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Research on the relationship between the formation of local construction culture and geographical environment based on adaptability analysis

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ABSTRACT

Objectives: Since the natural ecology and geographical environment are the basis for the formation of local architecture, based on the adaptability analysis, the article analyzes the natural ecology and geographical environment that affect the creation of regional local architecture, and analyzes the adaptability of traditional architecture to natural ecology and the impact of traditional culture. Methods: The summary of the response methods is to try to find the substantive connotation of vernacular architecture in order to provide basic theoretical support for contemporary vernacular architecture creation. At the same time, combined with the characteristics of the times of the contemporary area, it proposes a typical site design adaptability analysis, a suitability climate adaptability analysis and a construction adaptability analysis returning to the local culture. And for the coastal cultural and historical background of the region, the development of regional ancient towns is discussed, and the location of regional coastal ancient towns is analyzed for the coastal environment.
Results: The final selected model was a weighted average based on Akaike weights of 71 logistic candidate models that included all the variables in these 71 candidate models. The importance weights of variables are the criteria for assessing the impact and contribution rate of environmental factors on survival and dispersal, and are the sum of the Akaike weights of all candidate models containing a given predictor variable. The connection between households basically uses the scattered water of the building, does not occupy the foundation, and basically does not damage the landform. The entrance to the building is determined by the terrain on the one hand, and the road on the other, and is generally set on one side of the road. Finally, the coastal environmental background and historical and cultural background of regional ancient towns are summarized, and the research roughly explores the region. Conclusions: At the end of the article, through the interpretation of actual cases, it provides certain evidence and explanations for adaptability analysis, and expresses the design ideas of comprehensive trade-offs in the process of adaptability analysis, in order to provide contemporary local architectural design for the extensive urban and rural construction in the region with theories and adaptability analysis.

1. Introduction

In today's world, the globalization of construction applicability has become an inCevitable trend in various fields. One-sided adherence to closed regional characteristics and refusal to communicate with the outside world is tantamount to giving up opportunities for development and stifling the life of local culture (Chen et al., 2020). Especially when this wrong attitude is entangled with political needs and ideology, it is especially dangerous. The region faces huge construction opportunities, but in the rapid development, some construction problems have also appeared, such as insufficient attention to natural ecology, dislocation of cultural expression, etc. (Ten et al., 2021). The emergence of these problems is mainly due to the failure to consider the local natural environment and historical culture as the basis for the design, but this is precisely the basis for the local architectural design. The current research on the local architectural design has real-time significance (Bardosh et al., 2017; Goh, 2020; Reyes-García et al., 2016).

The regional economic level has been sharply improved, and the regional construction market has also obtained unprecedented

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development space. Especially after the implementation of the regional urban–rural integrated strategy, the large-scale construction wave has also spread to the regional township construction (Hardy et al., 2017). However, due to the lack of due consideration and reflection in the accelerated process of development (Shen and Tsai, 2016; Roncoli et al., 2016; Zheng et al., 2020).

Based on the existing theoretical research on traditional regional architecture in regional mountains, this article collects, organizes, and analyzes the latest research results of regional mountain architectural design practices in the past ten years, and analyzes the influencing factors of the development of local architecture to explain the natural ecology and geography. To analyze the characteristics of the natural ecology and geographical environment of the region, firstly, it analyzes the topographic and climatic factors that have a direct impact on architectural creation; secondly, it summarizes the characteristics of traditional regional culture, and analyzes the characteristics of traditional buildings under this influence. From this, we can draw the inherent influence of natural ecology and human ecology on traditional architecture.

2. Related work

Therefore, it is very protective to explore the adaptation methods between traditional towns and the coastal environment. At the same time, these traditional ocean adaptation methods are also very worthy of modernization construction (Estaji, 2017).

In Estaji's (Thomas et al., 2019) treatise a systematic introduction to the complexity of the subject in the study of urban ecology. In the book edited by Thomas (Adamson et al., 2018), from the perspectives of national marine economic history and marine society and humanities, historical interpretations of the Chinese nation's marine concepts, marine trade, marine beliefs, marine disasters, etc., have unearthed a large number of people in the coastal areas of the country for various marine social and cultural information. In Adamson's (Cafer et al., 2019) treatise, the foundation of the country's marine environment changes since the reform and opening up has been profoundly explained, and the social impacts and social roots of the country's marine environmental changes have been discussed, and many social, economic, and cultural aspects of maintaining the marine ecological environment have been proposed.

