Landscape shaping method of college communication space for campus culture connotation construction

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Abstract. In order to improve effectiveness of landscape shaping method of college communication space for campus culture connotation construction, a landscape shaping method of communication space based on delay function analysis model was proposed. Firstly, landscape shaping method model of college communication space was constructed based on biological gene theory, and college communication space landscape with regional characteristics was shaped by interpretation of contained information; secondly, landscape shaping compensation strategy of college communication space was constructed by heuristic algorithm, and delay function analysis model was constructed by marginal cost, then model optimization was implemented based on subgradient method; finally, effectiveness of proposed method was verified by simulation experiment.

Key words. Campus culture, College, Communication space, Landscape shaping.

1. Introduction

Along with development of social campus culture, human society starts to enter into the era of college communication space landscape shaping generally. College communication space landscape shaping is a humanity and social science taking human communication space landscape shaping consumption, communication space landscape shaping psychology, communication space landscape shaping behavior, and communication space landscape shaping demands as investigation object, taking satisfying individual, multifarious and diversified development of human as purpose, taking being medium between production system and living world as approach to study interaction rules between human communication space landscape shaping behaviors and campus culture phenomena. By observing development trend of fu-

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ture campus culture from the angle of humanities, it can be found that campus communication space landscape shaping is not only necessity of campus culture development, but new rules of human society development that is deducing, namely what college communication space landscape shaping reflects is not only a kind of campus culture form, it is even a human culture and a life style, that is all human activities and their expression related to communication space landscape shaping, including methods and contents of communication space landscape shaping, role and function of communication space landscape shaping, historic trend of communication space landscape shaping and so on. College communication space area starts to take a more and more important functional role in college activities especially public activities.

Attention of western countries on reflecting regional culture in landscape design starts from 1970s. Admiration of people on culture is losing generally, and modernism also loses attraction for the public generally. People hope to have new change, therefore value of history and traditional culture starts to be emphasized again. Knowledge and researches on regional characteristics also start to be emphasized by more and more scholars. Up to now, convergence of technology and production mode still promotes separation of human and traditional regional space. Campus culture, technology, culture and college lifestyle of all countries are converging gradually under wave of globalization. Phenomena of convergence and homogenizing even appear in landscape field. Original and distinct regional characteristic landscapes of all regions are disappearing gradually. In the 20th meeting of international construction association in 1999, architects, scholars and experts of all countries had understood the problem that regional culture characteristics were declining gradually. Therefore, "environmental crisis" and "characteristic crisis" were proposed to be problems that are urgent to be solved by the current architects, and *Beijing Charter* was passed by research and discussion, then shaping of regional landscape characteristics were put in important position formally, which aims to make landscape development stride forward towards regionalization. However, in the last 20 years, although domestic college communication space landscape construction has obtained great achievement, regional characteristics of landscape are still not obvious.

Under the times background of advocating discipline integration, the discipline has been difficult to solve all problems with theoretical research within the discipline. Closed and isolated field of traditional discipline must be walked out, and mutual penetration and integration among different disciplines must be strengthened for exploring essential rules through things themselves. Intersection and integration of related disciplines can make us obtain more scientific perspective and clearer understanding. Although discipline backgrounds are different, it is not difficult to find that there are some internal relation and similarities from each other among them. At the same time, under the general background of sustainable development, attention shall be paid to ecological principles with sustainable development characteristics for development of all disciplines, taking conforming to virtuous cycle of natural ecosystems as precondition. Therefore, combining ecological development rules to make landscape theory improved and perfected is not only demand of sustainable

development of landscape, but also meets requirement of integrated development of all disciplines.

