Global NEST Journal, Vol 26, No 10, 06288
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Distribution characteristics and development layout of rural tourism resources based on LSTM in-depth learning in the context of common prosperity†

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Received: 20/06/2024, Accepted: 17/07/2024, Available online: 08/10/2024
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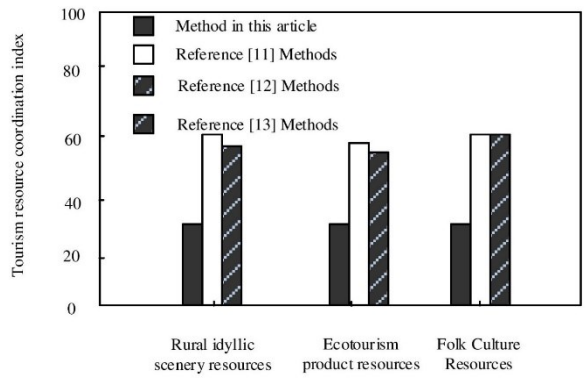
https://doi.org/10.30955/gnj.06288

Graphical abstract



Abstract

The development and layout of rural tourism resources is the core issue supporting the development and planning of tourism destinations. Currently, it mainly relies on the experience and judgment of planners, with strong subjectivity and lack of objective information technology support. Therefore, in the context of common prosperity, a method for distribution characteristics and development layout of rural tourism resource based on LSTM deep learning is proposed. After distinguishing various rural tourism resources using the classification method of rural tourism resources based on LSTM in-depth learning, the spatial distribution characteristics of various tourism resources are estimated using the analysis method for spatial distribution characteristics of tourism resources based on kernel density estimation; After identifying the current status of tourism resource functional areas through a method of tourism resource development and layout based on a grid spatial analysis model combined with the distribution characteristics information mastered, and from the perspective of tourists, it can optimize the layout mode of functional areas to maximize the benefits of rural tourism resources on the basis of satisfying tourists' preferences. After testing, this method can utilize intelligent information technology to optimize the development and layout of rural tourism resources.

Keywords: The context of common prosperity; LSTM deep learning; Rural tourism resources; Distribution characteristics; Development layout; Kernel density

1. Introduction

As the foundation of rural economic development, landscape planning of rural leisure tourism highlights its own value in promoting the construction of beautiful villages, promoting regional economic development, repairing the ecological environment, and increasing the construction of infrastructure services in rural areas [Kumar 2020; Guo and Jordan 2022]. Utilizing resource advantages, to develop rural tourism, rural industries and scientific industrial production, and make sustainable development in rural areas are considered to be the inevitable development stage of traditional agriculture under the revitalization and development of rural areas. The development and research of tourism projects is a systematic and long-term work that requires professional landscape planners to coordinate and discuss with the local government and villagers, complete rural landscape planning, build a complete rural tourism system, utilize the advantages of rural resources, bring economic benefits, and promote rural development. At this stage, the goal of poverty alleviation in China has been basically achieved, and rural revitalization is bound to be unstoppable. The best way to achieve this goal is to achieve rural revitalization through rural tourism [Zhang and Zhang 2020; Mtapuri and Giampiccoli 2020; Güzel 2021]. However, at present, the landscape planning of rural leisure tourism is not coordinated with the surrounding environment. Firstly, some villages pay insufficient attention to the surrounding environment during environmental transformation, and invest less in infrastructure. They simply believe that the

† This work supported by Research and Creation Project of Zhejiang Provincial Department of Culture and Tourism: Study on the Marketing Model of Homestay Tourism in Zhejiang Province from the Digital Perspective (2020KYY030)

Chen Shuangshuang and Xu Jinhu (2024), Distribution characteristics and development layout of rural tourism resources based on LSTM in-depth learning in the context of common prosperity, *Global NEST Journal*, **26**(10), 06288.

transformation of their own village environment can attract tourists to come for sightseeing [Manniello *et al.* 2020]. Regional tourism planning requires the establishment of a theoretical system and organizational structure model based on basic multidisciplinary theories such as geography, resource science, and tourism. It also requires the exploration of technical support measures in planning methods to supplement and corroborate the subjective experience and judgment of planning designers [Olishevska 2020].

In order to understand the spatial distribution characteristics of farmhouse entertainment in the main urban area of Chongqing with a view to optimizing its layout, Li *et al.* [2020] used GIS spatial analysis technology and mathematical statistical methods to quantitatively study the spatial distribution characteristics of farmhouse entertainment in the main urban area of Chongqing from the perspective of distribution type, balance, and spatial pattern, taking the points of interest of farmhouse entertainment captured from Baidu map as the research object. This method uses big data to study geographical phenomena, which can improve the accuracy of research, but lacks specific plans for the development and layout of tourism resources. Xu [2022] used ant colony algorithm to schedule resources when studying the clustering problem of rural tourism industry. This method has been verified to have a good resource scheduling effect, but ant colony algorithm is prone to fall into local optimization. In future applications, it is necessary to focus on optimizing the optimization ability of ant colony algorithm. Xing *et al.* [2020] analyzed the problems in rural tourism development in the Taihang Mountain area represented by Yesanpo from the perspective of tourists, and combined the tourism development laws and tourism poverty alleviation requirements to construct a new model for rural tourism development in the Taihang Mountain area. However, this method is too theoretical, and it is necessary to explore more systematic, modern, and scientific innovative methods for tourism collaborative development.

