

## Article

# Identifying the Spatial Patterns and Influencing Factors of Leisure and Tourism in Xi'an Based on Point of Interest (POI) Data

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**Abstract:** Leisure and tourism spaces are shared by both residents and tourists seeking a higher quality of life. Most of the literature focuses only on the study of a particular type of leisure or tourism space in cities and lacks an overall exploration of the distribution patterns of urban leisure and tourism formats. Based on the leisure and tourism point of interest (POI) data of 11 districts in Xi'an, this paper uses geospatial analysis to examine the spatial patterns of leisure and tourism facilities and their influencing factors in Xi'an. It is found in this study that the distributions overall and the various types of leisure and tourism spaces in Xi'an show the characteristics of central urban agglomeration and sparse dispersion in the surrounding urban areas. Different types of leisure and tourism patterns have obvious spatial scale dependence, but there are differences in the scope of spatial selection. In general, the core agglomeration area has limited radiation and driving effects on the peripheral areas, and there is a prominent phenomenon of imbalance in the distribution of leisure and tourism facilities following a single industrial structure. The formation of the spatial patterns of leisure and tourism is the result of a combination of dominant factors, driving factors, safeguarding factors, and other triggering factors. Urban leisure and tourism spaces are intertwined, and the spatial balance and industrial diversification of leisure and tourism can be promoted through scientific spatial planning. This study aims to provide services for urban land planning and policy-making by revealing the spatial distribution principles of leisure and tourism sites in tourist cities as represented by Xi'an.

**Keywords:** leisure; tourism; spatial pattern; influence factor; POI; Xi'an City



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## 1. Introduction

Although it is widely recognized that leisure and tourism are closely related in terms of motivation, experience, and behavior [1], existing research has generally viewed leisure and tourism as two separate fields, and direct theoretical exchanges between the two have been relatively limited [2]. There are two representative views on the relationship between “leisure” and “tourism”. The first viewpoint suggests that leisure includes tourism, which is a form of off-site leisure different from local leisure [3]. The second view is that not all tourist activities belong to leisure. According to the classification system established by the World Tourism Organization, tourism includes not only leisure but also non-leisure tourism, such as business tourism. Therefore, there is an intersection between leisure and tourism, but not the relationship of including and being included [4]. For example, some scholars have also paid attention to leisure-oriented tourism activities, such as leisure travel [5,6], as well as the continuity of daily leisure activities with tourism activities [7,8].

Ryan and Kinder (1996) argued that the separation of leisure and tourism research is due to the significant difference between rich tourism experiences and leisure activities that

occur outside of vacations [9]. Tourism differs from leisure by space, as tourism occurs in destinations different from the place of origin [10]. The commonly accepted assumption is that leisure is for local residents and tourism serves visitors [11]. However, is there a clear boundary between leisure and tourism space in a city? According to Kaplan (1960), social development and lifestyle changes have inevitably led to the integration of leisure and tourism. How to integrate the two is an important challenge for geographic research, and it is also a concern for government agencies and planning departments [12]. Generally, cities with perfect leisure functions are more likely to serve tourists well and become more attractive tourist destinations for them. In recent years, an increasing number of cities in China have begun to pay attention to the cultivation of the leisure and tourism industry. These cities aim to promote the improvement of urban functions through the development of leisure and tourism.

Although there are certain differences between daily leisure activities near the home and leisure travel activities, the daily leisure space of residents may also be the travel space for tourists to a large extent. Leisure and tourism facilities are generic for both local residents and travelers [13]. Urban leisure and tourism spaces are not only recreational spaces for local residents but also key nodes for tourist activities [14]. Urban leisure and tourism spaces thus have integration and intersectionality, and the boundary between serving local residents and tourists will be increasingly blurred. The spatial pattern is the foundation of industrial planning and construction and is of great significance for revealing the characteristics of spatial structure and the mechanisms of spatial differentiation [15]. Therefore, studying the characteristics of urban leisure and tourism space and the factors that influence their creation is of great significance for building the urban leisure and tourism industry, optimizing the layout of urban leisure and tourism space, and better meeting the needs of residents and tourists for a better life. It also helps urban managers formulate scientific and reasonable leisure and tourism development strategies.

Given the independence of “leisure” and “tourism” research, there are also differences in their research perspectives and content. Leisure research focuses on public entertainment and park management, highlighting the government’s public service function with a welfarism orientation, while tourism research tends to have a commercial orientation [11]. Research on urban leisure space mainly focuses on a particular type of public urban leisure space, such as parks [16], green spaces [17], sports and recreation sites [18], cultural venues [19], and coastal areas [20]. Most of the literature focuses on the planning and management of urban leisure space [21], public access to recreational spaces [22], health perceptions [23], and service experiences [24]. Research on urban tourism space mainly focuses on a certain type of tourism resource, such as hotels [25,26], homestay [27], scenic spots [28], and cultural heritage sites [29], etc., and studies on the spatial patterns of urban tourism [30,31], tourist spatial behavior [32], urban tourism spatial planning [33], and the evolution of the spatial structure of urban tourism [34]. However, in general, there are few studies that combine leisure and tourism space from the overall urban perspective.

Traditionally, urban leisure and tourism spatial data were mostly obtained through case studies [20], participatory observation [21], in-depth interviews [35], and other methods. With the advent of the big data era, some open platforms now provide big data, such as digital footprints [36], mobile positioning data [37], geotagged photos [38], and point of interest (POI) data [39], which have changed the original paradigms around geospatial data acquisition and research methods [40]. It also provides an opportunity for the accurate measurement of urban leisure and tourism space. Among them, POI data are favored in urban functional space research [41,42] due to their advantages, such as easy access, large data volume, and precise positioning [43].

It has become a trend to use information technology and big data to study urban leisure and tourism space, but at present, big data analysis and geographic information technology have not been widely used, and the existing research mostly focuses on the single format of urban leisure or tourism. There is a lack of academic attention to the overall

large-scale spatial pattern of leisure and tourism and its influence mechanisms. Based on this scenario, this paper applies POI data mining, ArcGIS spatial analysis, and geodetector technology to Xi'an, a premiere tourist city in China, to analyze the spatial distribution characteristics and influencing factors on Xi'an's various types of leisure and tourism industries. This paper reveals the principles of spatial distribution of leisure and tourism sites in Xi'an to further optimize the spatial layout and planning of leisure and tourism in Xi'an and provide a reference for other domestic cities committed to the development of leisure and tourism industries.

## 2. Materials and Methods

### 2.1. Study Area

Xi'an as the capital of Shaanxi Province as well as the ancient capital of 13 dynasties in China, is an important central city in Western China, and is also a "World Historic City" designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). This paper studies the 11 municipal districts of Xi'an, with a total area of approximately 5145.67 square kilometers. Xi'an is rich in tourism resources, including many historic relics, such as Emperor Qinshihuang's Mausoleum site and museum, Weiyang Palace, Daming Palace, and many other historical sites, as well as nationally recognized areas for nighttime cultural and tourism consumption, such as Beiyuanmen Historical and Cultural Block and Datang Night City. The cultural and tourism industry is the pillar industry of Xi'an. The "14th Five-Year Plan" for National Economic and Social Development and the Outline of Vision Goals for 2035 list "promoting the construction of national cultural and tourism consumption pilot cities and building national-level tourism and leisure blocks with distinctive cultural characteristics" as important tasks. The leisure and tourism industry in Xi'an has great development potential for the future. Moreover, Xi'an has a profound historical and cultural heritage, with a prominent image as an ancient capital, and is a representative of Chinese tourist cities. Therefore, this paper studies the leisure and tourism spatial layout in Xi'an and its influencing factors, which has substantial theoretical and practical significance for the study of spatial characteristics of leisure and tourism sites and industrial planning for tourist cities.