On the one hand, the comprehensive research on urban space and coastal environment is less involved (Dunets et al., 2019). Tan and Altrock (2016) and his research team have done a lot of basic research work on historical villages and towns, and are engaged in the investigation and research of ancient villages and ancient towns in Jiangnan area. It mainly involves research on the protection of historical cities and towns. Chowdhury and Moore (2017) research on traditional towns in the middle and lower reaches of the Yangtze River, such as Hubei, Jiangxi, Hunan, etc., mainly from the aspects of location selection, spatial form, architectural mode and cultural characteristics of traditional towns. And comprehensively, he is revealing its deep-level spatial organization rules, mainly from the perspectives of psychology (Tang et al., 2018), aesthetics (Healey et al., 2017), sociology (Wang et al., 2021), behavior (Ferro-Azcona et al., 2019), and other aspects of the comparative study of the spatial morphology of the towns in the Taihu Lake area (Qin et al., 2019; Hariharakrishnan and Bhalaji, 2021; Zhang et al., 2020; Cai et al., 2020; de Araujo et al., 2019; Szareski et al., 2018; Helgadóttir et al., 2018; Pérez-Fargallo et al., 2020; Wang et al., 2019; Li et al., 2020; Ruiz et al., 2018). The main natural element involved is the Jiangnan water system (Derville et al., 2019; García-Solache and Rice, 2019; Liu et al., 2018; Zarrinabadi et al., 2022), and the spatial research of regional coastal town is a certain theoretical reference significance (Bălăcescu et al., 2021).

3. The establishment of the relationship model between the formation of local construction culture and the geographical environment based on adaptability analysis

3.1. Hierarchical distribution of adaptability analysis

The adaptive geographic environment is not a static geographic environment (Ahrens et al., 2020). In addition to its inherent spatial attributes, the active changes in the climate, economics, and social environments give important adaptive temporal and temporal attributes to the environment. Fig. 1 is the hierarchical topology of adaptive analysis. It constitutes the street space characteristics of traditional towns with orderly changes, similar scales, and close connection with single buildings. In a modern city built on an efficient and convenient transportation network, the main traffic roads are for motor vehicles rather than walking.

The overall layout of the city only pays attention to the form and completely separates the connection with the texture and context of the ancient town (Okamuro et al., 2019). What's more, the construction of some places completely ignores the traditional culture, razes the primitive settlements to the ground, ignores the linear planning layout of the environment, and concentrates extensively to deal with the natural environment of towns.

$$X[t] = \{t \in R | x(1), x(2), ..., x(t)\} \tag{1}$$

$$\overline{x^2}(t,n) - |x(t,n)|^2 - 2|\overline{x(t,n)}| * \cos\alpha = 0 \tag{2}$$

The adaptive geographic environment of a life body refers to the virtual geographic environment that can adapt to a certain life body.

$$\frac{\alpha(x) - \alpha(x-1)}{\sum a(t) * w(x)} - \frac{\beta(x) - \beta(x-1)}{\sum b(t) * w(x)} = 0 \tag{3}$$

The bio-adaptive geo-environmental simulation has great potential in many research directions such as disease prediction and warning, biodiversity management, and ecological safety assessment (Oladigbolu et al., 2019; Wang et al., 2019). The streets with parallel contours constitute the main body of the urban space, which meets the requirements for street widths in the flow of people and commercial transactions. At the same time, the street space that extends along the contours has small changes in height, which is conducive to the use of transportation and free movement of people.

$$cov(X) = E\left[XX^T - \left(E(X)E(X)^T\right)\right] \tag{4}$$

$$P(S(i), S(j), ..., S(k)|T(t)) = P(S(i)|T(t))P(S(j), ..., S(k)|T(t)) \tag{5}$$

Contour lines of the same elevation may have different densities in different sections, resulting in inconsistent street widths, forming a retractable external space experience, enriching the street space, and satisfying the use of different functions.