In the context of common prosperity, this paper proposes a method for resource distribution and development layout of rural tourism based on LSTM deep learning. After in-depth analysis of the meaning of rural tourism resources, this method combines long-term memory neural network technology with attention mechanism in deep learning technology, classifies rural tourism resources, and introduces a kernel density estimation method to analyze the spatial distribution characteristics of tourism resources. After grasping the distribution characteristics of resources, the functional zoning and layout of rural tourism resources are completed from the perspective of tourists, thereby ensuring the rapid development of rural tourism.

2. Distribution characteristics and development layout methods of rural tourism resources

2.1. Analysis of tourism resources

2.1.1. Meaning of tourism resources

Tourism resources mainly include natural tourism resources and humanistic tourism resources [Lee and Liao 2021; Holmes *et al.* 2021]. In natural and human social environments, anything that can attract tourists and generate economic benefits through the development and utilization of the tourism industry can be called tourism resources.

2.1.2. Tourism resource monomers

Tourism resource monomers refer to a single individual that can be independently viewed or utilized as a tourism resource. The national standard "Classification, Investigation, and Evaluation of Tourism Resources" (GB/T18972-2003) (hereinafter referred to as the national standard) has been officially implemented since May 1, 2003. This technical standard will play an important role in the collection, analysis, evaluation, development, and planning of tourism resources in various regions of the country [Yi *et al.* 2020]. Structurally, it can be divided into three levels: main class, sub class, and basic type.

2.1.3. Tourism resource aggregation

Tourism resource aggregation refers to various types of tourism resource monomers clustered in a small range, which together form a tourism resource group with high tourism value. It can be considered as a resource ontology with constitutive relationships, derivative relationships, and concomitant relationships. Under certain scales, blindly using individual tourism resources as a research unit may undermine its overall effect, for example, a farmhouse composed of harvesting, fishing, local specialties, and recreational areas, a Buddhist temple composed of individual pavilions, temples, and towers, and a wetland park composed of wetlands, sightseeing river sections, animal and plant habitats, and woodlands [Chu *et al.* 2020], which can be considered as an individual collectively assembled [Ram and Hall 2022].

It can be seen that the layout of tourism resources needs to take the collection and allocation of tourism resources as the purpose, in order to form a tourism resource group with high tourism value and improve tourism value. Therefore, the development and layout of rural tourism resources requires comprehensive consideration of various tourism resource monomers and the construction of a tourism resource aggregation.

2.2. Classification method of rural tourism resources based on LSTM deep learning

The Long Short Term Memory (LSTM) neural network is an improved version of the cyclic neural network RNN [Knig *et al.* 2021; Ma *et al.* 2020; Lagesse *et al.* 2020]. LSTM performs much better than RNN when the input sequence length is long, which can not only effectively alleviate the gradient explosion or gradient disappearance problem existing in RNN, but also solve the problem that RNN cannot process long-distance dependent data [Niu *et al.* 2022]. The basic structure of the LSTM network is shown in **Figure 1**.

The input gate controls the input of the current unit, the output gate controls the output of the current LSTM unit

[Zhao *et al.* 2022], and the forgetting gate controls the historical information stored in the previous time unit.

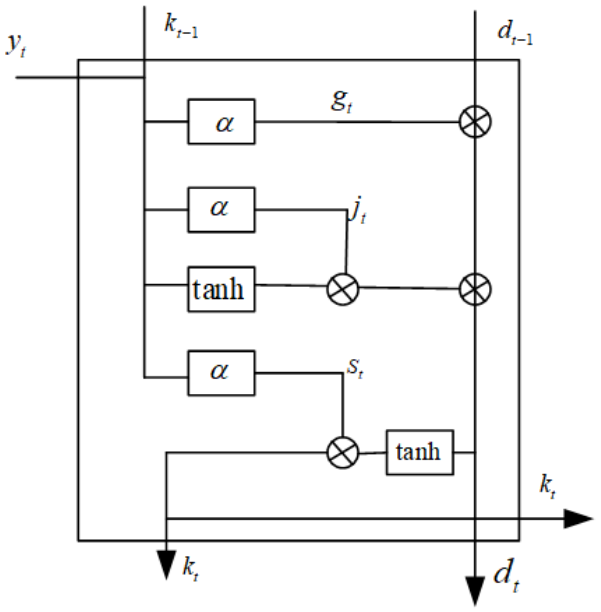


Figure 1. Basic structure of LSTM network

The storage unit *D* is a control parameter that mainly determines what tourism resources will be retained and forgotten during the classification process. The input gate, output gate, and forgetting gate at time *t* are recorded as J_t, S_t, and g_t, respectively. Then, at the time before and after the LSTM gating mechanism, the method for updating the status of rural tourism resources is as follows:

$$g_t = \alpha\varpi_g\left[k_{t-1}, y_t\right] + \alpha c_g \tag{1}$$

$$j_t = \alpha\varpi_j\left[k_{t-1}, y_t\right] + \alpha c_j \tag{2}$$

$$d_t = g_t^* d_{t-1} + \tanh\left(j_t^* \varpi_d\left[k_{t-1}, y_t\right] + j_t^* c_d\right) \tag{3}$$

$$S_t = \alpha\varpi_s\left[k_{t-1}, y_t\right] + \alpha c_s \tag{4}$$

$$k_t = S_t^* \tanh\left(d_t\right) \tag{5}$$

Where α is the Sigmoid activation function; tanh is a hyperbolic tangent function; ϖ_g, ϖ_j and ϖ_s are the weight matrices of the forgetting gate, the input gate, and the output gate in turn; c_j, c_s, and c_g are offsets for the three control gates, respectively; g_t and d_{t-1} are the decision parameters for discarding data, which are repetitive tourism resources; j_t refers to the tourism resources to be reserved; d_t is the control parameter for the formation of new tourism resources; k_t is the output generated using new parameters, representing the classification result of the new resource; c_d and ϖ_d are the offsets and weights of d_t, respectively. k_{t-1} and y_t are the output results of tourism resource classification and the input samples of current tourism resource at the time $t-1$, respectively.

Although LSTM neural networks work well for long sequence data tasks, they still have some shortcomings and limitations. For example, in actual tasks, sequences at different locations have different influences on classification results, and LSTM is unable to identify these differences, resulting in some important sequences containing information that has not received attention. The emergence of attention mechanisms can solve this problem to some extent. The idea of attention mechanism originates from the human visual system. Scientists have discovered a signal processing mechanism in their research, that is, when humans pay attention to information such as pictures, they selectively focus on certain parts while ignoring other inconspicuous information. This mechanism is called attention mechanism [Han *et al.* 2021]. The attention mechanism can calculate the weight of different feature information, thereby enabling special attention to those useful information. The attention mechanism is added to the LSTM network, and attention weights are allocated to different tourism resources at the input layer using the attention mechanism to distinguish similar tourism resource characteristics. The LSTM neural network structure introduced into the attention layer is shown in **Figure 2.**

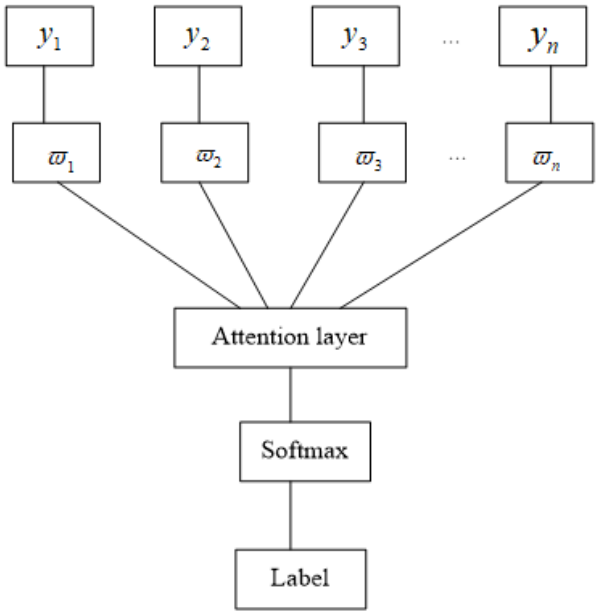


Figure 2. LSTM neural network structure with attention layer

After adding the attention mechanism, the LSTM network can obtain the characteristics of rural tourism resources in the input sequence through continuous training, and assign weights to them based on the importance of the characteristics, making representative rural tourism resources play a greater role in the final classification, to contribute to better completing the task of classifying rural tourism resources.

The attention mechanism assigns initial weights to each input and updates these weights during training based on the correlation between each input and the final classification result. The formula for the attention mechanism is as follows:

$$L_t = \tanh\left(\varpi y_t + c_{\varpi}\right) \tag{6}$$

Where ϖ is the weight of the attention mechanism L_t; c_ϖ is offset.

The attention weight ϖ is:

$$\varpi = \frac{\exp\left(L_t v_\varpi\right)}{\sum_{t=1}^{m}\left(L_t v_\varpi\right)} \tag{7}$$

Where v_ϖ is the initialization parameter for rural tourism resources.

The rural tourism resources after attention pooling are expressed as follows:

$$Y = \sum_{t=1}^{M} \varpi \cdot y_t \tag{8}$$

Where, M is the total amount of rural tourism resources.

2.3. Analysis method of spatial distribution characteristics of tourism resources based on kernel density estimation

In the field of statistical theory and application, parameter estimation and nonparametric estimation are commonly used to solve the problem of solving the distribution density function of random variables for a given set of sample points. Experience and theory indicate that there is a large gap between the basic assumptions of parameter estimation models and actual physical models, and the results obtained are not always satisfactory. The kernel density estimation method (KDE) for nonparametric estimation models does not utilize prior knowledge about data distribution, but does not attach any assumptions to the data distribution. It is a statistical method that studies the characteristics of data distribution from the perspective of the data sample itself [Hammitt and Robinson 2021].