### 2.2. Data Source

POI data are point element data representing real geographic entities, containing the geographical location and attribute information for all kinds of spaces and facilities related to human production habits and life. These data have the characteristics of accurate geographic information and rich volume [43]. In this study, the POI data of leisure and tourism formats in 11 districts of Xi'an were acquired through the Application Programming Interface (API) provided by Amap, which is one of the map platforms that currently provides POI data for free. By applying for a key to the API of Amap and searching for keywords such as POI classification and city, users can obtain batch access to all POI data of a certain type in their area. A total of 75,323 leisure and tourism POI data points were finally retained after data deduplication, merging, cleaning, screening, and bias correction. Each POI data point contains attribute information such as name, latitude and longitude, address, and type.

Combining the classification of urban leisure and tourism in the literature [44] and the classification of POI data from Amap, this paper classifies the leisure and tourism industry in Xi'an into five categories, including catering services, accommodation services, shopping services, sports and entertainment, and scenic spots. The POI data obtained for each type of location in the leisure and tourism industry are shown in Table 1.

**Table 1.** Classification and Statistics of Leisure and Tourism POI Data in Xi'an City.

| Category                 | POI Type                                                                                          | POI Number | Percentage |
|--------------------------|---------------------------------------------------------------------------------------------------|------------|------------|
| Catering services        | Chinese restaurants, specialty restaurants, general cuisine restaurants, cafes, tea houses, etc.  | 50,485     | 67.02      |
| Accommodation services   | Star-rated hotels, guesthouses, homestays, etc.                                                   | 13,295     | 17.65      |
| Shopping services        | Shopping malls, supermarkets, shopping centres, specialty markets, etc.                           | 2881       | 3.83       |
| Sports and entertainment | Sports venues, entertainment venues, fitness centres, nursing homes, etc.                         | 8337       | 11.07      |
| Scenic spots             | Lakes, mountains, wetlands, parks and squares, historical sites, temples and Taoist temples, etc. | 325        | 0.43       |

### 2.3. Methods

ArcGIS 10.3 software includes a variety of spatial analysis tools, of which the nearest neighbor index method, kernel density estimation, and Ripley's K function are common methods for analyzing spatial distribution features. These three spatial analysis methods can be used to clearly portray the spatial distribution characteristics and laws of leisure and tourism in Xi'an.

#### 2.3.1. Nearest Neighbor Index Method

The nearest neighbor index (NNI) method is a spatial measurement method that quantitatively describes the proximity of spatial point elements to describe the spatial distribution pattern. The spatial distribution trends of point data are judged by calculating the NNI, which is the ratio between the average observed distance of geographical element points and the expected average distance in a random distribution. The formulas are as follows [45]:

$$NNI = d(NN) / d(ran) \quad (1)$$

$$d(ran) = 0.5\sqrt{A/N} \quad (2)$$

In Equation (1),  $d(NN)$  denotes the average observed distance between point elements and their nearest neighbors in space, and  $d(ran)$  denotes the expected average distance between elements in a random state. In Equation (2),  $A$  represents the area of the study area, and  $N$  represents the number of sample points within the study area. If  $NNI > 1$ , it indicates that the sample points tend to be uniformly distributed. If  $NNI < 1$ , it indicates that the sample points are clustered, and the smaller the value, the higher the degree of clustering. If  $NNI = 1$ , it indicates that the sample points are randomly distributed.

#### 2.3.2. Kernel Density Estimation

Kernel density estimation is a method to calculate the density of point elements in their neighborhood, which directly reflects the spatial distribution pattern of elements [46]. Its calculation formula is as follows [45]:

$$f(x) = \sum_{i=1}^n \frac{1}{\pi r^2} k\left(\frac{d_{ix}}{r}\right) \quad (3)$$

In Equation (3),  $f(x)$  is the kernel density value at  $x$ ,  $n$  is the total number of samples,  $r$  is the search radius,  $k$  represents the distance weight, and  $d_{ix}$  is the distance from POI point  $i$  to  $x$ .

#### 2.3.3. Ripley's K Function

Ripley's K function is a point density distance function that counts the number of points within a search range established by a certain radius and can determine whether the elements have statistically significant clustering within a certain range [45]. This is because although the nearest neighbor index can portray the overall spatial distribution of point

data, the same point data may present different spatial characteristics at different scales. Therefore, the use of Ripley's K function can analyze the spatial clustering characteristics of various leisure and tourism modes in Xi'an at multiple scales. The formula is as follows [45]:

$$L(d) = \sqrt{\frac{A \sum_{i=1}^n \sum_{j=1}^n \frac{W_{ij}(d)}{n^2}}{\pi}} - d \quad (4)$$

In Equation (4), A represents the area of the study area, and n represents the number of various leisure and tourist spots.  $W_{ij}(d)$  represents the distance between the leisure and tourism points i and j within the range of distance d. L(d) represents the degree of agglomeration of leisure and tourism points within the range of distance d. The maximum and minimum values obtained by the test are defined as the upper and lower envelope values. If  $L(d) > 0$  and the simulation results are above the upper envelope, it indicates that this type of leisure and tourism point is agglomerated. If  $L(d) < 0$  are below the lower envelope, it means that this type of leisure and tourism spot is evenly distributed. If  $L(d) = 0$  and the simulation results are between the upper and lower envelopes, it indicates that this type of leisure and tourism site is randomly distributed.

#### 2.3.4. Geographic Detector

Geodetection is a spatial analysis method used to detect spatial differentiation and reveal the driving force behind it. The basic assumption is that if the independent variable has an influence on the spatial differentiation of the dependent variable, then the independent variable and the dependent variable have similar spatial distributions [45]. The extent to which a Factor X is able to explain the spatial divergence of Y is measured by the q-value. By calculating the q-value of a single factor and the q-value of two factors superimposed on each other, geodetectors can not only analyze the degree of influence of a particular independent variable on the dependent variable but also determine whether there is an interaction between the two factors and the strength of the interaction. The formula for calculating the influence q is as follows [45]:

$$q_x = 1 - \frac{1}{N\sigma^2} \sum_{i=1}^k N_i \sigma_i^2 \quad (5)$$

In Equation (5),  $q_x$  is the influence of the independent variable X on the density of the leisure and tourism industries in Xi'an.  $\sigma_i^2$  and  $\sigma^2$  are the discrete variances of the leisure and tourism densities in layers and regions.  $N_i$  and N are the number of units in the layer and region, respectively. For  $q \in [0, 1]$ , the larger the value, the greater the influence of the independent variable on the spatial differentiation of leisure and tourism, and vice versa.

### 3. Leisure and Tourism Spatial Characteristics

#### 3.1. Spatial Agglomeration Characteristics

The collected POI data of leisure and tourism in Xi'an were imported into ArcGIS for nearest neighbor analysis, and the nearest neighbor index (Table 2) was calculated to characterize the various types of leisure and tourism spatial agglomerations in Xi'an both as smaller units and overall. As shown in Table 2, the average observed distance for the overall leisure and tourism space is 29.62 m and the expected average distance is 166.77 m. The NNI is 0.178 and the Z value is −431.79. Therefore, the overall leisure and tourism space in Xi'an has a significant tendency toward agglomeration. The NNIs of the five types of leisure and tourism spaces, namely, catering services, accommodation services, shopping services, sports and entertainment, and scenic spots, are 0.151, 0.189, 0.359, 0.288, and 0.649, respectively. The NNIs are all less than 1, and the Z scores are all less than −2.58 with a P of 0. All of them passed the significance test at the 1% level. The results indicate that the five types of leisure and tourism spaces in Xi'an are all significantly



clustered, but the clustering characteristics of different types of leisure and tourism spaces show some differences. The degree of agglomeration of the identified types of leisure and tourism spaces, including the overall assessment, in descending order is as follows: catering services > overall leisure and tourism > accommodation services > sports and entertainment > shopping services > scenic spots.

