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# Geographical Distribution of Characteristic Towns in Zhejiang Province

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**Abstract.** To analyse the geographical distribution of characteristic towns in Zhejiang province. A total of 143 provincial-level characteristic towns in Zhejiang Province were used as research samples to establish a geographic information database. Based on the relevant theory of characteristic towns, the basic statistical analysis was carried out by using Excel, and the spatial distribution characteristics of characteristic towns were discussed by using the nearest neighbour index, geographic concentration index method and kernel density estimation method. The basic statistical results show that recent domain ratio is  $R=0.901<1$ , and the actual geographical concentration index ( $G_1$ ) is larger than the evenly distributed geographical concentration index ( $\bar{G}_1$ ), so the characteristic town in Zhejiang Province tend to aggregate distribution. The spatial distribution of different types of characteristic towns is significantly different. It is necessary to attach great importance to the uneven distribution of spatial characteristics of characteristic towns in Zhejiang Province. The analysis of the spatial distribution of characteristic towns can provide a theoretical basis for optimizing the spatial layout of characteristic towns.

**Keywords** Spatial distribution, the Nearest Neighbour Index, Geographic Concentration Index, Kernel Density Estimation.

## 1. Introduction

The characteristic town is one of the important contents of Chinese new urbanization and new rural construction. Li Qiang, then governor of Zhejiang Province, first proposed the concept of a characteristic town when he visited Yunqi Town in October 2014[1]. Two years later, the Ministry of Housing and Urban-Rural Development announced the first batch list of national-level towns [2]. There were 127 characteristic towns in the list. Since then, the characteristic towns construction wave swept across the country.

The construction of characteristic towns has great significance, including expand domestic demand, adjust industrial structure, alleviate urban-rural gaps, and eliminate imbalances between regions.



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Foreign scholars have carried out related research on the formation, positioning and development mode of characteristic towns and the integration of characteristic towns in the spatial structure[3]-[7]. However, because the characteristic town is still a new concept in China, the rise of the time is not long, the theory and practice are at the development stage, and its cultivation and construction is still in the exploration stage. The domestic related research mostly focuses on the connotation, the description of the characteristics and the discussion of the construction mode and the planning method [8]-[13]. The research on the spatial distribution of the characteristic towns is rare.

Based on it, this study combines the achievements of predecessors, and analyses the spatial distribution of characteristic towns in Zhejiang Province. On the one hand, it provides relevant theoretical support for the future development of characteristic towns. On the other hand, it provides basis and reference for its construction, so that it can make the characteristic towns play its due role in economic and social benefits.

## **2. Materials**

### *2.1. Data source*

The data of the characteristic towns are mainly from the official data released by the Characteristic Town Planning and Construction Joint Conference Office of Zhejiang and the Official Website Characteristic Town of Zhejiang(<http://tsxz.zjol.com.cn/>). A total of 134 provincial-level characteristic towns were announced from 2015 to 2018[2][14]-[16]. Administrative vector maps of Zhejiang province was downloaded from Diva GIS (<http://www.diva-gis.org/Data>)

### *2.2. The provincial geographic information*

We established Zhejiang Province geographic information database and characteristic town information database. The GIS spatial analysis was used to analyse the batches, types and geographical locations of the characteristic towns.

## **3. Analysis methods and result**

The selected 134 characteristic towns were precisely positioned with the Amap, and the latitude and longitude information of the sample points were recorded into the Excel table. The first part comprehensively analysed the spatial distribution characteristics of the characteristic towns. The second part comprehensively analysed the degree of aggregation of characteristic towns through the adjacent point index and geographic concentration. Finally, based on the kernel density estimation index, the kernel density of characteristic town are drawn.