This paper centers on a variety of rural tourism resource samples y_j classified in Section 2.2 and calculates a variety of rural tourism resource samples through a kernel function. Within the specified radius range of the research area (width a), the closer the distance from the grid cell center point within the search radius range to the sample point is, , the greater the density contribution value of each grid cell center point is. The specific method for estimating KDE is:

(1) Define a search radius by counting the number of events falling within the circular domain using sliding circles;
(2) Determine the ppaper size according to the density accuracy requirements;
(3) Calculate the density contribution value of each rural tourism resource sample to each grid within the circular domain through a kernel function;
(4) Assign a value to the density value of each grid, which is the accumulation of the density contribution values;
(5) Output the density value for each grid.

The estimation model is shown as follows:

$$z_m = \frac{1}{ma}\sum_{j=1}^{m} r\left(\frac{Y\left(y - y_j\right)}{a}\right) \tag{9}$$

Where, z_m is the calculated kernel density value of plot distribution in rural tourism resources; m and a are the number of plots and the estimated bandwidth of kernel density; $y–y_j$ refers to the distance between the land resource y and the land resource in rural tourism resources.

The kernel density estimation result is to convert the vector data of rural tourism resource into raster data, and the granularity of raster data directly affects the calculation result and calculation speed. The granularity selection is based on the area difference between vector data and raster data, and a comparative analysis of different granularity is conducted. In order to improve the accuracy of raster data, the granularity with the smallest area difference is selected as far as possible for kernel density estimation.

In kernel density estimation, the estimated point density (i.e., the search radius) becomes abrupt and uneven as the bandwidth a decreases, and becomes smooth as the bandwidth a increases. Changes in the bandwidth a can mask the density structure to varying degrees. Previous studies have generally determined the bandwidth a through multiple experiments, and the calculation formula for the search radius s_z is:

$$S_z = 0.9 z_m \times \min\left(S_E, E_n\sqrt{\frac{1}{\ln 2}}\right) \tag{10}$$

Where S_E and E_n are standard distances and median distances, respectively.

The kernel density estimation results can reflect the spatial distribution characteristics of rural tourism resources, thereby reflecting the spatial distribution status of resource groups.

2.4. Tourism resource development and layout method based on grid spatial analysis model

2.4.1. Scale and principles of tourism resource development and layout

(1) Layout scale

Tourism resource monomer is generally considered as the most basic component unit of tourism resources, while tourist attractions, forest parks, wetland parks, characteristic villages, and agritainments are often a manifestation of the quantity of tourism resources with specific value. Therefore, when considering grid based on tourism resource ontology, tourism resources can be divided into tourism aggregation based and resource monomer based (as shown in **Figure 3**). Among them, the macro tourism resource aggregation is a comprehensive aggregation of various micro scales, which is a dialectical unity of the interaction among the components, structure, nature, function, and diversity of individual tourism resources. The aggregation and networking of tourism resources on a macro scale is not a simple superposition of micro elements, nor is its research results a simple

synthesis of results. It is through the common organic connection of micro elements that the overall function can be well played. Both have specific roles that cannot be replaced by each other.

Generally, taking tourism resource aggregates as the research object, more emphasis is placed on macro tourism industry analysis, large-scale tourism resource development, spatial planning, and other research; The grid based research on tourism resource monomer is more suitable for in-depth research on the internal structure mechanism of tourism resources at small and medium-sized scales, as well as the potential agglomeration and combination effects of tourism resources. At the same time, it may be difficult to grasp the overall laws of tourism phenomena. For example, when studying regional tourism economic development from a local perspective, it is difficult to understand the spatial change characteristics at a larger scale.

The research on the development and layout of rural tourism resources in this paper belongs to the grid research based on individual tourism resources.

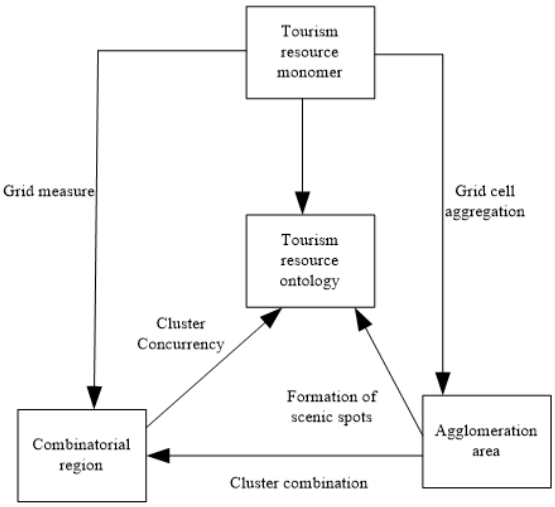


Figure 3. Grid based on tourism resource monomer

(2) Layout principles

Systematic principle: Due to the diversity of elements, it indicates that it is a relatively open but complete system. Therefore, in optimizing the spatial structure of rural tourism, it is necessary not only to optimize individual elements, but also to consider the overall situation and integrate and optimize the entire multi-element system.