3.2. Construction of cultural elements

When studying the climate problem of buildings, it is meaningful to study within a climate range that is not much different from its scale. The microclimate involves exactly the scale of the building based on it, reflecting the climatic characteristics of the climate around the building. Microclimate refers to the climatic influence produced under the influence of terrain. The geographical environment of the region's waterfront and mountainous areas forms a microclimate with different characteristics in different regions.

Regionality is the fundamental attribute of a region. Fig. 2 shows the scattered distribution of regional feature adaptability scores. The origin of the geographical attributes is rooted in the

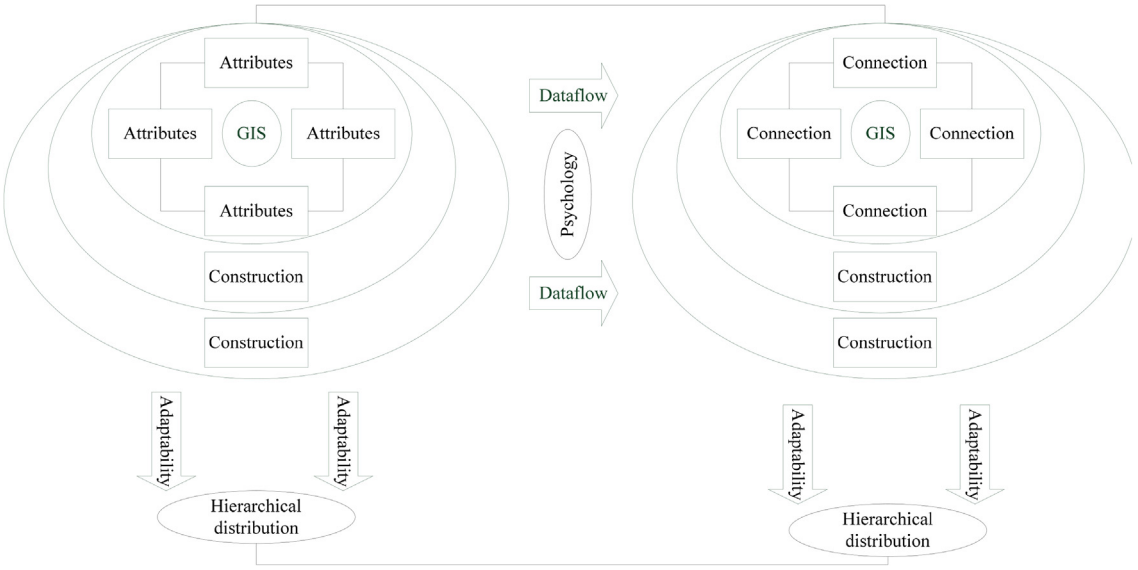

Fig. 1. Adaptive analysis hierarchical topology.

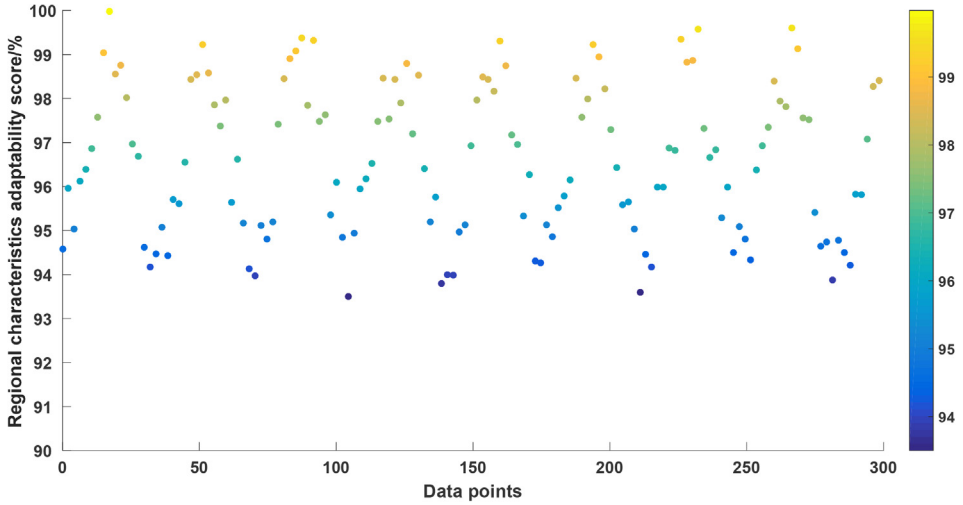

Fig. 2. Scattered distribution of regional feature adaptability scores.

natural geographical conditions and long history and culture of the area. Natural geographical conditions are the basic constituent elements of a region, and the framework that distinguishes this region from other regions. Human beings, as the main body of a region, act on the region, which is reflected in the fact that humans use their natural environment to create a regional landscape suitable for human development. At the same time, the natural environment of the region reacts on people and affects human production and lifestyle, which is reflected in human beings.