### *3.1. Overall situation and distribution characteristics*

The Joint Conference Office issued the “Guidelines for the Planning of the Creation of Characteristic Towns in Zhejiang Province (Trial)”, which divided the characteristic towns into three categories. The first major category is “providing technology and financial service products”, which are mainly divided into three major town types: information economy town, fashion town and financial town. The second category is “to provide physical products”, including environmentally friendly town, healthy town, fashionable town and high-end equipment manufacturing town. The third category is “to provide experience service products”, which can be divided into three main types: healthy town, tourist town and historical classic town

It can be seen from Table1 that the high-end manufacturing equipment town has the largest proportion of characteristic towns of industry orientation, which is 22.39%. It reflects that government of Zhejiang province attaches importance to the advanced manufacturing industry, especially in the mid-term high-end equipment manufacturing industry. Next is tourism town, accounting for 20.15%. This is closely related to the profound cultural heritage, good ecological environment and outstanding resource advantages in Zhejiang. Local natural, cultural landscapes and local natural resources provide opportunities for the development of tourism and related industries. The proportion of information

economy town is 17.16%. In the past decade, the Internet had become a new gene in the Zhejiang economy, laying down a solid foundation for the development of a small town with information economy. The development of big data and cloud computing has become a new path of economic transformation and upgrading. Furthermore, the information economy has become a new kinetic energy to lead the new normal of the economy. Fashion town, historical classic town, financial town and healthy town accounted for 11.94%, 8.96%, 6.72% and 6.72% respectively. The least was environmental protection town which account for 5.94%.

**Table 1.** Distribution of characteristic towns in Zhejiang Province.

Type	Number	Proportion
Information economy	23	17.16%
Environmental protection	8	5.97%
Health	9	6.72%
Tourism	27	20.15%
Fashion	16	11.94%
Financial	9	6.72%
High-end equipment manufacturing	30	22.39%
Historical classic	12	8.96%
Total	134	100.00%

### 3.2. Spatial distribution pattern

The characteristic town is the point feature. The adjacent point index is a geographical indicator that measures the proximity of point features. The formula is:

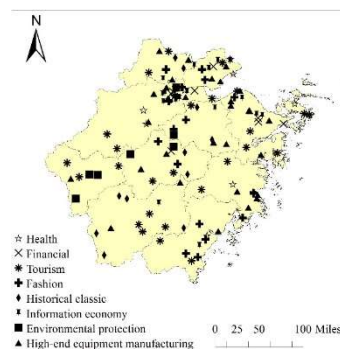
$$R = \frac{\bar{r}_1}{\bar{r}_E} = \frac{\frac{1}{n} \sum_{i=1}^n d_{min}}{\frac{1}{2} \sqrt{n/A}}$$

Where  $\bar{r}_1$  is the actual nearest distance;  $\bar{r}_E$  is the theoretical nearest distance;  $d_{min}$  is measured the distance between each point and its nearest neighbor; A is the area of the area; n is the number of points. When  $R=1$ , it means that the distribution type of point element is random; when  $R>1$ , the point feature is evenly distributed; when  $R<1$  is, the point element is aggregated in the distribution area. The result is shown in the following table 2. Recently, recent domain ratio is  $R=0.901<1$ , so the characteristic town in Zhejiang Province tend to aggregate distribution.

**Table 2.** The Nearest-Neighbour index of characteristic towns in Zhejiang Province.

Recent Domain Ratio	Z score	P value	Average observation distance	Expected average distance
0.901444	-2.1744	0.029675	13498.4535 Meters	14974.2514 Meters

The Quantities was used to visualize, the distribution status of the characteristic towns was obtained in figure1. The darker the color, the more characteristic towns in the area. It can be seen that the characteristic towns are unevenly distributed. As a provincial capital city, Hangzhou has the largest number of characteristic towns. The amount in Ningbo is just less than that in Hangzhou. Next are Jiaxing, Jinhua and Lishui. The number of characteristic towns in Zhoushan is the least. The remaining cities have 4-10 characteristic towns respectively.



