Analysis of the Evolution Pattern and Regional Conservation of Cultural Heritage from the Perspective of Urban Sustainable Transformation: The Case of Xiamen, China

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Abstract: This study focuses on the cultural heritage of Xiamen and uses the spatial analysis method of ArcGIS to analyze the spatiotemporal evolution and distribution characteristics of cultural heritage. Through analysis, we aim to optimize the structure of cultural heritage protection areas and tourism routes in urban planning by analyzing the spatial structure characteristics of Xiamen’s cultural heritage types in various historical periods. The results show that in terms of the time dimension, the existing cultural heritage in Xiamen was mainly built between 1840 and 1949, and the center of cultural heritage shows an overall trend of a “north-south direction”. In terms of spatial dimension, the existing cultural height in Xiamen shows a clustering distribution pattern, with clusters located in the Gulangyu and Xiagang areas of Siming District. According to the period, there is a clear spatial correlation pattern, showing a spatial clustering trend of “strong first and then weak”.

Keywords: cultural heritage; urban; sustainable transformation; regional conservation; GIS

1. Introduction

Cultural heritage has multiple values, such as historical, artistic, scientific, and social values. It is the outward manifestation of the level of material production of human society and serves as the carrier of historical and cultural information, as well as the cultural symbol of a nation and country [1]. According to the data released by the National Bureau of Statistics of China in December 2023, the investment in real estate development in China decreased by 9.4% year-on-year from January to November 2023 [2]. Therefore, the protection and utilization of cultural heritage and other existing spaces in cities have become crucial. From an international perspective, the current trend of cultural heritage protection is shifting from focusing solely on the protection of individual elements to focusing on the “mixed heritage” and “cultural landscape” formed by the interaction between cultural and natural elements [3]. Hence, there is a need to survey and analyze the cultural heritage in the region to provide a scientific basis for the overall conservation of the cultural heritage. On 3 September 2021, the General Office of the CPC Central Committee and the General Office of the State Council issued the Opinions on Strengthening the Protection and Inheritance of History and Culture in Urban and Rural Construction, which states that “The systematic protection, utilization, and inheritance of historical and cultural heritage in urban and rural construction is of great significance to the continuation of historical lineage, the promotion of high-quality development of urban and rural construction, the firming up of cultural self-confidence, and the building of a strong socialist cultural country” [4]. At present, most of Chinese cultural heritage is included in cultural relic protection units and protected by the Law of the People’s Republic of China on the Protection of Cultural Relics, but there are still a number of cultural relics that have been destroyed in the process of urbanization [5].
Overall, the planning and studies of cultural heritage are often conducted on an individual basis, lacking a holistic approach that considers the spatial and temporal distribution characteristics and the systematic protection of cultural heritage. Furthermore, the existing studies primarily focus on key heritage conservation units, which represent a relatively small number of sites and might not fully capture the spatial and temporal evolution of cultural heritage as a whole. There is also a lack of comprehensive analyses that consider different types of cultural heritage resources [6–8].

At present, the Geographic Information System (GIS) is being widely used as a mature spatial information technology for research and the comprehensive analysis of various spatial elements, and it is also an important method for spatial analysis and data processing in the field of cultural heritage [9]. GIS can be used as a vector calculation function to calculate the distribution characteristics of cultural heritage in terms of area and to implement the calculation results more intuitively into the urban geographic space in the form of visualization [10]. In recent years, major applications of GIS in China’s cultural heritage protection have encompassed information management, protection platforms [11,12], visualization of archaeological data [13,14], and disaster risk assessment [15–17]. In addition, the development of GIS has provided new ideas for the protection of cultural heritage, and the research method involving analysis of the spatial and temporal distribution of cultural heritage using GIS technology has become a hotspot that is widely discussed by scholars [18–21]. For example, Liu Jing et al. take the industry of modern cities as an entry point; they construct a GIS database and use kernel density analysis, mean center analysis, and other methods to study the spatial and temporal evolution and distribution of modern industry in China [8]. Feiyang Lin et al. take the Great Wall of the Ming dynasty as an example; they explore the spatial structure of its intangible cultural heritage based on GIS, construct a heritage corridor, and explore the suitable development mode of the heritage corridor of the Great Wall of the Ming dynasty from the macroscopic to mesoscopic level [22]. From a general point of view, the use of GIS technology to analyze the distribution characteristics of cultural heritage is conducive to the collection and integration of information on cultural heritage in the region and improves the scientific nature of the construction of the protection system and maintenance mechanism of cultural heritage in the region; at the same time, it effectively integrates the protection of cultural heritage into urban planning. However, the previous research on cultural heritage protection predominantly employed methods like kernel density analysis, mean center, and standard deviation ellipse to identify clustered areas and distribution centers of gravity for periods of cultural heritage, which tend to obscure heterogeneous points within the space and introduce uncertainty.