3.3. Geographical environment fusion factor

Landforms include topography and ground muscles. Both have different degrees of influence on the grounding method, structural form and environmental coordination of mountain buildings, thus restricting the construction of mountain buildings. Because the cultural landscape is produced in a specific region, it not only harmoniously echoes the region in form, but also adapts to the possibility of development constituted by the local natural, resource, social, economic and other conditions. The choice of large terrain and its characteristics are mainly related to urban planning. Small terrain refers to the local small patches of terrain that have a greater impact on the layout of building groups and land use organization; ground muscle is the texture composition of the ground surface, which corresponds to the geometry of the terrain, and its main elements are rocks, soil and vegetation. The morphology of ground muscle has reference value for how to integrate the architectural form with the environment.

Fig. 3 is the framework of geographic environment integration. Due to the complex and non-linear dynamic relationship between living organisms and the corresponding adaptive geographic environment, it is difficult to express with a simple formula. Spatial data mining algorithms can handle complex nonlinear relationships and have powerful spatial prediction capabilities; GIS has functions such as spatiotemporal analysis and spatial data model construction. Therefore, for the adaptive geographic environment

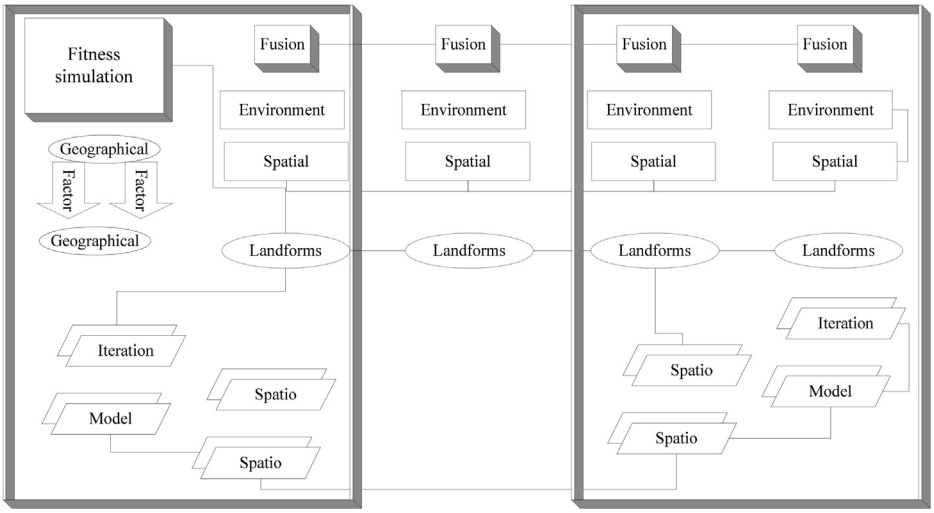

Fig. 3. Geographic environment integration framework.