2. Control and development of college communication space landscape shaping based on biological gene theory

2.1. Enlightenment of biological gene theory

Biological gene research is a research process going deep into internal rules of knowing life activities from observing phenomena of life activities generally by structure of important material basis of lives and researches on movement rules in essence. It is a cognitive development process from part to whole. Along with deepening of research, people find that gene technology is influencing and changing our lives and concepts more and more deeply. In theory, it determines and proves that life of everyone is cast surrounding a common support. This support is inherited from human ancestors. People are connected with all other lives in the earth by the support; in practice, transgenic technology has been applied on plants; rice containing vitamin A and C , wheat and vegetables containing animal protein are grown in green field... gene therapy will also bring more hope to human conquering disease and healthy survival. Thus, transformative significance of gene technology on human life and development is evident.

As a theory, profound significance of biological gene research lies in that it reflects consistent exploration of human on life endogenesis, growth, development and disappearance rules, and it is a process going deep into understanding life activity rules from observing phenomena of life activities generally by structure of important material basis of lives and researches on movement rules. This is the key that biological gene principles are selected as theory basis in the topic. In the genetic process of biology, what parental generation passes to the next generation are not some concrete characters, but only genetic information controlling development. It obtains expression in the form of password after a series of complex process at the time of synthesizing protein finally. At the same time, the whole process of gene expression is under strict regulation and control, which makes all life activities in biological system can be implemented orderly. Therefore, only by clarifying basic conception of information, gene, genetic code and so on, it can be possible for us to understand regulation mechanism of gene further.

2.2. Biological gene and environment

Gene influences biological inheritance characters by combined effect of environment, or all environmental factors influence biological heritability by gene. On the one hand, in the genetic transcription and mRNA translation process, temperature or stimulation of environment (external environment contacted by cells) will influence final results. Gene generation and replication need to be realized with help of cell environment and enzymes in cells, while these aspects that gene will express its unique characteristics rely on cell environment closely; on the other hand, individu-

als that are inbred for a long period will be degenerative by lack of new genes. In the evolutionary process of biology, adaption to environment is a necessary condition. As biomutation is caused by own change of of gene, the reason is not related to function of living organism and it has contingency and randomness. However, by environmental selection, only variation adapting to the environment can be inherited stably.
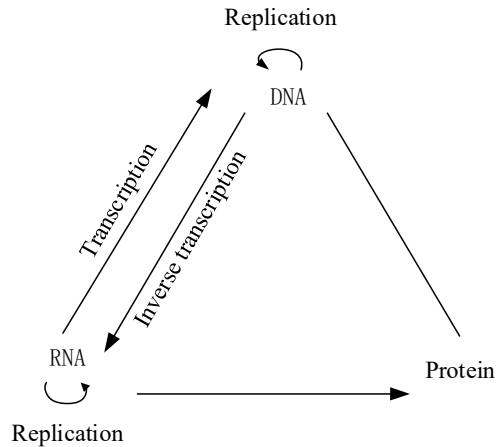

Fig. 1. Central rules of gene

In complex biology, evolution of all life entities is implemented by gene replication, mutation and own selection. By identification, judgement and recombination of common genes of all life entities, people hope themselves and other creatures can survive and develop better. It is regarded by ecology that adaptability to environment is common character of life entities. All life entities can adapt to environmental change, and keep balance and harmony with environment to different extents. Life of an organism is ongoing in close association with surrounding environment conditions. Their habits, life styles and environment they encountered, adding the element of time determine form of life entities, quantity of organs and capacity of movement. After evolution and natural selection for 3 billion years, creatures have fine adaptability to environment. Environment is changing constantly and each creature is also changing correspondingly.

2.3. Concept of "regional gene" in college communication space

As we all know, influence of natural factors such as climate, resource, geography, creatures and so on and humanity factor such as politics, campus culture, religion, cultural customs and so on cannot be inseparable in any regions. However, as information transmitted by them and action mode differ in a thousand of ways, subjective response of people is also different. Therefore, varied landscape space mode is also created, which is the same as influence of gene on biological species. Taking it as example, there is not only eastern tradition with Yangtze river delta as

representative, but also western tradition with Italian water town as representative, also contemporary with bund of Shanghai Huangpu River as representative. People in different regions also create colorful landscape features for response of different natural environments.