Xiamen City, positioned on the southeast coast of Fujian Province in China, is recognized as an Economic Special Zone and serves as a vital central metropolis, port, and scenic tourist city along the southeastern coastline. Specifically, the city’s administrative framework encompasses six districts: the Huli, Siming, Jimei, Haicang, Tongan, and Xian-gan districts. (Figure 1) Due to its unique geographical location and historical factors, the development of urban space in Xiamen is contradictory, abrupt, and uneven [23], and the study of the spatial distribution of cultural heritage in Xiamen contributes to the further understanding of the morphological characteristics of Xiamen’s urban space and provides a quantitative data basis for urban planning. In ancient times, Xiamen was known as “Ludao” or “Jiaheyu” and was part of Houguan County during the Han dynasty; then, it was under the jurisdiction of Nanan and Tongan counties during the Tang dynasty, with “Jiaheili” set up; during the Song to Yuan dynasties, it belonged to Suide Village, Tongan County [24]. In the twenty-seventh year of the reign of Ming Emperor Hongwu (1394), ancient Xiamen City was built, and after the mid-Ming dynasty, the foreign trade of Xiamen Port developed rapidly, and a large settlement was gradually formed in the areas between Shuixian Temple and ancient Xiamen City [25]. After the Opium War, the Qing government was forced to sign the Treaty of Nanjing with Britain; thus, Xiamen became one of the five ports of entry for trade, as stipulated by the Treaty of Nanjing [26]. In 1843, Xiamen
was officially opened as a port, and the Qing government formally approved the “Xiamen Gulangyu Land Concession Regulations” in 1902, making Gulangyu Island a “tenancy of nations”, which developed a diverse cultural heritage to some extent [27]. In 1911, the Xinhai Revolution broke out, and in September of the same year the Qing dynasty rule on Xiamen Island was ended. Xiamen was liberated on 17 October 1949. In 1953, Jimei Township in Tongan County was transferred to Xiamen City and changed to a township [28]. Since then, Xiamen’s jurisdiction expanded beyond the island. Currently, the research content on Xiamen’s cultural heritage mainly focuses on three aspects: (1) Research on a particular region, period, or type of architecture in Xiamen: Mei Qing explored the role of returnees in the modernization of Xiamen and the fusion of multiple cultures from the perspective of the Nanyang returnee housing colonies [29]. Qian Yi explored the evolution of the veranda style on Gulangyu Island [30]. Cheng Li and Wu Tingting discussed the repairing technique of a large wooden framework of traditional architecture in southern Fujian using the example of the Huangshixiaozong ancestral hall [31]. (2) Research on the history of urban construction in Xiamen: Yang Zhe studies the evolution of Xiamen’s urban spatial form in modern times and divides the urban construction from 1902 to 1949 into three phases. He points out that 1902–1919 is the preparatory period for Xiamen’s urban development, 1920–1937 is the period of rapid development, and 1939–1949 is the period of stagnation, and he explores the causes and characteristics of urban space in different periods [23]. (3) Research on the history of Xiamen’s urban development in historical, humanistic, social, economic, and cultural dimensions: Zhou Zifeng explored the history of modern Xiamen’s urban development and considered the “Xiamen Network” from an economic point of view to analyze its urban construction from 1900 to 1937 [32]. These studies largely focus on Gulangyu Island or Xiamen’s historic urban areas, and most of the research aims are carried out in terms of individual or single types of heritage; in addition, the timeframe of the studies is mostly limited to the modern era, which still lacks a comprehensive collation and systematic quantitative analysis of Xiamen’s cultural heritage in the whole area; holistic reflections on the spatial and temporal evolution of its cultural heritage and its distributional characteristics are also lacking.