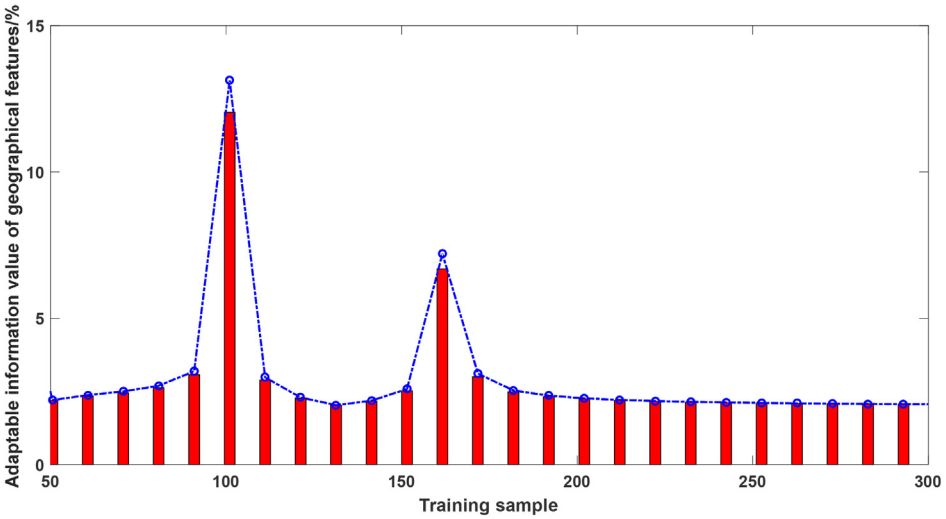

Fig. 4. Numerical histogram of geographic information adaptability to geographical features.

simulation of living organisms, spatial data mining algorithms and GIS fusion is an effective method..

3.4. Relational model weight iteration

The adaptive geographic environment is not a static geographic environment. In addition to its inherent spatial attributes, the active changes in the climate, economy, and social environment endow the adaptive geographic environment with important time attributes and dynamic characteristics. Fig. 4 is a histogram of geographic information adaptability to geographical features.

Each rule itself can be regarded as a model, which is derived from the "if-then" statement to obtain the value of the variable of interest. The GARP-based model is not a simple mathematical model that can be a more accurate reasoning model. Different types of rules are predicted to simulate species prediction models according to the method of rule setting, and finally different generation rule sets are synthesized, and finally the best adaptive geographic distribution is obtained in Table 1.

We initially establish a set of adaptive geographic environment simulation models suitable for different scenarios and different times, and analyze the trend of potential distribution prediction results in the future, providing a strong basis and reference for the prevention and control of alien species or epidemiology and information management.

Table 1
Distribution of adaptive models.

Model variable	Adaptive factor set value
Input variable	0.41428
Rule setting	0.42025
Environment error	0.57454
Simulation mode	0.43154
Structure factor	0.25628
Adaptive mean value	0.70906
Generation rule	0.62663
Predictive ability	0.37602
Output variable	0.45228

4. Application and analysis of the relationship model between the formation of local construction culture and the geographical environment based on adaptability analysis

4.1. Data extraction for adaptive analysis

Using the spatial data mining capabilities of GIS, various required information can be obtained through spatial sampling to the greatest extent, and then the numerical estimation of unknown sampling points can be used to obtain the potential distribution range on a continuous time series.

Fig. 5 is the distribution of the characteristic parameter of the regional characteristic adaptability. Compared with other factors, the regional climate, geographical conditions and the mutual influence between buildings will constitute important factors affecting the building itself. The type of warm and humid climate distinguishes the fortress-style building from the traditional courtyard structure, with a double-layered architectural pattern..

4.2. Simulation analysis of construction cultural environment

Under global climate change, on the basis of model establishment and environmental simulation principles and methods, based on the ARCGIS platform, it simulates future climate data sets on different time series, studies the methods of invasive plant adaptive geographic environment simulation, and establishes multiple time scales GIS species prediction model..

Based on the adaptive geographic distribution results of other regions, the model results with the greatest significance and the best accuracy are screened out, and the final model results are output in the form of grids. Fig. 6 shows the significance level of the adaptability of regional characteristics. After analyzing in GARP, you can get the distribution model of a species in its original area, get its adaptive geographic environment, and then project the adaptive environment to the environmental variable GIS layer of other regions, you can get it.

4.3. Example application and analysis

The application of new technologies, new materials, and new processes should be comprehensively considered with a sustainable ecological concept, so as to improve the relatively backward living environment in the local area, to adapt to the gradually changing lifestyles of the people in the region, and to improve the quality of living.