Market-oriented principle: The development and construction of rural tourism resources can only be market-oriented in order to achieve long-term survival and development. In the development and construction of rural tourism resources, it is called the market-oriented principle that the theme, content, direction, and other aspects of their future development can be determined according to the continuous changes in market demand.

The principle of sustainability: In the optimization and integration of rural tourism spatial structure, it is not only necessary to put people first and meet the needs of the tourism market, but also to strictly abide by the principle of placing equal emphasis on development and protection. Guided by the theory of sustainable development, it is necessary to fully consider the environmental carrying capacity of rural tourism resources and the original ecology of folk customs, so as to achieve economic benefits of rural tourism while creating social and ecological benefits.

2.4.2. Gridded spatial analysis model

(1) Evaluation of rural tourism resource group

Rural tourism resource group refers to a gathering area formed by the aggregation of certain common tourism resources, which is the basis for identifying rural tourism functional areas. Therefore, after analyzing the spatial distribution characteristics of resources in Section 2.3, an in-depth analysis of tourism resource groups is conducted. The uniqueness of grid based tourism resource evaluation lies in [Wen 2022], which is to select appropriate evaluation models in different scale grids to adapt to research objectives. From the perspective of measurement indicators, considering the development potential of tourism resource groups within the grid, it is the result of the superposition of the quantity, quality, and aggregation of tourism resource groups. Therefore, an improved development potential method of tourism resource group is selected to establish a grid evaluation model:

$$Q_{ji} = S_z\left(\varpi_1 \cdot B_{ji} + \varpi_2 \cdot \varepsilon_{ji}\right) / \left(\varpi_3 \cdot \gamma_{ji}\right) \tag{11}$$

Where Q_{ij} is the development potential of category i rural tourism resource group in the j-th grid; B_{ij}, ε_{ji}, and γ_{ji} are dimensionless expressions standardized by range, representing the superiority index, scale index, and aggregation index of the i-th tourism resource group in the j-th region, respectively. ϖ_1, ϖ_2, and ϖ_3 are the weight values of the superiority index, scale index, and aggregation index. The j-th regional tourism resource group superiority index, scale index, and aggregation index are:

$$B_j = \frac{U_{j1}}{M_j} \cdot \varpi_1 + \frac{U_{j2}}{M_j} \cdot \varpi_2 + \frac{U_{j3}}{M_j} \cdot \varpi_3 \tag{12}$$

$$\varepsilon_j = \frac{N_j}{O_j Q_{ij}} \tag{13}$$

$$\gamma_j = \frac{\bar{D}_1}{D_e} \tag{14}$$

Where, U_{j1}, U_{j2}, and U_{j3} are the number of individual tourism resources with premium grade, top grade, and good grade in the grid of the study area, and indicators such as the ornamental value, cultural value, popularity, rarity, scale and abundance, and environmental protection of rural tourism resources are selected as the impact factors for the level evaluation; M_j is the total number of individual tourism resources in the rural tourism resource group; O_j is the area of the study area;

$\bar{D}_1$ is the average value of the distance between the closest points of the region type; D_e is the theoretical closest distance.

(2) Identification of rural tourism functional areas

The rural tourism functional area is a regional space set up for the development of a specific theme on the basis of tourism resource gathering areas. Delineation of tourism functional area units is the basis for the identification of tourism functional areas, and existing research mainly focuses on empirical methods and qualitative classification. This paper attempts to identify the current rural tourism functional areas by combining quantitative identification methods based on POI data, so as to establish index frequency density and type ratio for each functional area unit to identify functional properties. The calculation formula is:

$$P_j = \frac{n_j}{M_j} Q_{ji} \tag{15}$$

$$\delta_j = \frac{P_j}{\sum_{j=1}^{8} P_j} Q_{ji} \tag{16}$$

Where n_j represents the number of tourism resources of the j-th type within the grid; P_j represents the frequency density of type j tourism resources in the total number of this type; δ_j represents the frequency density ratio of all types of tourism resources within the type j tourism resource frequency density unit, reflecting the degree of centralization of a certain type of tourism resources.