Development of college communication space area cannot leave college. Development evolution process of colleges influence determination of function and property of college communication space area, and this is general characteristic of all college communication space regions. In addition, as weather and climate, topography and landform, political campus culture, cultural customs and so on in each college are different, these factors are interwoven together complexly influencing generation and development of environment in college communication space area to different extent, and also forming college communication space area mode with varied forms in different region at the same time.

Therefore, we regard understanding, grasp and subjective response on environmental factors (such as physical environment factors, culture factors and so on) influencing generation and development of college communication space area as "regional gene" of college communication space area, or "regional gene" is carrier with all regional information. "Regional gene" is changed along with change of time and space, where it not only includes distinctive natural geography in all regions, but also includes unique life style, behaviors and customs, thinking mode, value orientation and so on formed by humans in the process of social development in the region. On the one hand, it reflects certain adaptation of college communication space region to environment; on the other hand, it receives "natural selection" of environment. It is clear that college communication space area can be inherited stably only by dynamic adaption to constantly changing environment.

"Regional gene" of college communication space area is the sum of all kinds of material and spiritual elements formed along with forming and developing process of college, owned by college communication space area specially, exerting influence on development of college communication space area and reflecting college communication space area and college attribute positioning. It includes information of geography, climate and other natural environment factors, also includes information of society, campus culture and other social environmental factors, and involves information of history, culture, folk customs and ideological aspect. The significance of studying "regional gene" in college communication space area by us lies in shaping college communication space area landscape with regional characteristics and maintaining characteristic appearance of colleges in the aspect of nature and culture by interpretation of carried information to make it integrate into college environment organically, become constituent parts of colleges with representative, influence and drive development of the whole college.

2.4.   *Establishment of landscape evaluation system framework of college communication space area*

Relatively detailed explanation is made for regional landscape characteristic shaping process of college communication space area above. Continuous use and protection method of "arrangement, screening, integration and expression" is proposed by
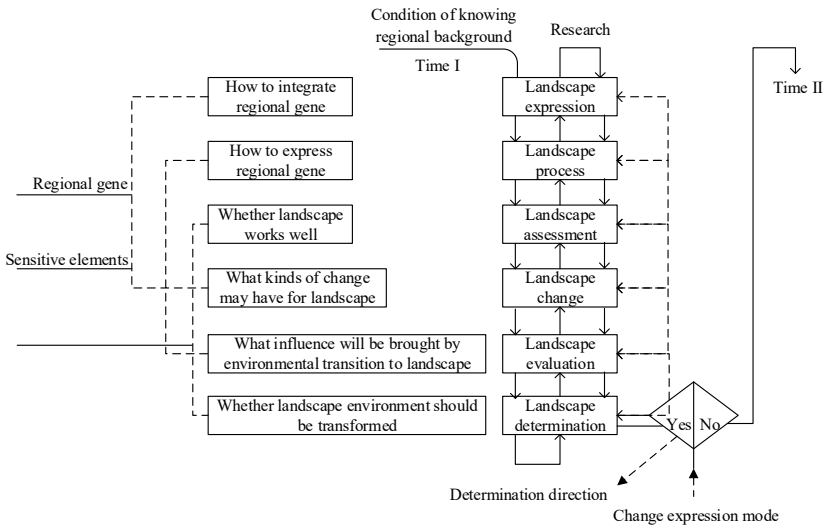
Fig. 2. Security Pattern control and development mode framework for regional
landscape of college communication space

