{BSDMZ} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(Z_i - \mu)^2} \tag{1}$$

In the formula, N is the number of effective scores of the "baseline"; Z_i is the score value of the "baseline"; μ is the average value of the "baseline" subject; We standardize the original values with the standard deviation of the mean of the baseline to eliminate the measurement differences caused by different perceptions, and then we can obtain the standardized SBE values of each subject.

$$SBE_i = \frac{MZ_i}{BSDMZ} \tag{2}$$

Formula: SBE_i is the standardized value; MZ_i is the average value; BSDMZ is the standard deviation of the average Z value of the baseline group.

Table 1 SBE comparison of plant landscape structure

Position	Hierarchical structure	Amount	Maximum value	Minimum value	Average value
Shore	Tree-vegetation	13	3.28	2.04	2.68
	Tree-shrub-vegetation	12	3.57	1.75	2.86
	Shrub-vegetation	4	2.62	1.90	2.22
	Vegetation	2	2.62	2.26	2.45
Shoreside	Tree-vegetation-wetland	5	2.89	1.38	2.18
	Tree-vegetation	3	2.89	2.04	2.60
	Tree-shrub-vegetation	3	3.20	2.45	2.81
	Vegetation	3	1.82	1.07	1.43
Water	Monolayer-single plant	3	2.40	1.23	1.78
	Monolayer-multi plant	3	2.40	2.01	2.17
	Multilayer plants	4	4.25	1.31	2.80

4.4 Result and Analysis

For example, in the Pearl River Delta, there are abundant types of plant allocation in waterfront recreational sites. By comparing SBE values of different allocation types, we can reflect the preference of visitors to which type [18]. According to the plant hierarchical structure, all SBE values were summarized, and the SBE data of different plant configuration structures were obtained. The results are listed in Table 1.

We draw the following conclusions:

(1) Tree-shrub-vegetation, because its overall seasonal color is prominent, the level is clear, the landscape is simple and pure. This is the most preferred landscaping arrangement for shore plants for visitors.
(2) The configuration structure of coastal plants is tree-shrub-vegetation, because of its outstanding seasonal color, distinct hierarchy and simple and pure landscape. It is also the most preferred form of revetment plant landscape configuration for tourists.
(3) The configuration structure of aquatic plants is multi-layer plants, single-layer plant and single-layer plants. This shows that there are many layers, because of its rich overall level and diverse landscape forms, which is the most common configuration mode of plant landscape on the water surface, and also the most favorite configuration of plant landscape on the water surface for tourists.

5 Conclusions

Among the plant landscape configuration structures, the average SBE values of tree-shrub-vegetation structure in terrestrial plant landscape, tree-shrub-vegetation structure in coastal plant landscape and multi-layer and multi-structure in water plant landscape are the highest, which indicates that it is the most beautiful and favorite among recreational people. However, the judges' score on the plant landscape displayed by the plant configuration at a certain time cannot fully reflect the overall evaluation of the characteristics of the plant landscape in the space during the four seasons, this has certain limitations, we do further research in post-menopausal studies.

Acknowledgements This research was financially supported by Scientific Research Projects of Higher Education Institutions in Hainan Province in 2019 (Study on Ecosystem Service Function Upgrading and Ecological Restoration Technology in Nandu River Basin Hnky2019ZD-39).

References

1. Lu Ning. 2011. Research on evaluation index system of Leisure City based on urban leisure index. *Journal of Capital University of Economics and Trade* (6): 77–85 (In Chinese).
2. Lou Jiajun and Xu Aiping. 2011. Study on the development stage and evolution characteristics of urban leisure function in Shanghai. *Tourism Science* 25 (2): 16–22 (In Chinese).
3. Hu Xin. 2014. Research on spatial form of mountain cities abroad. Master's Thesis of Chongqing University (In Chinese).
4. Zhou Yongguang, Ruan Fangshi, and Shen Xuwei. 2013. A comparative study of recreational space in waterfront between China and foreign countries. *Urban Issues* (In Chinese).
5. Kabalci, Y. 2016. A survey on smart metering and smart grid communication. *Renewable and Sustainable Energy Reviews* 57: 302–318.
6. Schleich, J., C. Faure, and M. Klobasa. 2017. Persistence of the effects of providing feedback alongside smart metering devices on household electricity demand. *Energy Policy* 107: 225–233.
7. Diamantoulakis, P., V. Kapinas, and G. Karagiannidis. 2015. Big data analytics for dynamic energy management in smart grids. *Big Data Research* 2 (3): 94–101.
8. Irfan, M., J. Iqbal, A. Iqbal, and Z. Iqbal. 2017. Opportunities and challenges in control of smart grids—Pakistani perspective. *Renewable and Sustainable Energy Reviews* 71: 652–674.
9. Djenouri, Y., A. Bendjoudi, and M. Mehdi. 2015. Gpu-based bees swarm optimization for association rules mining. *The Journal of Supercomputing* 71 (4): 1318–1344.
10. Castelli, M., L. Manzoni, and L. Vanneschi. 2017. An expert system for extracting knowledge from customers' reviews: The case of amazon.com, inc. *Expert Systems with Applications* 84: 117–126.
11. Centeno, R., R. Hermoso, and M. Fasli. 2015. On the inaccuracy of numerical ratings: Dealing with biased opinions in social networks. *Information Systems Frontiers* 17: 809–825.
12. Ghaderi, A., H. Mohammadpour, and H. Ginn. 2015. High impedance fault detection in distribution network using time-frequency based algorithm. *IEEE Transactions on Power Delivery* 30 (3): 1260–1268.
13. Bayindir, R., I. Colak, and G. Fulli. 2016. Smart grid technologies and applications. *Renewable and Sustainable Energy Reviews* 66: 499–516.
14. Ebesu, T., and Y. Fang. 2017. Neural semantic personalized ranking for item cold-start recommendation. *Information Retrieval Journal* 20 (2): 109–131.

15. Fang, H., J. Zhang, and Y. Bao. 2013. Towards effective online review systems in the Chinese context: A cross-cultural empirical study. *Electronic Commerce Research and Applications* 12: 208–220.
16. Andrea, A., F. Ferri, P. Grifoni, and T. Guzzo. 2015. Approaches, tools and applications for sentiment analysis implementation. *International Journal of Computer Applications* 125: 26–33.
17. Leiva, J., A. Palacios, and J. Aguado. 2016. Smart metering trends, implications and necessities: A policy review. *Renewable and Sustainable Energy Reviews* 55: 227–233.
18. Beuscart, J., K. Mellet, and M. Trespeuch. 2016. Reactivity without legitimacy? Online consumer reviews in the restaurant industry. *Journal of Cultural Economy* 9: 458–475.