(3) Spatial development and layout of rural tourism

Tourism routes and spatial development axes are the main framework for guiding tourism flows, linking scenic spots (points), and integrating regional tourism products, reflecting the projection of dynamic changes in the tourism system on a linear trajectory. Using the knowledge based recommendation idea for reference, it can evaluate the similarity between current rural tourism functional areas and analyze tourism routes from the perspective of tourists. Assume that the functional area collection on the tourist route is V={v_1, v_2, … , v_m}, a tourism resource layout model is established as follows:

$$ST = \frac{JC}{SQ} = \frac{\varpi_1 \times P_j \delta_j \sum_{j=1}^{n} \sum_{i=1}^{m} Q_{ji}(v_j) + \varpi_2 \times \frac{\sum_{j=1}^{n} \eta_j(v_j)}{n}}{\varpi_1 \times P_j \delta_j \sum_{j=1}^{m} price(v_j) + \varpi_2 \times \left(\sum_{j=1}^{m} ptime(v_j) + \partial \right)} \tag{17}$$

Where ST is the result of tourism resource layout; JC refers to the income from tourism resources; SQ is the tourism expenses of tourism routes; $price(v_j)$ refers to the resource tickets and other fees within the functional area v_j; $ptime(v_j)$ is the playing time of the resources in the functional area v; ∂ is the cost of walking time; Qji(vj) is the tourism resource rating value of the functional area v_j; $\eta_j(v_j)$ is the tourists' favorable rating score in the functional area v_j. Through a questionnaire survey, the impact indicators on tourists' experience, such as guidance service level, tourists' internal level, others' words and deeds, travel experience, tourism process and feelings, accommodation and shopping conditions, environmental protection, and tourism process control, are selected; n is the number of tourists participating in the evaluation.

From the perspective of tourists, through the development and layout method of tourism functional areas that meet the interests of tourists, a collection of tourism functional areas that meet the interests of tourists is generated in the surrounding areas. The degree of interest of tourists determines the economic development status of the rural tourism industry. This mode of layout can achieve the maximum development of rural tourism resources in a mode that meets the preferences of tourists.

3. Experimental analysis

3.1. Design of experimental environment

The overall characteristics of rural tourism resources in the study area are shown in **Table 1**.

As shown in Table 1, the types of rural tourism resources in the study area are mainly divided into three main categories: rural idyllic scenery, ecotourism product resources, and folk culture. Each main category is subdivided into multiple subcategories. This rural area is rich in tourism resources. Therefore, when conducting resource development and release for this rural area, it is necessary to deeply analyze the distribution characteristics of tourism resources, and complete the optimization of the development and layout of rural tourism resources in the context of common prosperity.

3.2. Classification of tourism resources

Before analyzing the distribution characteristics of tourism resources, in order to improve the operational efficiency of rural tourism resource data, the method in this paper uses a rural tourism resource classification method based on LSTM in-depth learning to classify rural tourism resources. Table 2 shows the LSTM network parameters.

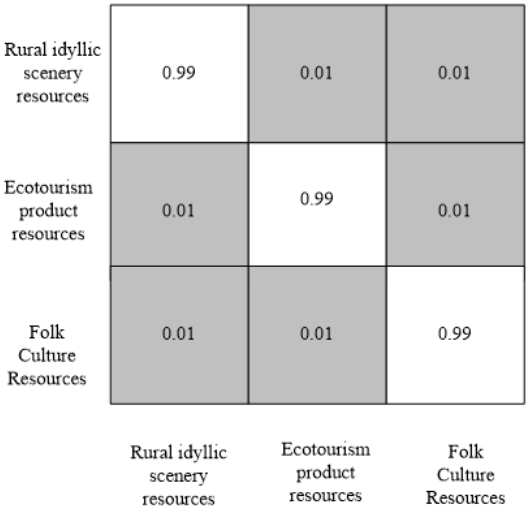


Figure 4. Classification confusion matrix of rural tourism resources

The method in this paper selects the rural tourism resource classification method based on LSTM in-depth learning to classify the three main categories of tourism resources shown in Table 1. The confusion matrix of the classification results is shown in **Figure 4.**

As can be seen from **Figure 4**, after classifying the three main categories of tourism resources shown in Table 1, the classification results are relatively accurate, with a classification accuracy of 0.99 for rural idyllic scenery tourism resources, ecotourism product resources, and folk cultural resources.

Table 1. Overall Characteristics of Tourism Resources in the Study Area

Main class	Subclass	Basic type
Rural idyllic scenery resources	Mountain Forestry Landscape	Mountain forest
		Mountain agriculture
		Plough
		Hilly farmland
	Pastoral landscape	Mountain grassland animal husbandry
	Water resources landscape	Rivers, fisheries
Ecotourism product resources	Special crop planting	Farmland demonstration area
		Picking Garden
		Fruit, tea
		Forestry, aquaculture
		Flowers and nurseries
	Agricultural auxiliary facilities	Featured production tools
Folk Culture Resources	Folk festivals	New Year's Day
		Religious activities and temple fairs
		Folk events and fairs
	Folk art	Folk Quyi
		Folk Paper Cuttings

Table 2. Details of LSTM network parameters

Parameter Type	Numerical value
Training set size/piece	100
Input Data Dimension	20
Number of workouts	200
Batch size	35
Iterations	16
Gradient descent mode	SGDM
Learning rate	0.02
Loss function	Cross entropy
Weight initialization method	Gaussian distribution

3.3. Analysis of the distribution characteristics of tourism resources

For classified rural idyllic scenery tourism resources, ecotourism product resources, and folk culture resources, the method in this paper uses the spatial distribution characteristics analysis method of tourism resources based on kernel density estimation to analyze the spatial distribution characteristics of resources. The analysis results of spatial distribution characteristics of tourism resources before and after the use of kernel density estimation are shown in **Figure 5** and **Figure 6**.