the process of comprehensive arrangement, preferential screening and restructuring
integration of "regional gene" to provide certain method for characteristic landscape
shaping of college communication space area. However, college communication space
area landscape is in a process of dynamic change from beginning to end. "Regional
gene" regulation method also shall be a process of constant comparison and selec-
tion. Therefore, related mechanism systems shall be established in order to make
landscape shaping of college communication space region have operability, which
has certain practical significance for shaping regional landscape. According to intro-
duction to landscape security pattern characteristics in Chapter II, a corresponding
evaluation system related on regional characteristic landscape shaping is also tried
to be found and established at the end of the thesis, in order to provide internal reg-
ulation method for regional characteristic landscape shaping and manifestation and
establish a relatively stable landscape pattern within certain period. As researches on
landscape security pattern of college communication space area pay more attention
to landscape environment problem of college communication space area, relationship
between college communication space area pattern and process and social campus
culture development, but also emphasize on comprehensive integration of these as-
pects. Therefore, we can establish a security pattern control and development mode
framework for regional landscape of college communication space (Fig. 2) in order
to make landscape security pattern approach of college communication space area
has operability.

  The framework shows that regional characteristic landscape shaping of college
communication space is not fully a passive process that pursues a optimum and pre-
ferred plan according to natural process and resource conditions completely. On the
one hand, the process of seeking answers can be a scientific and top-down process,

namely start from collection and arrangement of "regional gene", and then make landscape change scheme, which has similarities as process of extension and transmission of "regional gene". On the other hand, under most conditions simultaneously, this framework shows a bottom-up process, namely problems that shall be solved and goals shall be clarified for landscape shaping process firstly, and then "regional gene" shall be explored and arranged for integration and expression taking it as guide. As environment of college communication space area is in dynamic change from beginning to end, landscape security pattern is a process of finding a respectively and the most stable balance point in the process of such a dynamic development.

3. Design compensation strategy design based on heuristics

3.1. Heuristic beta value updating algorithm

Initial beta value $(beta\,(\beta_a))$ in delay function is iterative. The main challenge is convergence and user balance. There is strong correlation between capacity limitation and college communication space landscape distribution. General theory of landscape shaping takes marginal cost as basic design strategy. Design effectiveness can be expressed as:

$$\hat{t}_a\,(x_a) = t_a\,(x_a) + x_a \cdot \partial t_a\,(x_a)/\partial x_a\,. \tag{1}$$

Where $\hat{t}_a\,(x_a)$ is marginal cost. $\partial t_a\,(x_a)/\partial x_a$ is additional marginal cost experienced by each landscape element on x_a of landscape shaping. Optimal flow of system shall be realized on the network by marginal cost, and landscape elements under utilization shall be expanded. Therefore, using $x_a \cdot \partial t_a\,(x_a)/\partial x_a$ as a framework to update initial test is as follows:

$$\hat{t}_{aC}^{(i)} = \left(t_a^0 + b_a^{(i)}\right)(1 + f\,(C_a))\,. \tag{2}$$

$$\nabla b_a^{(i)} = \left(x_a^{(i)} - C_a\right)\frac{\hat{t}_a^{(i)} - \hat{t}_{aC}^{(i)}}{C_a}\,. \tag{3}$$

$$b_a^{(i+1)} = b_a^{(i)} + \nabla b_a^{(i)}\,. \tag{4}$$

Where superscript i and a expresses current iteration and landscape shaping of respective (over) saturation; $\hat{t}_{aC}^{(i)}$ expresses marginal cost of expansion delay function when capacity is $x_a = C_a$; $b_a^{(i)}$ is additional punishment of free design time limit. $\nabla b_a^{(i)}$ is calculation speed of initial beta in current iteration.