**Table 2.** Nearest Neighbor Distance for Leisure and Tourism Spaces in Xi'an City.

| Category                 | The Average Observed Distance (m) | The Expected Average Distance (m) | NNI   | Z       | P | Spatial Distribution Type |
|--------------------------|-----------------------------------|-----------------------------------|-------|---------|---|---------------------------|
| Overall                  | 29.62                             | 166.77                            | 0.178 | −431.79 | 0 | Significant agglomeration |
| Catering services        | 28.57                             | 189.19                            | 0.151 | −364.94 | 0 | Significant agglomeration |
| Accommodation services   | 69.62                             | 370.54                            | 0.189 | −179.14 | 0 | Significant agglomeration |
| Shopping services        | 264.75                            | 736.44                            | 0.359 | −65.77  | 0 | Significant agglomeration |
| Sports and entertainment | 141.97                            | 493.35                            | 0.288 | −124.41 | 0 | Significant agglomeration |
| Scenic spots             | 1323.26                           | 2039.63                           | 0.649 | −12.11  | 0 | Significant agglomeration |

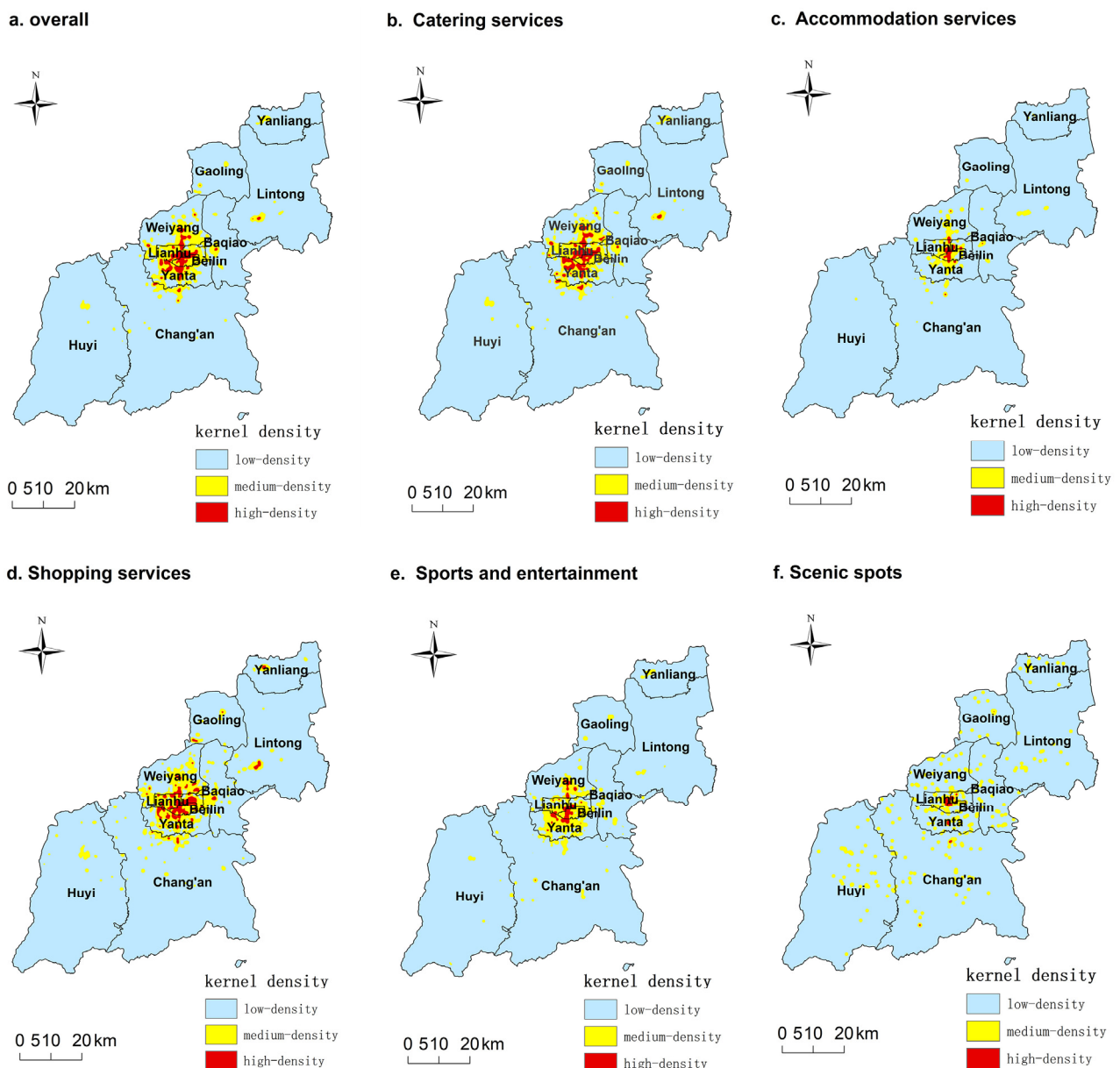
Specifically, catering service points are the most numerous and most spatially clustered, indicating that the strongest demand of local residents and foreign tourists is for catering and leisure service spaces in Xi'an. The agglomeration degree of accommodation services is only second to that of catering services, and the NNI values of these two types of leisure and tourism are relatively similar overall, reflecting to some extent that the overall development of leisure and tourism in Xi'an is highly synchronized with the catering and accommodation industries. The degree of concentration of sports and entertainment and shopping services is at the medium level, and there is still a gap between the number of leisure spots in the periphery of the city and that in the center of the city. The NNI of scenic spots is 0.649, whereby although it also shows significant agglomeration, the degree of agglomeration is relatively weak compared to the overall distribution and the distributions of other types. The scenic type is influenced by the natural environment and history, and its spatial layout is subject to a low degree of human intervention. The scenic spot category in Amap includes various types and volumes of scenic spots, such as tourist attractions, wetlands, and ruins, which are included in POI data crawling. The map can only obtain point data spatially and does not record social attributes such as scenic spot size, resource grade, and popularity. Due to the scattered distribution of differently graded scenic spots in various districts of Xi'an, the concentration of scenic leisure and tourism spots is relatively low.

### 3.2. Spatial Distribution Characteristics

The kernel density estimation method is used to calculate the distribution densities overall and for various leisure and tourism types in Xi'an, and the natural fracture method is used to divide the kernel density of various leisure and tourism spots into three grades: low-density areas, medium-density areas, and high-density areas. The spatial distributions overall and for various types of leisure and tourism spaces in Xi'an are shown in Figure 1. On the whole, the overall distribution and all types of leisure and tourism spaces in Xi'an show the characteristics of central urban agglomeration and sparse dispersion in the surrounding urban areas.