As shown in **Figures 5** and **6**, before the use of kernel density estimation, the density within the unit space of the study area is uniform, ignoring the differences in the focal intensity of points at different internal locations, and ignoring the continuity of spatial resources. The kernel density method can solve the above problems. The kernel density value gradually decreases as the central radiation distance increases, which is reflected in the distance attenuation effect of considering the characteristics of rural tourism resources on its surrounding location services. Therefore, this method uses the analysis method of spatial distribution characteristics of tourism resources based on kernel density estimation, and it is feasible to analyze the spatial distribution characteristics of resources.

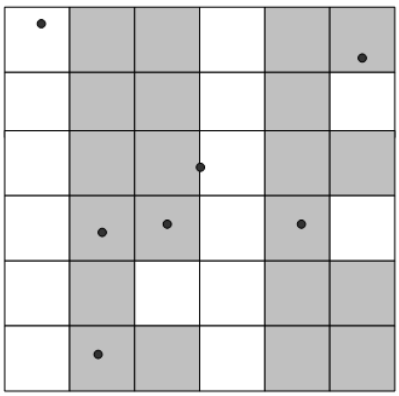


Figure 5. Effect of feature analysis before use of kernel density estimation

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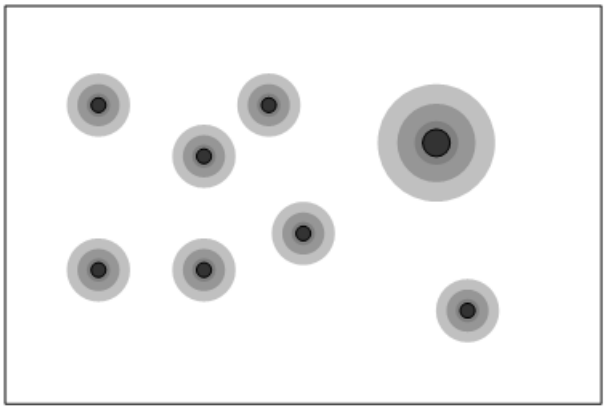

Figure 6. Effect of feature analysis after use of kernel density estimation

3.4. Development layout effect

Table 3 shows the distribution details of the three major resource types in the study area.

The limited scope includes various types of tourism resources. In order to analyze the layout effect of the method in this paper on rural tourism resources, the tourism resource coordination index σ is used as an analysis indicator, which refers to the degree of difference and the ability to cooperate between different types of tourism resources. The standard deviation coefficient results of the proportion of tourism resources in each village in the whole town are used to compare the coordination degree of the combination of tourism resources in each village region, and a set of coordination indexes are finally calculated. The calculation formula is:

$$\sigma = \frac{\sum_{i=1}^{N}\left(\theta_{ji} - \bar{\theta}_j\right)}{\frac{N}{\bar{\theta}_j}} \tag{18}$$

Where, θ_{ji} and $\bar{\theta}_j$ are the *i*-th type of tourism resources in the *j*-th region, respectively, accounting for the proportion and average proportion of the total regional tourism resources; *N* is the total number of types of rural tourism resources. The lower the coordination index of rural tourism resources is, the better the combination of tourism resources in the rural area is; The higher the coordination index of rural tourism resources is, the poorer the combination of tourism resources in the region is. When the coordination index is below 50, the more harmonious the coordination of rural tourism resources is; The coordination index is between 50 and 80, indicating that the coordination of rural tourism resources is relatively uncoordinated; If the coordination index is greater than 80, it indicates that the coordination of rural tourism resources is extremely uncoordinated. **Figure 7** shows the details of the coordination index of rural tourism resource using the methods of this paper, reference [Li *et al.* 2020], reference [Xu 2022], and reference [Xing and Zhu 2020].

Table 3. Distribution details of the three major resource types in the study area

Rank	Rural pastoral scenery resource functional area/unit	Ecological tourism product resource function zone/unit	Folk Culture Resource Functional Area/piece	Total/piece
1A	8	1	1	10
2A	2	1	0	3
3A	1	0	0	1
4A	0	0	0	0
Amount to	11	2	1	14

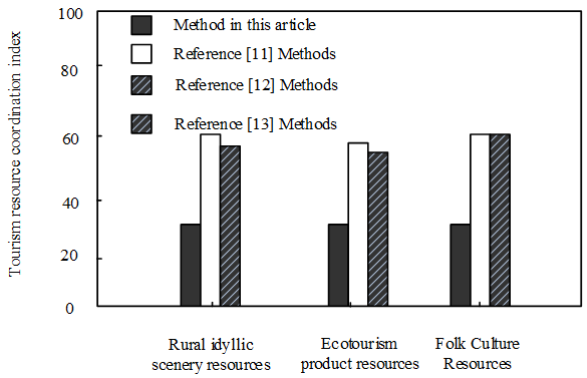

Figure 7. Details of tourism resource coordination index

From **Figure 7**, it can be seen that the coordination index is below 50, representing a relatively coordinated coordination of tourism resources. From the perspective of tourists, the method in this paper generates a collection of tourism functional areas that meet the interests of tourists in the surrounding areas through the recommendation method of tourism functional areas that meet the interests of tourists. The coordination between individual tourism resources is relatively coordinated. The method in this paper has a good effect on the development and layout of rural tourism resources. In contrast, the methods of reference [Li *et al.* 2020], reference [Xu 2022], and reference [Xing and Zhu 2020] are not as effective as the methods in this paper.