![Location map of Xiamen City](image)

**Figure 1.** Location map of Xiamen City.

Given this, our study focuses on the cultural heritage throughout Xiamen City, using GIS technology to analyze the spatial and temporal evolution and distribution characteristics of the cultural heritage in Xiamen City. Additionally, the study introduces new tools to carry out a correlation analysis study of multi-factor attributes, in combination with traditional spatial analyses. The global autocorrelation analysis can reflect the degree
of clustering of cultural heritage in the overall space. Clustering and outlier analysis, on the other hand, can reveal local spatial association patterns and find heterogeneous points outside the aggregation area. By analyzing the geographic location and historical background of the heterogeneous points, we can explore the reasons for the formation of the heterogeneous points, avoid the uncertainty of the results, and explore the aggregation characteristics of Xiamen’s cultural heritage more comprehensively. Xiamen, as a coastal city in southeastern China, has a representative history of urban construction and development. The results of this study can reveal the social logic inherent in the distribution characteristics of its cultural heritage, enhance further knowledge of the evolution of urban history and changes in the humanistic environment of Xiamen, address the gaps in existing research, and provide a quantitative data basis for the regional protection of Xiamen’s cultural heritage. The results can also provide a new direction for the protection of cultural heritage in the same type of city and can promote the transformation and improvement of urban planning models in the context of urban planning and landscape transformation.

2. Data Sources and Research Methods

2.1. Data Sources

The data include nine batches of cultural relic protection units and seven batches of historical buildings, Taiwan-related cultural relics and monuments, etc., which were announced by the Cultural Relics Bureau of Fujian Province, Xiamen Municipal People’s Government, Xiamen Municipal Bureau of Culture and Tourism, and Xiamen Gulangyu Municipal Administrative Committee. The temporal scope of cultural heritage is divided by the history of Xiamen’s urban development, and the cultural heritage items throughout different historical stages are counted based on the period of their construction, without double counting. The historical materials are gathered from the relevant literature, such as Xiamen Zhi (Zhou Kai), Lujiang Zhi (Xue Qifeng), Xiamen Municipal Records (Xiamen Local History Compilation Committee), Xiamen Ancient Architecture (Chen Wen), Xiamen City Construction Journal (Xiamen Urban Construction Journal Compilation Committee), Studies on the History of Urban Development of Modern Xiamen (Zhou Zifeng), etc.

A comprehensive understanding of the cultural heritage is a prerequisite for heritage conservation work, which requires on-site investigations and analyses of the heritage. To provide a reliable basis for the determination of heritage value, on-site research based on the list of cultural heritage items in Xiamen was carried out, and the methods used for the research included GPS geographic information acquisition, document retrieval, photographic records, records of heritage profiles, records of preservation of current status, detailed mapping, and oral histories to support the evidence, etc. The definition of cultural heritage is based on the Law of the People’s Republic of China on the Protection of Cultural Relics and the Xian Declaration.

As of 2023, there are 1713 general immovable cultural relics and 250 cultural relic protection units in Xiamen. Among them, there are 7 national key cultural relic protection units (50 sites), 54 provincial cultural relic protection units (61 sites), 95 municipal cultural relic protection units (98 sites), and 94 district- and county-level cultural relic protection units (94 sites). Xiamen has been declared a provincial-level historical and cultural city, with a total of 507 historical buildings, 3 traditional buildings, 2 industrial heritage sites, 93 red cultural heritage sites, 89 Taiwan-related cultural relics and monuments, 1 national-level historical and cultural block, 2 provincial-level historical and cultural blocks, 2 municipal historical blocks, 8 municipal-level historical areas, 5 provincial-level traditional villages, and 1 world cultural heritage site. This study focuses exclusively on point-like cultural heritage items that have a heritage protection level. Owing to instances of certain cultural heritage sites in Xiamen being listed multiple times on different protection registers and the unverifiable age of some sites, the total number of unique cultural heritage sites has been established as 776.
2.2. Research Methods

The research process of this paper, as shown in Figure 2, consists of three main steps: (1) GIS database creation: Data on immovable cultural relics with clear construction times and locations from the statistical results are compiled. These point data are then entered into the GIS according to their latitude and longitude, along with additional information such as building name, address, and construction time, to establish a GIS database. Base map element data, including Xiamen’s city limits, district and county boundaries, major rivers, and railways, are also imported into the GIS. (2) GIS database analysis: The database undergoes analysis using ArcGIS 10.2 software’s analytical tools, namely the kernel density tool, mean center tool, standard deviation ellipse tool, global spatial autocorrelation tool, and clustering and outlier tool, to generate correlation analysis maps. (3) Results analysis: By examining the spatial–temporal patterns and distribution characteristics of Xiamen’s cultural heritage across various periods and types, the study suggests regional protection measures that are informed by these insights.