As seen in Figure 1a, the overall distribution of leisure and tourism sites shows the characteristics of "one center, multiple points, and two axes". Leisure and tourism in Xi'an are centered on the Bell and Drum Tower. The north–south direction takes Weiyang Road, North Street, and Changan South Road as its axis, which is basically consistent with Metro Line 2. The east–west direction takes Fengqing Road and Huancheng South Road as its axis, which mostly coincides with the nodes of Metro Lines 2 and 6. The core area spans four districts, including Lianhu, Beilin, Xincheng, and Yanta, forming a high-density hierarchical agglomeration. The medium-density area is distributed around the core area, in line with the core-edge development pattern. All other districts have

multiple tourism hotspots that are scattered in distribution. Leisure and tourism hotspots in Weiyang District are distributed near the physical location of the municipal government and Xi'an City Sports Park. The hot spots of Yanta District are located in and around the Shaanxi Provincial Historical Museum and Tang Paradise. Leisure and tourism hotspots in Chang'an District are concentrated in Chang'an District's university town and near Chang'an Park. Baqiao District is focused on commercial centers such as Huayang City and Xi'an Sky City Shopping Centre. Leisure and tourism hotspots in Lintong District are concentrated in areas such as Emperor Qinshihuang's Mausoleum site and museum, Mount Li, and Huaqing Pool. The distribution of high-level and medium-level agglomerations reflects the characteristics of proximity to transport, scenic spots, and business districts.



**Figure 1.** Kernel Density Analysis of the Spatial Distribution of Leisure and Tourism in Xi'an.

The catering category (Figure 1b) accounts for the largest proportion of the overall leisure and tourism POI data, and its distribution pattern and form are closest to the overall leisure and tourism spatial characteristics. The most densely clustered area is basically within the Ring Road, and its spatial scope is largely consistent with the historical urban area defined in the Conservation Plan for Xi'an Historical and Cultural City (2020–2035),

which is the area with the most historical and cultural heritage in Xi'an. The middle-grade agglomeration area is outside the core area but within the area bounded by the Ring Road.

The accommodation category (Figure 1c) is characterized by “small agglomerations and small dispersion”. The core area of high-level agglomeration is centered on the Bell and Drum Tower, which is mainly located at the junction of the three districts of Lianhu, Xincheng, and Beilin and consists of the areas of North Street, Tieta Temple, South Street, and East Street. Intermediate agglomerations are distributed on the periphery of high agglomerations, and in addition to the three districts in which the high agglomerations are located, they are distributed in contiguous or point-like forms in the districts of Weiyang, Yanta, Lintong, and Chang'an.

The shopping category (Figure 1d) shows a spatial distribution pattern of “small aggregations, multiple points, and large dispersion”. The high-level agglomeration area is centered in the Bell and Drum Tower area, spreading out in a planar shape towards the surrounding area. For example, the shopping leisure and tourism spots in Yanta District are concentrated in the main blocks of Chang'an Road, Yanta Road, Furong South Road, Qujiang Road, Tangyan Road, etc. Medium-level clustering areas are distributed in all districts and are relatively scattered.

Sports and entertainment (Figure 1e) are characterized by a “linear and widely dispersed” pattern. High-density cluster areas are mainly distributed in the four districts of Weiyang, Lianhu, Xincheng, Beilin, and Yanta. They start from Weiyang Road and Beijie Street in the north and end at Chang'an South Road in the south, with a concentrated distribution along the axis. Other areas have scattered medium-density clusters.

Scenic spots (Figure 1f) show a spatial distribution pattern of “small aggregations and large dispersion”. The high-density agglomerations are the Bell and Drum Tower scenic area, the Xi'an City Wall area, the Daming Palace National Heritage Park area, Dayan Pagoda, and the Tang Paradise area. Medium-density agglomerations are more dispersed, with multiple distribution points in each district.

### 3.3. Spatial Scale Characteristics

Ripley's K function is used to judge the significance of multiscale agglomeration for the spatial distributions overall and in various types of leisure and tourism spaces in Xi'an. In Figure 2, the distributions overall and for various types of leisure and tourism spaces in Xi'an city follow the principles of significant agglomeration at different spatial scales. Based on the distance at which the peak occurs, overall leisure and tourism distribution reaches peak agglomeration at 19.3 km, which is higher than the peak agglomeration for any of the individual leisure and tourism types. This indicates that the five types of leisure and tourism spaces work together to enhance the agglomeration strength of the distribution of leisure and tourism spaces overall.

The catering service distribution is highly similar to the overall distribution for leisure and tourism, and catering services reach peak agglomeration at 19.1 km, which is higher than other types of leisure and tourism. This suggests that catering service points show agglomeration characteristics at larger spatial scales, with a wide range of spatial choices for location. This is followed by accommodation services and sports and entertainment locations, both of which reach their peak agglomeration at 18.7 km, with a slightly lower location selection ability. Scenic spots and shopping services reach peak agglomeration at 17.6 km and 17.0 km, respectively. Since scenic spots are more influenced by history and geography and shopping and commercial facilities are more influenced by business districts and location, these two categories of leisure and tourism have a lower level of ability to choose their locations and range among all categories. In conclusion, leisure and tourism facilities in Xi'an show obvious spatial scale dependence, but different types of leisure and tourism facilities have different degrees of spatial scale dependence. This difference is related to factors such as the nature of leisure and tourism facilities, location, environment, and market demand.