4. Discussion

When developing the rural tourism industry, in addition to using a reasonable development layout plan, other issues need to be addressed. Therefore, this paper proposes the following two suggestions for the development of rural cultural tourism:

4.1. Focusing on ecological resource protection

The basic condition for developing rural cultural tourism is ecological resources. Therefore, rural areas need to protect rural ecological resources while utilizing them.

Firstly, it should strengthen the protection and restoration of the rural ecological environment, improve the rural

ecological environment, and recycle the rural ecological environment. Before developing rural cultural tourism, it needs to strengthen the management of rural agriculture, control the destruction of ecological resources by agriculture, achieve coordinated development of agriculture and ecology, change the extensive agricultural production mode, scientifically plan agricultural production, reduce the destruction of ecological resources, and provide basic conditions for the development of cultural tourism. At the same time, it also needs to strengthen the management of rural residents' lives, and prohibit the random discharge of sewage and the random stacking of garbage; Strengthen ecological protection publicity for residents and improve their awareness of ecological protection; In addition, improve the protection and supervision mechanism of the rural ecological environment [Wen *et al.* 2022], strengthen the management and punishment of ecological destruction, and protect ecological resources.

Secondly, it should maintain rural characteristics. When excavating rural cultural tourism resources, it is necessary to understand and respect the characteristics of the countryside itself, develop and emphasize rural characteristics, and avoid similarities in the development methods of tourism resources. Specific precautions include eliminating the destruction of rural grasslands and not constructing artificial lawns; Respecting the local landscape, not painting the snake to add feet, and adding artificial mountains and waters; Selecting trees that are suitable for the local ecological environment and not engaging in useless planting. In terms of the development of parking lots, a piece of open space is reserved, the rural ground is not changed, and cement floors are paved.

Finally, it should maintain the rural landscape. The development of rural cultural tourism inevitably requires the construction of rural areas, which must be constrained and not destroy the style and features of the countryside. When building and ecological planting, we must respect the style and features of the countryside. We can improve the style and features of the countryside, but we cannot change the original style and features of the countryside beyond recognition. Specific maintenance measures include limiting the height of buildings, modifying the appearance of houses, and scientifically planning ecological planting.

4.2. Improving rural transportation conditions

Among the many factors that affect the development of tourism, one is transportation conditions. Developing cultural tourism in rural areas requires vigorously improving rural transportation conditions and repairing rural roads. At the same time, with the strong support of the government, rural roads can achieve traffic connectivity with highways, highways, etc., and build a transportation network to facilitate tourists to come. With the development of the social economy and the improvement of people's living standards, cars have entered thousands of households, and self-driving tours have become a way for many people to travel. Therefore, the development of cultural tourism in rural areas needs to take this into account, designing car access routes for tourists, and opening parking lots and camping sites without damaging the local landscape. It needs to strengthen the construction of car campsites and provide supporting facilities to meet the various needs of self-driving tourists. At the same time, for self-driving tourists, it can provide self-driving tourism routes, plan the travel distance of self-driving tourism, and bring new tourism experience to self-driving tourists. Whether for self-driving tourists or other tourists, transportation conditions have become an important factor for tourists to consider when choosing a tourist destination. Therefore, in order to attract more tourists to the countryside for cultural tourism, rural transportation construction must be done well [Ma *et al.* 2020].

5. Conclusion

This paper proposes a resource distribution feature and development layout method of rural tourism based on LSTM in-depth learning, forming an integrated technical method from tourism resource data classification, resource distribution feature analysis, and tourism resource development layout, providing support for the application of rural tourism planning in the context of common prosperity. In the experiment, this method has a classification accuracy of 0.99 for rural idyllic scenery tourism resources, ecotourism product resources, and folk cultural resources, and can analyze the differences in resource focus intensity at different locations within rural tourism resources, as well as the continuity between spatial resources, optimizing the analysis effect of tourism resource distribution characteristics, so that when implementing the development and layout of tourism resources, it ensures the coordination between individual rural tourism resources and can be used for the development and layout of rural resources.

Acknowledgment

This paper is supported by the “2023 Wenzhou Philosophy and Social Science Planning Annual Project” project: Research on Wenzhou City's Cultural and Tourism Brand Image Shaping under the Background of Common Wealth--Analysis Based on Ground Grid Theory (23WSK220YBM) and Digital Research on Empowering the Cultural Inheritance and Innovation of Wenzhou City's Corridor Bridge (23WSK214YBM).

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