Figure 2. Data analysis process.

2.2.1. Kernel Density Analysis

The kernel density function is utilized to assess the distribution of cultural heritage sites in Xiamen for probability estimation. Using kernel density estimation, it is possible to distinguish areas where Xiamen’s cultural heritage is concentrated based on various attributes, such as the periods and types of the heritage sites. The function is formulated as a bivariate probability density function, centered on the heritage site locations, and it decays toward 0 within a certain bandwidth. The usual formula for estimating the density is the Rosenblatt–Parzen kernel [33]:

$$R(x) = \frac{1}{nh} \sum_{i=1}^{n} k\left(\frac{x - x_i}{h}\right)$$  \hspace{1cm} (1)
In the formula, \( R(x) \) is the probability value of the element becoming \( R \) at \( x \). In this study, \( R \) is the cultural heritage site.

\[
k(x - x_i)
\]

is the kernel function, where \( (x - x_i) \) is the distance from the estimated value point \( x \) to the industrial heritage point \( x_i \); \( h \) is the bandwidth and is greater than 0. Studies have shown that the kernel function has a minimal impact on the results and \( h \) has a large impact, and there is no authoritative formula for determining the value of \( h \). Based on many experiments, the author determines the value of \( h \) to be 1 km.

### 2.2.2. Mean Center and Standard Deviation Ellipse Analysis

The movement of the mean center over the different periods is indicative of the changing trend of the spatial distribution of the cultural heritage in Xiamen. This metric helps to identify shifts in the geographic concentration of heritage sites over time. Additionally, the standard deviation ellipse provides an insight into the principal distribution scope, the prevailing directional trends, and the degree of clustering of the cultural heritage within the city by period. The area enclosed by the ellipse indicates the extent of the distribution range; the orientation of the long axis points to the predominant distribution direction, and a shorter short axis implies a higher degree of spatial concentration [34]. The formula is as follows:

\[
C = \frac{1}{n} \sum_{i=1}^{n} \left( \frac{x_i - \bar{x}^2}{x_i - \bar{y}} \right) = \left\{ \begin{array}{l}
\frac{x_i - \bar{x}}{y_i - \bar{y}} \\
\end{array} \right.
\]

In the formula, \( x \) and \( y \) are the mean center point coordinate values, \( x_i \) and \( y_i \) are the element coordinate values, and \( n \) is the total number of elements.

### 2.2.3. Global Spatial Autocorrelation Analysis

Global spatial autocorrelation is one of the geospatial statistical methods that reveal the degree and significance of spatial correlation across a region. It tests for clustering among spatial units within the entire area. Moran’s I index measures this type of autocorrelation, with values ranging from \(-1 \) to \( 1 \). Under a specified significance level, a Moran’s I index greater than 0 indicates positive spatial autocorrelation, suggesting that similar values are clustered together. Conversely, an index of less than 0 suggests negative spatial autocorrelation, meaning that similar values tend to be dispersed. An index value of 0 means that the spatial pattern is random [35]. The formula is as follows:

\[
I = \frac{n}{S_O} \sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} z_i z_j 
\]

In the formula, \( z_i \) is the deviation of the attribute of element \( i \) from its mean value \( (x_i - \bar{x}) \), \( w_{ij} \) is the spatial weight between the \( i \) and \( j \) elements, which is equal to the total number of elements, and \( S_O \) is the aggregation of all the spatial weights.

\[
S_O = \sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij}
\]

### 2.2.4. Clustering and Outlier Analysis

The clustering and outlier analysis can identify the spatial clusters with high or low values and the spatial outliers. It uses the local Moran’s I value, \( z \)-scores, \( p \)-values, and codes that indicate the type of clustering for each statistically significant element. The formula is as follows:

\[
I_i = \frac{x_i - \bar{x}}{S_i^2} \sum_{j=1 \land j \neq i}^{n} w_{ij} (x_j - \bar{x})
\]
x_i is the attribute of element i, \( \bar{X} \) is the mean of the corresponding attribute, and \( w_{ij} \) is the spatial weight between the i and j elements.

\[
S_i^2 = \frac{\sum_{j=1,j\neq i}^{n}(x_j - \bar{X})^2}{n - 1}
\]

(6)

n is equal to the total number of elements.