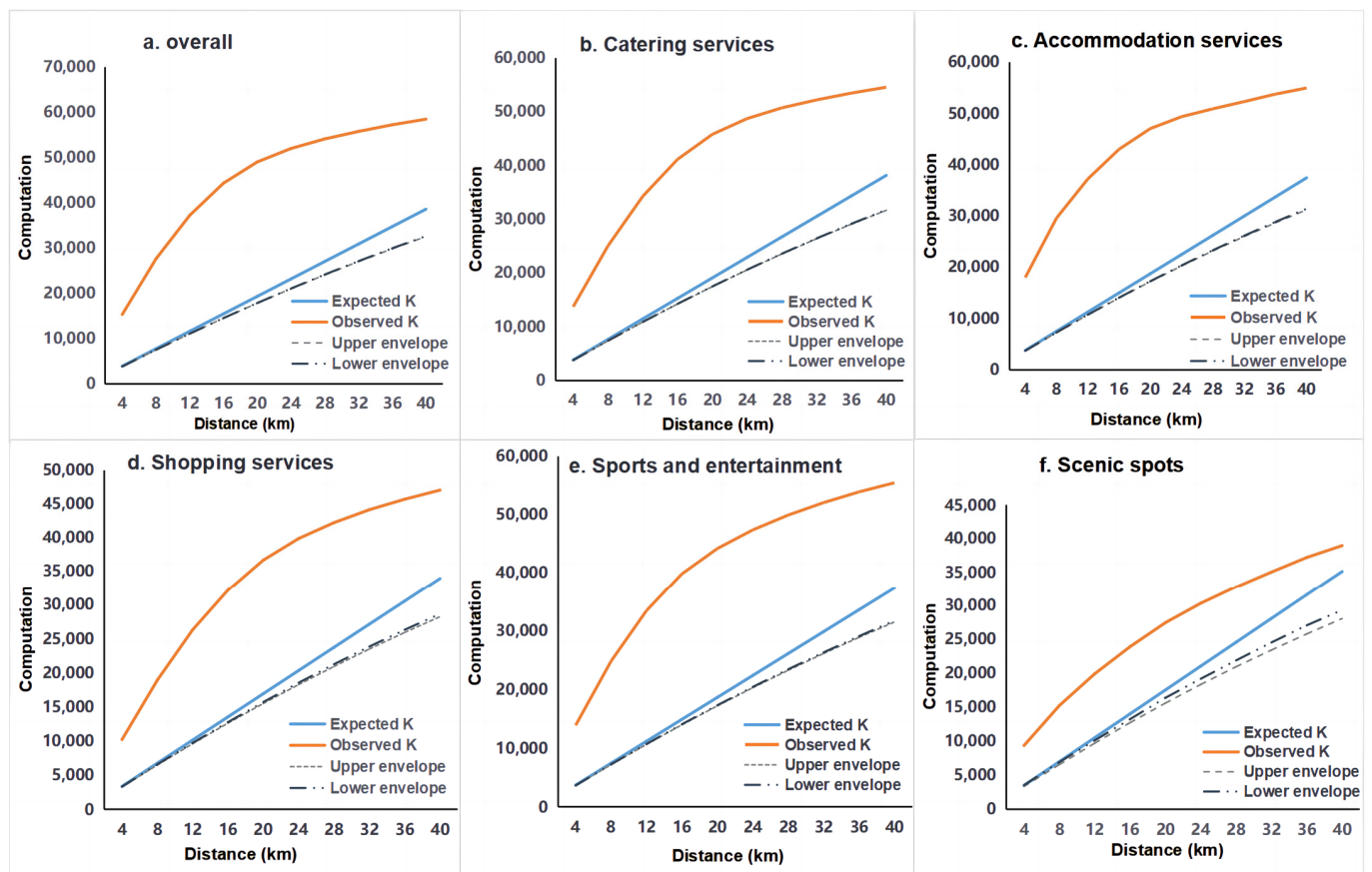


Figure 2. Ripley's K Function Analysis of Leisure and Tourism Spaces in Xi'an City.

#### 4. Factors Influencing the Spatial Distribution of Leisure and Tourism

##### 4.1. Impact Indicators and Analysis

The formation of the spatial pattern of urban leisure and tourism is the result of a combination of multiple factors. It has been argued that the economy, population, transport, infrastructure, and policy are the main factors influencing the distribution of urban leisure and tourism patterns [30,47]. The previous results of the spatial distribution of leisure and tourism in Xi'an also show that the leisure and tourism sites are characterized by near traffic and densely populated business districts. In addition to these aspects mainly considered by previous scholars, this paper argues that industrial structure is also a main factor affecting the distribution of leisure and tourism. Generally speaking, areas with a developed economy and a high proportion of the service industry have a dense distribution of commercial and leisure facilities, which provide an adequate supply for the development of leisure and tourism. Where the population is concentrated, people's demand for leisure and tourism is strong, and commercial and leisure activities are more frequent. Transport and infrastructure are the guarantee for leisure and tourism activities and provide convenience for people's leisure and tourism activities. In addition, factors such as policy and history also influence the spatial distribution of urban leisure and tourism, but these aspects are often difficult to quantify and are not considered in quantitative analyses.

Therefore, an indicator system is constructed for influencing factors, which includes seven representative indicators in five dimensions: economic level, demographic factors, industrial structure, traffic conditions, and infrastructure. The level of economic development is composed of the average house price at level  $X_1$  and the per capita disposable income of urban residents,  $X_2$ . The demographic factor is represented by the population density of permanent residents,  $X_3$ . The industrial structure consists of the proportion of the service industry to GDP,  $X_4$ , and the density of cultural service enterprises,  $X_5$ . The traffic conditions are measured by the  $X_6$  indicator of road network density within the region.

Generally, the more developed the evening economy is, the more perfect the facilities are, and the more it contributes to the development of leisure and tourism. Therefore, the night light intensity,  $X_7$ , is used to reflect the comprehensive level of infrastructure development in all urban areas.

Geodetector technology is used to calculate the q-value of the influence of each factor on the spatial differentiation of leisure and tourism in Xi'an, in which the dependent variable is the spatial density both overall and for the various types of leisure and tourism sites in 11 districts of Xi'an, and the independent variables are the seven indicators in the above index system. Geodetector analysis (Table 3) shows that all seven indicators are significant at the 1% level, indicating that the seven selected factors have a significant influence on the spatial differentiation of leisure and tourism in Xi'an, and the intensity of the effect is, in descending order, population density  $X_3$  > density of cultural service enterprises  $X_5$  > per capita disposable income of urban residents  $X_2$  > night light intensity  $X_7$  > the proportion of the service industry in GDP  $X_4$  > road network density  $X_6$  > average house price level  $X_1$ .

**Table 3.** Geographical Detection Analysis of Factors Influencing the Spatial Distribution of Leisure and Tourism in Xi'an City.

| Indicator Dimension  | Detection Factors                                      | q Ranking | Overall | Catering Services | Accommodation Services | Shopping Services | Sports and Entertainment | Scenic Spots |
|----------------------|--------------------------------------------------------|-----------|---------|-------------------|------------------------|-------------------|--------------------------|--------------|
| Economic level       | Average house price level, $X_1$                       | 7         | 0.137   | 0.230             | 0.097                  | 0.137             | 0.261                    | 0.123        |
|                      | Per capita disposable income of urban residents, $X_2$ | 3         | 0.679   | 0.760             | 0.580                  | 0.679             | 0.738                    | 0.664        |
| Demographic factors  | Population density, $X_3$                              | 1         | 0.866   | 0.935             | 0.877                  | 0.866             | 0.873                    | 0.839        |
| Industrial structure | The proportion of the service industry to GDP, $X_4$   | 5         | 0.434   | 0.489             | 0.374                  | 0.434             | 0.594                    | 0.411        |
|                      | Density of cultural service enterprises, $X_5$         | 2         | 0.811   | 0.872             | 0.636                  | 0.811             | 0.773                    | 0.744        |
| Traffic conditions   | Road network density, $X_6$                            | 6         | 0.430   | 0.486             | 0.304                  | 0.430             | 0.410                    | 0.329        |
| Infrastructure       | Night light intensity, $X_7$                           | 4         | 0.663   | 0.715             | 0.571                  | 0.663             | 0.726                    | 0.538        |

Population density has the strongest explanatory power for the spatial distribution of leisure and tourism in Xi'an, which suggests that leisure and tourism in Xi'an is distributed with a strong population dependency. In the dimension of economic development level, the average housing price in the region has the lowest influence on the spatial distribution of leisure and tourism sites, while the per capita disposable income of urban residents has the third highest explanatory power, which is relatively strong in explaining the spatial differentiation of leisure and tourism. The income level of local residents largely influences the consumption demand for leisure and tourism; the higher the income level, the stronger the demand of residents for leisure and tourism. The leisure and tourism industry not only carries commercial attributes but also has public and welfare characteristics, so the average housing price level may not be a key factor affecting the spatial distribution of leisure and tourism. In terms of industrial structure, the proportion of the service industry to GDP and the density of cultural service enterprises rank fifth and second, respectively, in their explanatory power for the spatial differentiation of leisure and tourism in Xi'an. This is related to the fact that the leisure and tourism industry has cultural attributes and belongs to the service sector, which is also in line with Xi'an's urban image as a historical and cultural ancient capital. The intensity of nighttime lighting and the road network both have strong explanatory power for the spatial differentiation of leisure and tourism sites in Xi'an, ranking fourth and sixth, respectively, which indicates that the development of the leisure and tourism industry is more closely related to the city's high-quality facilities and traffic conditions.