In equation (4), satisfy marginal cost principle, namely use $x_a \cdot \partial t_a\,(x_a)/\partial x_a$ update speed value. x can be substituted by additional college communication space landscape flow $\left(x_a^{(i)} - C_a\right)$, slope (dt/dx) of delay function can be obtained by slope of marginal cost of expansion subtracting capacity value and normalized step value,

namely $\left(\hat{t}_a^{(i)} - \hat{t}_{aC}^{(i)}\right)\Big/ C_a$. In Fig. 1a, graphical representation of three iterations of expansion delay function of equation (17-19) is given. At the time of the first iteration, there is no initial beta value $initial - beta\,(b_a)$, namely $b_a^{(1)} = 0$, the capacity is controlled within $x_a^{(1)} > C_a$, speed value $\nabla b_a^{(1)} > 0$ is shown by computer graphics, which promotes delay function of the next iteration, namely $b_a^{(2)} = 0 + \nabla b_a^{(1)}$. In the second iteration, although it is a marginal cost of expansion $\nabla b_a^{(1)}$, college communication space landscape quantity is still higher than capacity design ability, namely $x_a^{(2)} > C_a$. Therefore, speed value $b_a^{(2)} > 0$ is used to calculate iterative value of the third time: $b_a^{(3)} = b_a^{(2)} + \nabla b_a^{(2)}$. Implement the third time of iteration, the capacity keeps unchanged, namely $x_a^{(3)} = C_a$. Three key components of the algorithm: $beta\,(\beta_a)$, $initial - beta\,(b_a)$ and speed ∇b_a, as shown in Fig. 3.

(a) Iteration Process of Expansion Delay Function

(b) Schematic of Noneffective Punishment
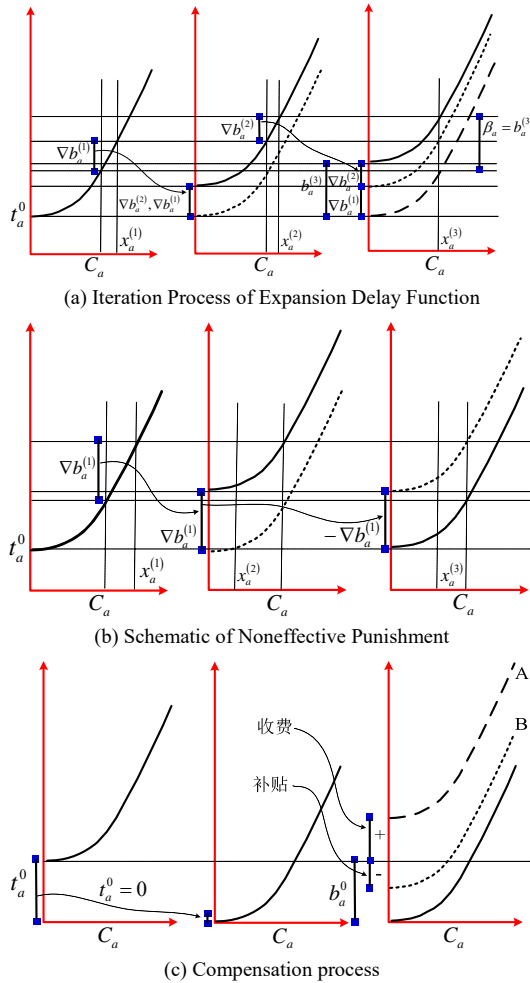
(c) Compensation process

Fig. 3. Delay function representation method in proposed landscape shaping

In such a progressive method, if it is found that one (above) saturation region is not saturated, corresponding punishment of iteration position in the center is noneffective, as shown in Fig. 1b, namely $p_a^{(i+1)} = 0 \left| x_a^{(i)} < C_a \right.$. The above *initial − beta* (b_a) calculation process can be summarized by two rules:

$$b_a^{(i+1)} = \begin{cases} b_a^{(i)} + \nabla b_a^{(i)}, & x_a^{(i)} \geq C_a \\ 0, & x_a^{(i)} < C_a \end{cases} \tag{5}$$

The above setting conforms to KKT stable point condition of production allocation problem, where beta value of unsaturated area must be set to be 0.