The \( z_i \) of the statistic is calculated according to the following formula:

\[
z_i = \frac{I_i - E[I_i]}{\sqrt{V[I_i]}}
\]

(7)

\[
E[I_i] = \frac{\sum_{j=1,j\neq i}^{n} w_{ij}}{n - 1}
\]

(8)

\[
V[I_i] = E[I_i^2] - E[I_i]^2
\]

(9)

\( x_i \) and \( x_j \) denote the observed values of a phenomenon on spatial units i and j, respectively. A positive value I indicates that the element has neighboring elements that contain equally high or equally low values of the attribute and that this element is part of a cluster. A negative value I indicates that the element has neighboring elements that contain different values and that this element is an outlier [36].

Using the clustering and outlier analysis tool to examine the distribution of Xiamen’s cultural heritage sites, we can classify statistically significant clusters into four categories as indicated by the output field “COType”: High–High (HH), Low–Low (LL), High–Low (HL), and Low–High (LH). An HH cluster denotes a scenario in which spatial units with high values are surrounded by other high-value units, suggesting a concentration of similar values. Conversely, an LL cluster indicates that spatial units with low values are similarly grouped. An HL cluster reveals that high-value spatial units are adjacent to low-value units, highlighting potential anomalies or transitions within the spatial pattern. Lastly, an LH cluster shows low-value spatial units neighboring high-value units, which might also indicate areas of transition or singularities in the distribution of cultural heritage sites.

3. Results

Based on the aforementioned census results, a Geographic Information System (GIS) database of cultural heritage in Xiamen was established, as illustrated in Figure 3. The framework of the database primarily encompasses two types of elements: cultural heritage elements and base map elements. The cultural heritage elements comprise various items, such as recognized cultural relic protection units, historical buildings, and cultural relics and monuments associated with Taiwan, among others. Meanwhile, the base map elements feature essential geographic and administrative details, including the Xiamen City boundaries, district and county boundaries within Xiamen, key waterways and railways, urban roads, and other relevant infrastructural features. The data for the cultural heritage elements were sourced from the census conducted specifically for this purpose in Xiamen, ensuring an accurate and up-to-date reflection of the heritage sites. The base map elements were derived from the National Basic Geographic Information System.
3.1. Characteristics of the Spatial and Temporal Distribution of the Cultural Heritage

According to previous studies, such as Xiamen Zhi, Lujiang Zhi, Xiamen City Zhi, and Study on the History of Urban Development in Modern Xiamen, and considering the history of Xiamen’s urban growth, the evolution of Xiamen’s cultural heritage can be divided into five distinct periods: (1) the Sui-Tang to the Five Dynasties period (581–979), (2) the Song to Yuan Dynasty period (979–1368), (3) the Ming to Mid-Qing Dynasty period (1368–1840), (4) the Late Qing Dynasty to Republic of China (ROC) period (1840–1949), and (5) the People’s Republic of China (PRC) period (after 1949). Table 1 presents a statistical analysis of the number and the details of the cultural heritage sites from each period. According to the results, Xiamen has 20 cultural heritage sites from the Sui-Tang to Five Dynasties period, making up approximately 3% of the total heritage count; 45 heritage sites from the Song to Yuan Dynasty period, constituting around 6%; 153 sites from the Ming to Mid-Qing Dynasty period, accounting for 20%; 518 sites from the Late Qing Dynasty to ROC period, representing about 66%; and 40 sites from the PRC period, which make up roughly 5%.

Overall, the bulk of Xiamen’s cultural heritage was constructed during the Late Qing Dynasty to ROC period. This era saw the development of various significant structures, such as foreign consulates, hospitals, houses of worship, and villas, with a notable concentration on Gulangyu Island and the Xiagang area in Siming District. These findings suggest that the modern era marked a zenith of urban development for both the ancient city of Xiamen and Gulangyu Island. The historical backdrop, characterized by the emergence of Gulangyu Island as a “tenancy of nations” and the influx of overseas Chinese, catalyzed a fusion of local and foreign cultures. This confluence led to the creation of numerous modern cultural heritage sites influenced by Western architectural styles, leaving a lasting imprint on Xiamen’s cultural topography.
Table 1. Statistics on cultural heritage in Xiamen by historical period.