**Figure 1.** City-level distribution of characteristic towns in Zhejiang Province.

### 3.3. Spatial distribution balance

Geographical concentration indicates the degree of aggregation of the research object in the regional space. The value less expressions the concentration lower, otherwise the higher. The formula is as follows:

$$G = 100 * \sqrt{\sum_{i=1}^t \left(\frac{x_i}{T}\right)^2}$$

Among it,  $x_i$  is the number of i-th city characteristic town,  $T$  is the total number of characteristic towns in Zhejiang Province, and  $t$  is the total number of prefecture-level cities in Zhejiang Province.

It can be seen from Table3 that the geographic concentration index of the characteristic towns in Zhejiang Province ( $G_1$ ) is calculated to be 34.36. If the characteristic towns are evenly distributed in each city, the number of characteristic towns in each city is  $134/11=12.18$ , at this time  $\bar{G}_1=30.15$ . The actual geographical concentration index ( $G_1$ ) is larger than the evenly distributed geographical concentration index ( $\bar{G}_1$ ), so the distribution of characteristic towns in Zhejiang Province in various cities is an aggregation trend. In addition, the environmental protection town has the highest geographical concentration index, followed by financial towns and information economy towns. If the characteristic towns are evenly distributed in various industries, the geographical concentration index  $\bar{G}_2$  is 35.255, and the actual geographical concentration index of each type of characteristic town is larger than  $\bar{G}_2$ , and the distribution of characteristic towns in the industrial category is concentrated.

**Table 3.** Table geographic concentration index of characteristic town in Zhejiang.

Type	Geographic concentration index
Information economy	57.19
Environmental protection	58.63
Health	48.43
Tourism	32.08
Fashion	38.53
Financial	57.74
High-end equipment manufacturing	36.51
Historical classic	51.37

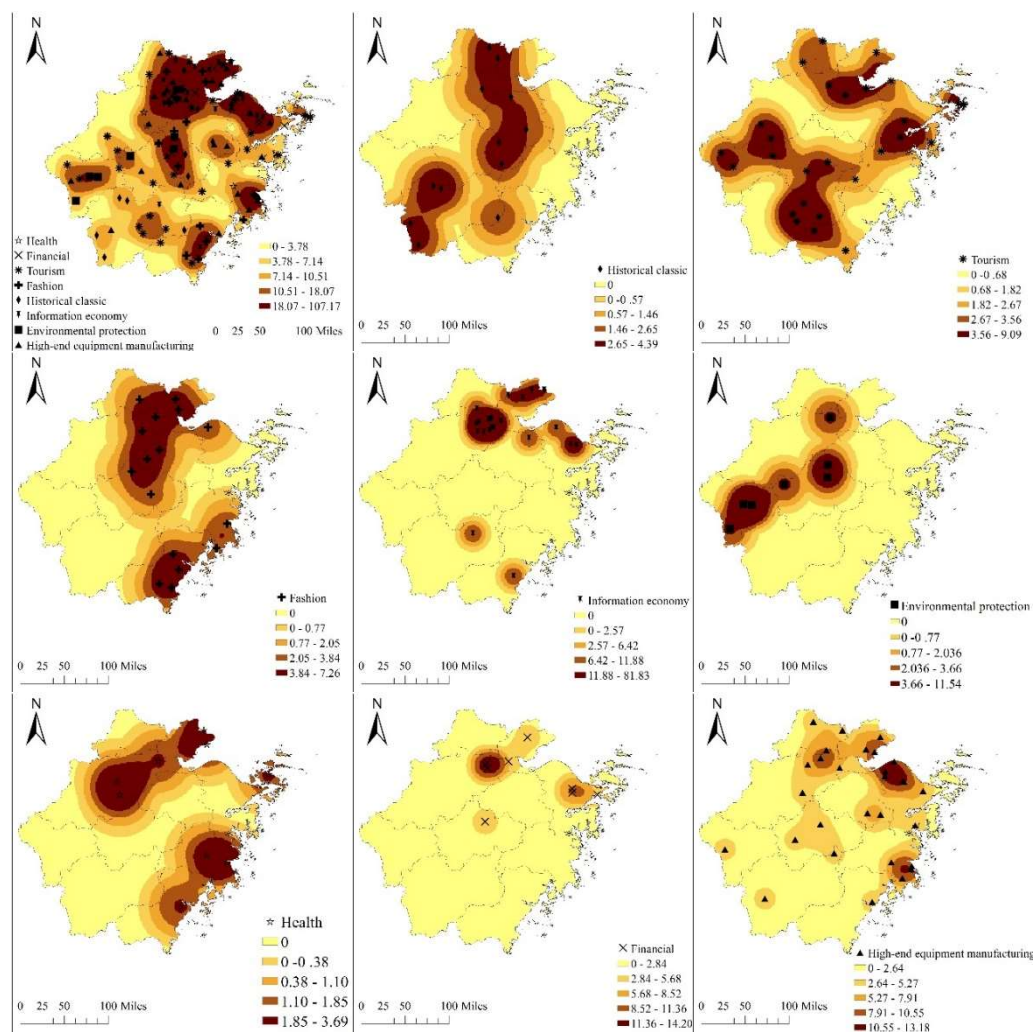
### 3.4. Spatial Distribution Aggregation Area Analysis