#### 4.2. Interaction Detection of Influencing Factors

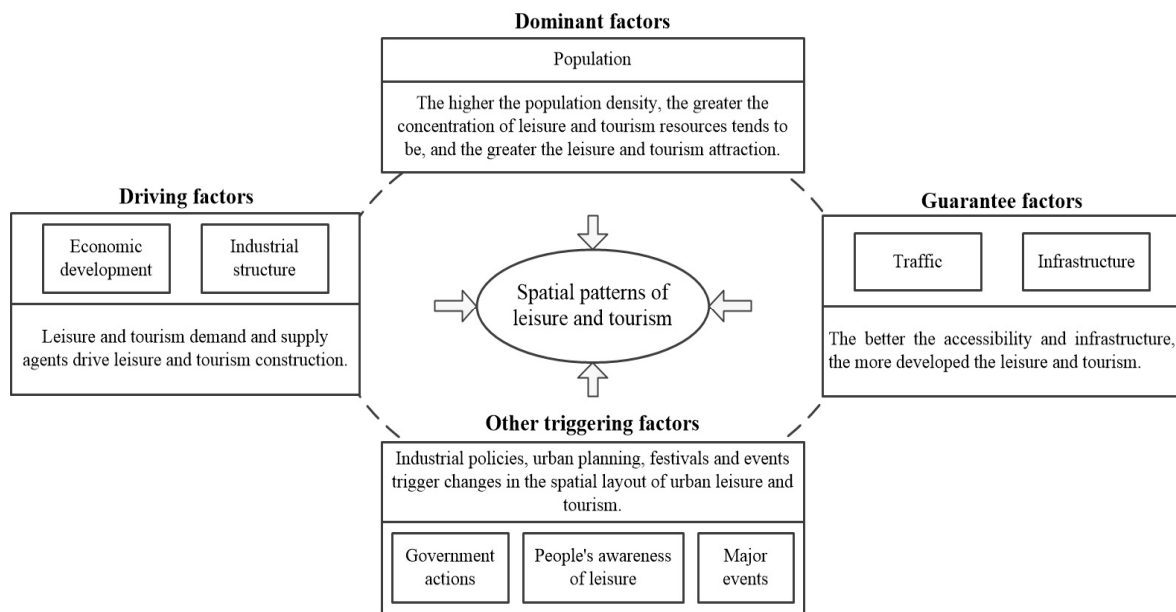
The influence value of  $q$  reflects the single-factor explanatory force of each factor on spatial differentiation, but the combined effect of different factors may have different effects on spatial differentiation. The interaction detector can be used to analyze whether the combined effect of any two factors on the dependent variable  $Y$  is independent, as well as the change in explanatory power. The results of analysis of the interactive influence of factors in the spatial differentiation of leisure and tourism sites in Xi'an (Table 4) show that the interaction of every two factors manifests a nonlinear enhancement (NE) or a bifactor enhancement (BE). That is, the interactions of every two factors are all greater than the explanatory power of each factor alone, and the influence of each factor on the spatial differentiation of leisure and tourism in Xi'an is interrelated and thus not an isolated effect. On the whole, the interaction between the factors is dominated by BE, i.e., the influence of the interaction of two factors is greater than the maximum influence of either factor alone. The interaction between housing price and other factors will show more NE results; that is, the influence of housing price interacting with other factors is greater than the sum of the influences of single factors. Although the explanatory power of housing prices in single factor impact analysis is not strong, when interacting with other factors, it also has a strong explanatory power on the spatial differentiation of leisure and tourism in Xi'an, with all calculations exceeding 0.8. The interaction of the other six factors also enhances the explanatory power of spatial differentiation.

**Table 4.** Interactive Analysis of Factors Influencing the Spatial Distribution of Leisure and Tourism Sites in Xi'an City.

| $A \cap B$     | Overall    | Catering Services | Accommodation Services | Shopping Services | Sports and Entertainment | Scenic Spots |
|----------------|------------|-------------------|------------------------|-------------------|--------------------------|--------------|
| $X_1 \cap X_2$ | 0.889 (NE) | 0.874 (BE)        | 0.828 (NE)             | 0.889 (NE)        | 0.813 (BE)               | 0.927 (NE)   |
| $X_1 \cap X_3$ | 0.951 (BE) | 0.953 (BE)        | 0.904 (BE)             | 0.951 (BE)        | 0.879 (BE)               | 0.939 (BE)   |
| $X_1 \cap X_4$ | 0.976 (NE) | 0.984 (NE)        | 0.871 (NE)             | 0.976 (NE)        | 0.864 (NE)               | 0.945 (NE)   |
| $X_1 \cap X_5$ | 0.972 (NE) | 0.943 (BE)        | 0.977 (NE)             | 0.972 (NE)        | 0.985 (BE)               | 0.988 (NE)   |
| $X_1 \cap X_6$ | 0.997 (NE) | 0.989 (NE)        | 0.994 (NE)             | 0.997 (NE)        | 0.999 (NE)               | 0.991 (NE)   |
| $X_1 \cap X_7$ | 0.966 (NE) | 0.995 (BE)        | 0.919 (NE)             | 0.966 (NE)        | 0.888 (BE)               | 0.936 (NE)   |
| $X_2 \cap X_3$ | 0.868 (BE) | 0.937 (BE)        | 0.877 (BE)             | 0.868 (BE)        | 0.878 (BE)               | 0.844 (BE)   |
| $X_2 \cap X_4$ | 0.799 (BE) | 0.862 (BE)        | 0.630 (BE)             | 0.799 (BE)        | 0.762 (BE)               | 0.747 (BE)   |
| $X_2 \cap X_5$ | 0.813 (BE) | 0.874 (BE)        | 0.637 (BE)             | 0.813 (BE)        | 0.777 (BE)               | 0.749 (BE)   |
| $X_2 \cap X_6$ | 0.975 (BE) | 0.984 (BE)        | 0.870 (BE)             | 0.975 (BE)        | 0.864 (BE)               | 0.943 (BE)   |
| $X_2 \cap X_7$ | 0.797 (BE) | 0.870 (BE)        | 0.623 (BE)             | 0.797 (BE)        | 0.785 (BE)               | 0.723 (BE)   |
| $X_3 \cap X_4$ | 0.997 (BE) | 0.998 (BE)        | 0.999 (BE)             | 0.997 (BE)        | 0.996 (BE)               | 0.994 (BE)   |
| $X_3 \cap X_5$ | 0.973 (BE) | 0.952 (BE)        | 0.982 (BE)             | 0.973 (BE)        | 0.982 (BE)               | 0.992 (BE)   |
| $X_3 \cap X_6$ | 0.975 (BE) | 0.999 (BE)        | 0.921 (BE)             | 0.975 (BE)        | 0.894 (BE)               | 0.944 (BE)   |
| $X_3 \cap X_7$ | 0.974 (BE) | 0.999 (BE)        | 0.921 (BE)             | 0.974 (BE)        | 0.894 (BE)               | 0.942 (BE)   |
| $X_4 \cap X_5$ | 0.836 (BE) | 0.918 (BE)        | 0.653 (BE)             | 0.836 (BE)        | 0.788 (BE)               | 0.747 (BE)   |
| $X_4 \cap X_6$ | 0.674 (BE) | 0.670 (BE)        | 0.757 (NE)             | 0.674 (BE)        | 0.865 (BE)               | 0.680 (BE)   |
| $X_4 \cap X_7$ | 0.839 (BE) | 0.930 (BE)        | 0.660 (BE)             | 0.839 (BE)        | 0.791 (BE)               | 0.753 (BE)   |
| $X_5 \cap X_6$ | 0.996 (BE) | 0.989 (BE)        | 0.993 (NE)             | 0.996 (BE)        | 1.000 (BE)               | 0.993 (BE)   |
| $X_5 \cap X_7$ | 0.839 (BE) | 0.930 (BE)        | 0.660 (BE)             | 0.839 (BE)        | 0.791 (BE)               | 0.753 (BE)   |
| $X_6 \cap X_7$ | 0.975 (BE) | 0.999 (BE)        | 0.921 (NE)             | 0.975 (BE)        | 0.894 (BE)               | 0.945 (NE)   |

#### 4.3. Influencing Mechanisms

The formation of the spatial patterns of urban leisure and tourism sites is a complex process influenced by many factors. Based on the analysis of geographic detectors in combination with findings from relevant studies [48–51], the impact mechanisms affecting the spatial pattern of leisure and tourism sites in Xi'an are further analyzed from four aspects: dominant factors, driving factors, guarantee factors, and other triggering factors (Figure 3).