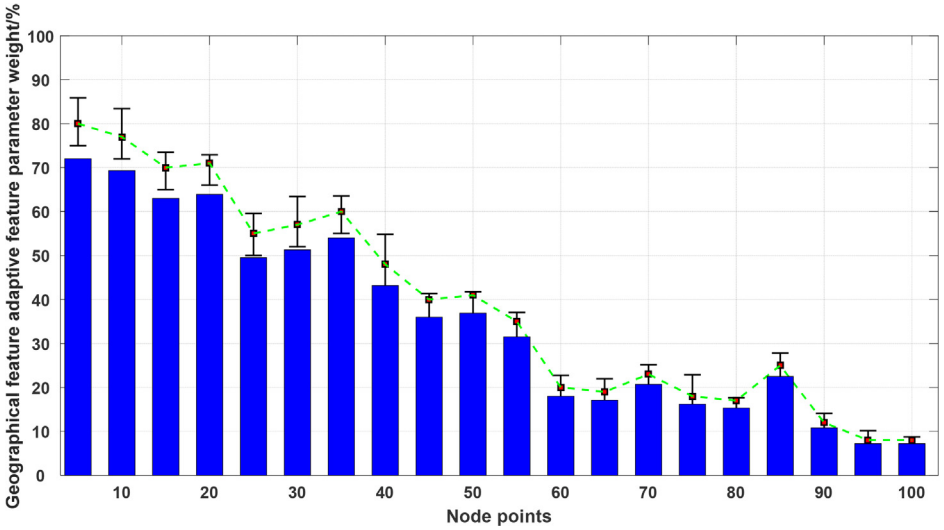

Fig. 5. Distribution of adaptability characteristic parameters of regional characteristics.

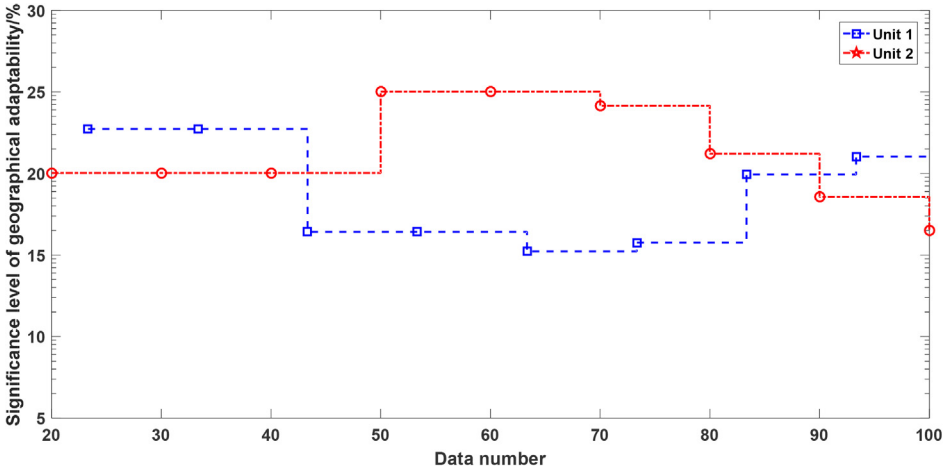

Fig. 6. Significance level of regional characteristics adaptability.

Fig. 7 shows the distribution of spatial proportions of regional characteristics adaptability. This section calculates the area changes between the future distribution results and the current distribution results under different climate scenarios and different time nodes. Among them, the diffusion area in the A2 scenario is the largest, with an increase of 57.2 %; the diffusion area in the A1B scenario is the second, which is 32.2 %; the area of diffusion in the B1 scene is the smallest, which is 11.1 %.

In the expansion of the use of space in Table 2, it is obvious that the single house is the axis, and the "complexity" of the composite demand is arranged in the vertical space layout, so that the connection of the use space realizes the purpose of "benefiting oneself, not benefiting others" livestock arranged on the overhead floor of Lingkong, people live in the middle floor, and food is stored in the attic floor.

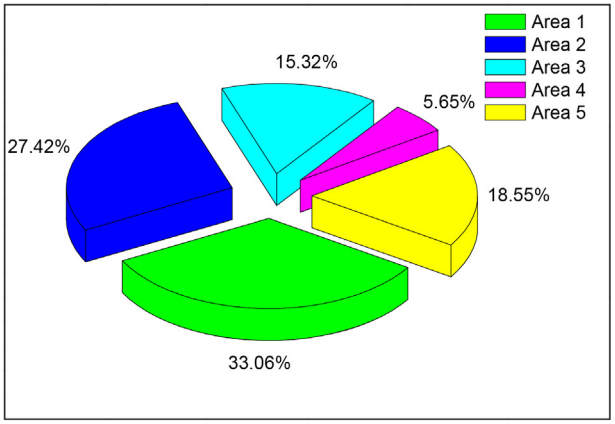

Fig. 7. Distribution of spatial proportions of regional characteristics adaptability.