3.2. *Design compensation strategy*

Now design subsidy can be included into model. As previously mentioned, a negative circulation may damage the whole design process. In order to avoid this condition, marginal cost of landscape shaping shall be guaranteed to be normal value from beginning to end. For this, free capacity design time of all collection/subsidy landscape shaping shall be canceled firstly, and then we initialize initial beta to corresponding marginal cost of free flow. Actually, there is no any change and delay function keeps unchanged:

$$\begin{cases} b_a^{(0)} = t_a^0 \\ t_a^0 = 0 \end{cases} \tag{6}$$

The details are shown in Fig. 1c. In the last step of iteration calculation, according to obtained beta value, delay function of A or B is obtained. Beta value subtracts free flow time $\beta_a - t_a^0$, and positive value (delay function A) or negative value (negative function B) can be generated, which represents capacity design fee or subsidy respectively. In addition, absolute value of subsidy cannot exceed free circulation time. In other words, no areas will have negative marginal cost; therefore, negative circulation will not appear.

Giving iteration (iteration n) output in the last time, collection/subsidy value $(-t_a^0 \leq s_a \leq +\infty)$ can be calculated as follows:

$$s_a = \tilde{t}_a^{(n)} - t_a^0 \left(1 + f\left(\bar{C}_a \right) \right) . \tag{7}$$

4. Empirical analysis

Macro is used for coding in the method. This is a special programming language of landscape plan software Emme 3 of college communication space, where Frank-Wolff algorithm is adopted for solution of TAP process without capacity limitation. A desk-type PC computer with CPU of 3.60GHz and 16 GB RAM is used. Secondly, a network example in a large-scale landscape shaping in real life is used for verification of algorithm performance.

Iterative operation of the algorithm is 237 times until relative gap and rela-

tive step value are decreased under 0.0001 and 0.01 respectively. Calculation time is only 15 seconds. Calculation result includes college communication space landscape, marginal cost of expansion and capacity design fee/subsidy value is also shown in Fig. 2. In order to satisfy restriction of college communication space landscape, slight violations as shown in the row of x_a/C_a is less than 1%, which can be due to that ITT is a heuristic algorithm and has certain out-of-limit condition. Change of college communication space landscape and marginal cost of expansion for continuous iteration of 1, 2 and 3 in landscape shaping is shown in Fig. 4.

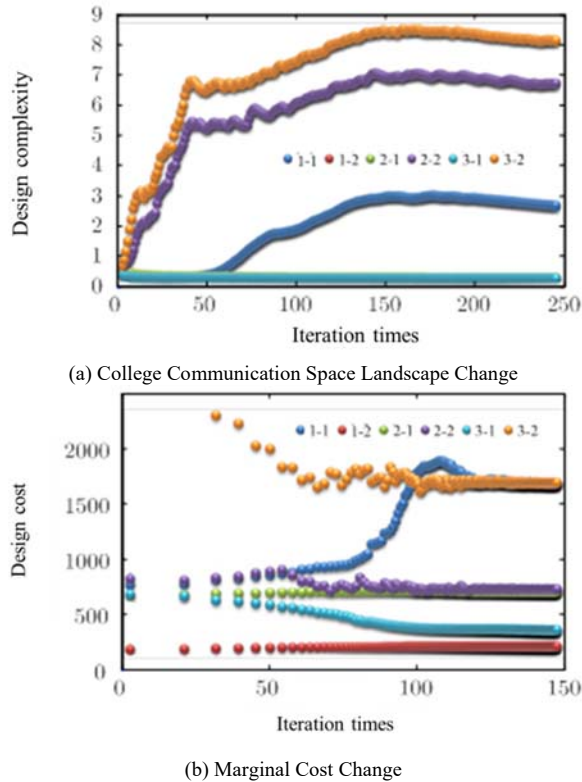(a) College Communication Space Landscape Change

(b) Marginal Cost Change

Fig. 4. Calculation result of the first three continuous iterations

It is shown by results in Fig. 2 and results show that this change is unstable in early iterations, and it will result in unstable change of college communication space landscape quantity and marginal cost, but it will be converged generally along with iteration process, and will be stable finally. This shows that algorithm has an expected effect in network control of landscape shaping in example. Growth of 5% can be regarded as college communication space landscape growth once a year or twice a year.