**Figure 3.** Impact Mechanisms of Leisure and Tourism Spatial Patterns.

(1) Dominant factors

Demographic factors are the dominant factors influencing the formation of the spatial pattern of leisure and tourism sites in Xi'an. Population is regarded as a source of tourism growth [49]. The purpose of leisure and tourism is to provide good facilities, leisure environments, and services and to meet the leisure and tourism needs of residents and tourists. The higher the degree of population concentration, the greater the market demand for leisure and tourism. In general, population density is closely related to the location, resources, and attractiveness of the area. The three districts with high population density in Xi'an are Beilin District, Lianhu District, and Xincheng District, which are the center of Xi'an. These districts have the highest concentration of leisure and tourism resources, which are the richest in historical and cultural connotations for the region and the most expressive of the charms of ancient capital culture. Allocentric tourists are more likely to be attracted by the cultural heritage of a given destination [50]. These districts are an important activity area for foreign tourists to experience the original lifestyle of the local residents.

(2) Driving factors

The level of economic development and industrial structure are important driving factors influencing the spatial layout of leisure and tourism sites in Xi'an. The higher the level of economic development in the region, the higher the disposable income of the residents, and the stronger the demand for leisure and tourism consumption [51]. Leisure and tourism includes catering, accommodations, entertainment, tourism, and other forms of business belonging to the scope of the service industry, and the degree of development of the city's service industry has a direct impact on the development of leisure and tourism. Culture and tourism are inextricably linked, especially in a city such as Xi'an, where history and culture are deeply rooted, and cultural tourism resources are an important carrier of leisure and tourism activities. As the main operators in the leisure and tourism market, cultural enterprises provide important support for the development of high-quality leisure and tourism products and the optimization and upgrading of the leisure and tourism industry in Xi'an. These enterprises drive the innovation and development of the leisure and tourism industry.

### (3) Guarantee factors

Transport facilities and infrastructure play an important role in tourism development [51,52] and are important guarantees for the development of leisure and tourism. From the spatial distribution characteristics of leisure and tourism in Xi'an, there is a notably strong dependence on traffic, and the middle-level and high-level agglomerations are mostly distributed along the metro lines, main roads, ring roads, and other axes and circuits. The areas with strong lighting at night are Beilin, Lianhu, Yanta, and Xincheng, including the Bell and Drum Tower business district and the emerging cultural and tourism consumption agglomeration areas, such as Datang Night City. The supporting tourism service facilities and various infrastructure in these areas are relatively mature, providing an important guarantee for the functional improvement of leisure and tourism clusters.

### (4) Other triggering factors

The formation and evolution of urban leisure and tourism distributions are also influenced by other factors that are difficult to quantify, such as government actions (policies and regulations, urban positioning, land planning, industrial planning, etc.), public awareness of leisure and paid vacation systems, and major events (conferences and exhibitions, sports events, festivals, web celebrity events, etc.). In the future, with the continuous enhancement of public awareness of leisure, the service functions of cities for residents and tourists will become increasingly perfected. The emergence of new technologies and new forms of businesses will also further influence the formation of the spatial patterns of leisure and tourism services.

## 5. Discussion

Previous studies have mostly focused on the spatial distribution of a certain type of leisure or tourism type in the city. This paper reveals the characteristics of the spatial distributions of leisure and tourism types in Xi'an, a nationally recognized urban center of excellent tourism and their influencing mechanisms from the overall perspective of leisure and tourism space in the city. This study argues that urban leisure and tourism spaces are spaces shared by hosts and guests. Urban leisure and tourism can be divided into five types: catering services, accommodation services, sports and entertainment, shopping services, and scenic spots.

The reason for studying urban leisure and tourism spaces together is not only that they are intertwined and difficult to distinguish, but also that leisure and tourism can enhance each other's development. Rising living standards have awakened people's sense of leisure, and a city with good leisure facilities and environment is equally attractive to tourists and can also enrich their experience. As seen from the above analysis, the distribution of scenic spot sites is strongly influenced by the environment and history, and its ability of location selection is limited. In contrast, recreational facilities have a strong location selection ability and can complement traditional attractions. Quality leisure facilities not only serve residents well but also provide tourists with alternatives to attractions. For example, many night-time specialty snacks and shopping bazaars, night-time cultural performances, and other leisure projects in Xi'an have attracted a large number of tourists and become new tourist hotspots, promoting the development of night-time tourism in Xi'an.

Theoretically, this study deepens the exploration of the spatial law of urban leisure and tourism and enriches the study of the relationship between leisure and tourism. At the practical level, it is aligned with the law of urban development and practical requirements in China. China's National Tourism and Leisure Development Program (2022–2030) and the 14th Five-Year Plan for Tourism Development both explicitly propose promoting the development of tourism and leisure and creating a number of nationally designated tourism and leisure cities with distinctive cultural characteristics. Consequently, the exploration of the spatial principles guiding leisure and tourism development will help Chinese tourist cities plan the layout of tourism and leisure facilities more scientifically.



The results of the nearest-neighbor distance and kernel density analyses show that the distributions overall and for various types of leisure and tourism spaces in Xi'an present the characteristics of concentration in the central urban area and sparse dispersion in the surrounding urban areas, but there are differences in the degree of concentration and the patterns among different types of services. This finding verifies the conclusion of some scholars that the distribution of urban leisure tourism resources has an obvious core-periphery structure [30,31]. The high-density distributions overall and for various types of leisure and tourism sites in Xi'an exhibit a proximity to transportation, scenic areas, and commercial districts. Generally, the most concentrated core area of the distributions both overall and for various types of leisure and tourism services is centered on the Bell and Drum Tower scenic spot, within the scope of the Ring Road, which is the most richly preserved area of historical remains relating to Xi'an's history as an ancient capital and was delineated in Xi'an's early urban planning as the urban center. This conclusion is in line with the views of some studies. In the case of tourist historic cities, tourism is closely intertwined with the daily lives of local people [53]. The best value hotels are most likely to be located in and around the central districts of urban tourist destinations where population and economic activities are denser [25]. However, the distribution of medium-sized agglomerations in Xi'an shows significant differences, with a distribution of multiple points or axes. The spatial concentration of tourism investment should be shifted from the spot approach to the axis approach while those axes are equipped as comprehensive spatial strategic in the regional tourism plans [54]. Therefore, attention should be paid to these points and axes outside the center of the city, which have a high potential for future development of the leisure and tourism industry.

The spatial distribution of leisure and tourism in Xi'an is to some extent representative of the distinctive characteristics of leisure and tourism spaces in cities within the historical capital category, i.e., the "star effect" of the historical core area is obvious, but the peripheral areas of the core area may have "image masking". The image of the city as a tourist destination is not set by the will of tourism developers but by the perception of the tourism market [55]. Tourists are influenced by a variety of factors when choosing a destination, including its perceived image. Invisible competition exists within the same region and destinations with a distinctive image and high visibility are often more popular with tourists. Xi'an, as the ancient capital for thirteen dynasties in China, has a distinctive urban image as a historical capital. The ancient city wall, the Bell and Drum Towers, and the Emperor Qinshihuang's Mausoleum Site and Museum are the most attractive cultural symbols of the ancient capital to tourists, and therefore, the layout of the city's leisure and tourism industry is centered on these attractions, with a highly concentrated industrial layout. The number of leisure and tourism facilities in areas outside the central city is relatively few and scattered, and the development of leisure and tourism resources that are not closely related to the cultural image of Xi'an's ancient capital, such as landscape resources, parks, public spaces, etc., have received relatively low-key development efforts.