Kernel density estimation analysis is primarily used to calculate the density of an element in its surrounding area. Its formula is as follows:

$$f(x) = \frac{1}{nh} \sum_{i=1}^n k\left(\frac{x - x_i}{h}\right)$$

Where  $f(x)$  is the kernel density estimate,  $k\left(\frac{x-x_i}{h}\right)$  is the kernel function,  $h>0$  is the search radius, and  $x - x_i$  is the distance from the estimated point to the measurement point,  $n$  means the number of characteristic towns. The kernel function and search radius determine the degree of kernel density. The larger the kernel density estimation, the denser the point. The kernel density distribution map of the characteristic towns in Zhejiang Province was generated.

As shown in the figure2, the difference of spatial distribution density of the characteristic towns in Zhejiang Province is very significant. Among the characteristic towns, the Hangzhou, Jiaxing and Huzhou area are the high-density area, the eastern region of Zhejiang is a sub-density area. Moreover, Zhoushan area, the west region and the middle area of Zhejiang have the lowest kernel density. The spatial distribution of different types of characteristic towns is significantly different. In the figure, the high-end manufacturing characteristic town and the information economy characteristic town show two core areas, namely northeast area of Zhejiang province and Taizhou. The environmental protection town is a high-density area in the central and western part of Zhejiang Province. The healthy and fashion town show two major gathering areas in the north of Zhejiang and the east coast of Zhejiang. Financial town is mainly concentrated in sub-provincial cities such as Hangzhou and Ningbo. The historical classics and tourist-oriented towns are mainly concentrated in the north of Zhejiang and the west of Zhejiang, which are rich in natural resources and have profound traditional cultural foundation.



**Figure 2.** The kernel density of characteristic town in Zhejiang Province.

#### 4. Conclusion

In summary, this study analyses the overall spatial distribution characteristics of the characteristic towns in Zhejiang Province and the distribution patterns of various types of characteristic towns by using the nearest neighbour index, geographic concentration index, and nuclear density estimation. The following conclusions are drawn: On the whole, the spatial distribution of characteristic towns in Zhejiang Province is in a state of aggregation. The northern region of Zhejiang has a high level of economic development, so the number of characteristics towns is large. The manufacturing base of the eastern area of Zhejiang is relatively deep, so it has formed a secondary gathering area of characteristic town. Tourism-oriented characteristic towns are concentrated in Zhoushan, central region and western of Zhejiang because of the outstanding natural resource advantages. In addition, there are significant differences in the spatial distribution of different types of characteristic towns in Zhejiang Province. Information economy, finance, high-end manufacturing and healthy towns are highly concentrated, with the convergence of high-end manufacturing, finance and information economy towns showing similarities.

The main shortcoming of this study is that only the spatial distribution of the characteristic towns is studied, but the factors affecting its distribution are not further studied. In addition, there may be slight deviations in the coordinate data of the town collected by hand.

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