Table 2
Analysis of living environment factors.

Environment factors	Factor a	Factor b	Factor c
Scene 1	0.00387	0.76083	0.59349
Scene 2	0.21913	0.01835	0.21958
Scene 3	0.66058	0.16329	0.49489
Scene 4	0.31848	0.97866	0.47026
Scene 5	0.00595	0.20545	0.09743
Scene 6	0.80696	0.15655	0.29916
Scene 7	0.48388	0.27223	0.53751

Fig. 8 is the distribution of the geographical feature adaptability layer factor. The first step is to obtain continuous years of meteorological and climate data covering the climate stations of the study area, and use the interpolation function in the GIS to interpolate the climate point data to the data layer covering the climate surface of the study area, so as to obtain the climate factors of the study area. The importance of each candidate variable on survival and outbreak effects can be obtained using the Logistic weighted average model, and the results of the weight assessment of the factors of its variables are shown in the figure. The database, combined with the survival range of the research species, such as a certain temperature range, humidity range, etc., with the help of data query and processing functions, display the range of climate values suitable for the survival of the research target in the research area, and you can get the scope of initial adaptive survival. Finally, according to other constraints such as elevation, host, road, etc., multiple layers that form multiple influence factors can be obtained. By using the overlay function of the layers, the distribution of the adaptive geographic environment can be obtained by intersecting the layers of environmental variables.

5. Conclusion

In terms of the overall layout of architectural culture, this article explores the evolution of urban spatial collages in different periods presented by the overall layout of regional ancient towns, and analyzes the coastal characteristics and causes of the spatial structure and spatial boundaries of the overall layout of ancient towns. In terms of residential space, it analyzes the multi-dimensional comprehensive considerations of ancient towns' residential buildings on coastal natural climate, marine life, and marine industry; in terms of industrial space, it explains the cyclical symbiosis mode of the ancient town's industrial space in response to the laws of marine life and tides. Finally, we complete the analysis of the results of national invasive plants in different scenes and different time series, and use representative species to illustrate and research and analyze. Through the study of the regional natural ecology and geographical environment, the essential connotation and dominant factors of local architecture are clarified. At the same time, combined with the characteristics of the times, it proposes a typical adaptability analysis of contemporary regional local architectural design, and provides theories and adaptability analysis of contemporary local architectural design for the extensive urban and rural construction and renewal.

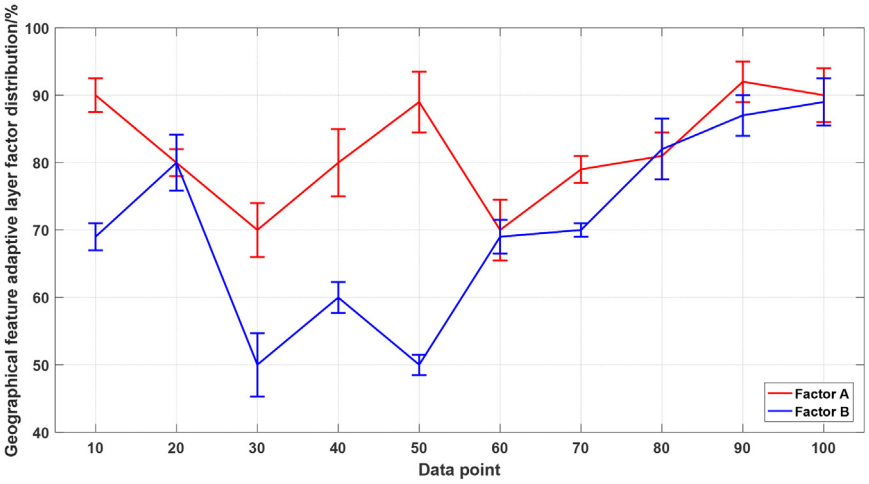

Fig. 8. Distribution of adaptability layer factors for regional characteristics.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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