Although this paper analyses the spatial distribution of the leisure and tourism industry in Xi'an only from the perspective of leisure and tourism market supply and does not analyze the spatial flow of residents and tourists on the demand side, it can be indirectly speculated that the flow of residents and tourists in Xi'an will also be very concentrated, forming distinctive "hot spots" and "cold spots" of leisure and tourism. This spatial imbalance will inevitably affect the overall development of the industry. Local residents outside the central city do not have equitable access to the city's leisure resources, and foreign tourists are influenced by the misimpression that their activities in Xi'an are limited to the central city. The sparse distribution and poor accessibility of leisure and tourism resources outside the central city further constrains the mobility of residents and tourists outside the core area. In the long run, the gap between the leisure and tourism industries in the center and the surrounding areas will increase day by day, which would be detrimental to the overall economic and social development of the city. It should be noted that the POI data used in this paper are the data of all leisure and tourism sites, which can only reflect

the distribution of leisure and tourism facilities as a whole, and which cannot be used to clearly distinguish the respective activity spaces of residents and tourists.

Through the study of the influencing factors on the spatial distribution of leisure and tourism in Xi'an, it is found that the spatial distribution of leisure and tourism patterns in Xi'an is related to factors such as population density, density of cultural service enterprises, per capita disposable income of residents, infrastructure, and transport. This conclusion is basically consistent with the findings of push and pull studies of tourism activity [51]. However, compared with general tourist cities, Xi'an specializes in cultural tourism products; therefore, when considering the factors affecting the spatial distribution of leisure and tourism in Xi'an, this paper includes the density of cultural service enterprises and the proportion of the service industry in GDP, which are two factors reflecting the industrial structure, in the system of influencing factors. The data show that the influence of these two factors, especially the density of cultural service enterprises, is relatively strong.

In summary, leisure and tourism are important drivers of the economic and social development of cities. The rationality of the spatial layout of leisure and tourism in Xi'an and the development of leisure and tourism have a positive impact on the construction of Xi'an as a national central city and are also inspirational to the development of leisure and tourism in other cities across the country. The high-quality development of leisure and tourism in Xi'an should include spatial balance and industrial diversification. Based on this, this study proposes the following suggestions:

- (1) The radiation effect of the core agglomeration should be enhanced, and new growth poles should be cultivated. The layout of the leisure and tourism industry in Xi'an is relatively concentrated, with various types of leisure and tourism resources mainly concentrated in the central urban areas of Beilin, Xincheng, and Lianhu. The "one core" pattern has basically formed, but the radiation and driving effect of the core agglomeration area on the outer region is limited. In the future, efforts should be made to further optimize resource allocation, promote the transfer of resource elements, strengthen regional industrial cooperation, promote the extension of transportation networks, and cultivate new growth poles to promote the integration and coordinated development of the main urban area and other sections. Furthermore, efforts should aim to improve the rationality of the overall layout of leisure and tourism formats in the region of Xi'an, as well as the ability to provide leisure and tourism services. The noncentral urban areas should increase their marketing and publicity efforts to fully demonstrate the unique charms of their respective areas and promote the reasonable flow of tourists between the central urban areas and the peripheral areas.
- (2) The advantageous resources of each district should be fully tapped to form a diversified leisure and tourism system. At present, cultural tourism in Xi'an city center, Yanta District, and Lintong District has formed a certain influence due to their unique historical and cultural resources. However, from the overall scope of the Xi'an urban area, the situation of whole-area tourism remains undeveloped, and important leisure and tourism resources such as the landscape resources represented by the Qinling Mountains and the Weihe River and the city parks represented by the Xi'an City Sports Park have not yet been fully tapped. In the future, while successfully building the historical and cultural core area, we can fully tap into the advantageous leisure and tourism resources of Baqiao, Chang'an, and Gaoling districts to create diversified leisure and tourism experiences, such as cultural performances, ecological leisure and holidays, festivals and recreation, athletics, business meetings, parks and outdoor recreation, and other leisure and tourism modes.

## 6. Conclusions

Urban leisure and tourism space is a space for local residents and tourists to share a better life, as well as a space to show the unique charm of the city. Exploring the spatial pattern of urban leisure and tourism and the influencing mechanisms is of guiding significance for urban planning and industrial layout. Based on the leisure and tourism POI data

in Xi'an, this paper classifies the leisure and tourism sites into five types: catering services, accommodation services, shopping services, sports and recreation, and scenic spots, and analyzes the spatial distributions of leisure and tourism overall and for different types and their influencing factors. The results of this study show that the leisure and tourism space in Xi'an is significantly clustered, which is in line with the spatial development pattern of "core-periphery". Using geodetectors, we analyze the influences and interactions of population, industrial structure, economic development level, traffic conditions, and infrastructure on the spatial differentiation of leisure and tourism types in Xi'an. This paper then explores the influencing mechanisms of the spatial patterns driving leisure and tourism sites in Xi'an from four aspects: dominant factors (population), driving factors (economic level, industrial structure), guaranteeing factors (infrastructure, traffic condition), and other triggering factors (governmental behaviors, consumption orientation, major events).

This study finds that in Xi'an, a famous historical capital of China, despite the mature development of the leisure and tourism industry, the distribution of the industry is highly concentrated in the central urban area, and the spillover and driving effect of the central urban area on the peripheral areas is relatively limited. The distinctive image of Xi'an as an ancient capital is a "double-edged sword", which exacerbates to a certain extent the imbalance in the distribution of the leisure and tourism industry between the central city and the peripheral regions. This phenomenon should be taken into account by government policy and the relevant planning and management departments of the city. The layout of urban leisure facilities should consider the balance within the urban area and safeguard the common leisure rights of urban residents. The development of the tourism industry also fully exploits the advantageous leisure and tourism resources of various districts in the city, and some cultural and tourism integration and innovative leisure and tourism projects can be considered for layout in other areas outside the central urban area. Combined with the historical and cultural projects in the central urban area, these services will provide tourists with diversified and high-quality leisure and tourism products.

The limitations of this study are as follows: First, limited by the characteristics of the POI data itself, the acquired data for leisure and tourism sites in Xi'an are spatial point data, which fail to reflect the difference in the volume of the leisure and tourism industry, and there is a certain amount of error in the spatial distance and kernel density analyses. Second, this paper only examines the distribution of leisure and tourism facilities in Xi'an from the perspective of supply, without considering the respective activity spaces and views of residents and tourists from the perspective of demand. Third, there are many factors affecting the spatial distribution of urban leisure and tourism facilities, but it is difficult to obtain data at the district level and the street level. Therefore, when analyzing the factors affecting the spatial differentiation of leisure and tourism types, only seven main indicators were selected for analysis, and some factors could not be taken into account due to the difficulty of obtaining or quantifying data. Future research is required to connect POI big data with qualitative surveys, focusing not only on the spatial layout of leisure and tourism patterns but also on human mobility and the views of residents and tourists. Through a variety of data sources, the rationality and regularity of the spatial distribution of urban leisure and tourism can be explored more deeply, with a view to providing better guidance for the development of the urban leisure and tourism industry and urban planning.

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