Here 20 communication space landscape plan schemes of certain college in China are extracted as example. Simulation of scoring by experts is adopted and 5 landscape plan design experts are invited. Scoring is subject to communication space

design evaluation standard listed in Chapter 2, and average value of scoring is extracted as final assigning score. The result is shown in Table 1.

Table 1. Assigning result of landscape plan scheme of certain college communication space

Scheme No.	Function positioning	Space arrangement	Campus characteristic	College communication space landscape organization	Campus scenic spot	Service facilities	Vegetation landscape	Impression evaluation
1	5.6	7.8	9.2	7.8	8.7	7.8	7.8	8.7
2	9.1	9.5	7.8	8.6	7.4	8.6	8.9	6.4
3	8.3	9.2	8.6	8.3	9.2	8.6	9.6	9.2
4	7.6	6.4	5.8	7.6	6.4	5.8	6.2	7.9
5	8.9	9.2	8.9	9.2	8.7	9.4	5.2	9.1
6	9.6	7.9	9.6	6.4	6.3	8.2	6.3	8.3
7	9.0	9.3	6.2	5.9	8.2	7.9	8.2	9.3
8	6.3	8.0	7.4	8.7	4.9	6.4	7.2	8.0
9	7.8	8.7	4.8	8.9	9.2	4.9	2.6	8.9
10	8.6	7.4	8.6	9.6	8.3	9.2	8.6	9.6
11	9.4	5.2	9.1	6.2	4.9	8.9	8.9	9.2
12	8.2	6.3	8.3	9.0	9.3	6.2	9.6	7.9
13	7.9	8.2	5.4	6.3	8.0	7.4	8.0	8.9
14	9.2	4.9	2.6	8.3	9.2	8.6	8.7	9.6
15	6.4	7.2	8.4	7.6	6.4	9.1	9.2	4.9
16	5.9	4.9	1.9	7.9	8.2	5.4	6.4	7.2
17	9.0	5.1	8.3	9.6	7.9	9.6	5.9	4.9
18	8.7	6.2	6.5	9.0	5.1	8.3	5.1	8.3
19	7.4	6.7	9.3	9.0	9.3	6.5	6.2	6.5
20	8.5	7.6	4.8	7.2	8.4	9.0	5.1	8.3

It can be seen that algorithm in the Thesis can be applicable to communication space landscape plan scheme evaluation after proper setting with higher prediction accuracy and good generalization ability. There are complex nonlinear relationship among function positioning of college communication space, space arrangement, campus characteristics, college communication space landscape organization, campus scenic spot, service facilities, vegetable landscape and comprehensive quality. Comprehensive score of the scheme can be given automatically by inputting expert evaluation index value in each index of the model, which overcomes randomness, subjective uncertainty and cognitive ambiguity of artificial evaluation, and guarantees objective and correct evaluation result. There are large differences among knowledge background and experiment of experts, which will influence accuracy of predict result. In order to guarantee accuracy of initial data, quantity of evaluation experts shall be increased to reduce errors. At the same time, a large number of and reliable samples are fundamental guarantee of prediction accuracy. Empirical parts of the research are mainly aimed at landscape plan scheme of certain college communication space. Sample quantity shall be increased to improve evaluation accuracy in future researches.

5. Conclusion

A communication space landscape shaping method based on delay function analysis mode is proposed. Landscape shaping method mode of college communication space is constructed based on biological gene theory, landscape shaping compensation strategy of college communication space is constructed based on heuristic algorithm, and delay function analysis model is constructed by marginal cost, and then model optimization is implemented based on subgradient method; finally, effectiveness of proposed method is verified by simulation experiment.

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