<table>
<thead>
<tr>
<th>Historic Stage</th>
<th>Count</th>
<th>Representative Cultural Heritage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sui-Tang to the Five Dynasties period (581–979)</td>
<td>20</td>
<td>Jinbing Huang’s Ancestral Hall, Hulushan Iron Dregs Pile, Lushan Hall, Dalunshan Mountain Gate, Cizaowei Kiln Site, Emperor’s Well, Zhenji Temple Ruins, Xuchuo Ancient Kiln Site, Xue Ling Zhi’s Tomb</td>
</tr>
<tr>
<td>Song to Yuan Dynasty period (979–1368)</td>
<td>45</td>
<td>Tingxi Kiln Site, Wuxian First Stream Bridge, Anile Village Pagoda, Wengong Study Hall, Fantian Temple Brahmin Stupa, Meishan Temple Brahmin Stupa, Tongan City Walls, Tongyu Pool, Da Yuan Hall, Wu Tong Ferry Ruins, Qingjiao Ciji Palace Xiamen City Wall, Sanqutian Wharf Site, Dafu Di, Four-courtyard Complex, Shuicaotai Site, Longtoushan Site, Sunlight Rock Temple, Daxiongao Hall of Nanputuo Temple, the ruins of Yanyu Pavilion, the ruins of Yanyu Pond, the fortress of Huli Mountain, Ancient Mansion Huang’s Ancestral Hall, Ye He’s Tomb, Tongan Confucius Temple</td>
</tr>
<tr>
<td>Ming to Mid-Qing Dynasty period (1368–1840)</td>
<td>153</td>
<td>Tongan Bell Tower, the former site of the U.S. Consulate, the former site of the HSBC Bank Staff Apartments, Hongning Hospital Site, Boat House, the former site of the HSBC Bank Building, Xiamen Light Bulb Factory, Chuncao Hall, Lei Cuo, the former site of the Gulangyu Telephone Company, the former site of the Japanese Consulate, Xilin Kabling Villa</td>
</tr>
<tr>
<td>Late Qing Dynasty to ROC period (1840–1949)</td>
<td>518</td>
<td>Kah Kee Park, Da Deng 8.23 Artillery Battle, Main Building of Huaqiao Museum, Former site of Xiamen Special Economic Zone Administrative Committee Office Building, Guilai Garden, Yihui Building, Lujiang Mansion, South Gate</td>
</tr>
<tr>
<td>PRC period (after 1949)</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

3.1.1. The Overall Distribution and Concentration Areas of Cultural Heritage by Period

The results of the kernel density analysis applied to Xiamen’s cultural heritage, as examined through the lenses of various historical eras using GIS technology, are visualized in Figure 4. This analysis reveals how the existing cultural heritage of Xiamen is characterized by multiple core clusters, with the most striking concentration found on Gulangyu Island within Siming District, although smaller accretions are present in each district. From the Sui-Tang to Five Dynasties period (581–979), the heritage sites are relatively few and dispersed, with minor cores in eastern Haicang District, northern Xiangan District, and the central areas of the Jimei, Tongan, and Huli districts. Notably, the northern part of Xiangang District and the central parts of the Tongan and Huli districts form the principal clusters, which primarily comprise ancient tombs and edifices. In the Song to Yuan Dynasty period (979–1368), there is an increase in the number of cultural heritage sites, with additional small core aggregations in the south of Haicang District and the southeast of the Xiangang and Jimei districts. The most potent cores are now found in the current Tongan District, indicating an expansion from the previous period, with stone carvings dominating among the heritage types. During the Ming to Mid-Qing Dynasty period (1368–1840), the quantity of cultural heritage sites rises markedly, with new clusters emerging on Gulangyu Island and in the southwestern section of Siming District, as well as in central Haicang District. The most pronounced cores are in the Xianggang area and on Gulangyu Island in Siming District, along with the central part of Tongan District. Here, Siming District is predominantly associated with Yanping cultural sites and ancient structures such as family temples and ancestral halls, while Tongan District features ancient tombs and traditional residential buildings. The Late Qing Dynasty to ROC period (1840–1949) stands out as the epoch with the largest proliferation of heritage sites, including a surge on Gulangyu Island. Spatial aggregation becomes more defined, with the main core areas in Xiagang and on Gulangyu Island in Siming District and the southeastern portion of Jimei District. The architectural styles from this period are principally modern and exhibit Western influences, along with the distinctive Jiageng-style campus architecture.

The PRC period (after 1949) heralds a relative decrease in the addition of cultural heritage sites; yet, significant aggregation cores persist, especially in southeastern Jimei District, southwestern Siming District, and central Haicang District, with the architectural landscape dominated by campus buildings and revolutionary sites.
Figure 4. Distribution of kernel density of Xiamen’s cultural heritage by period.

3.1.2. The Centers of Gravity and Spatial Associations of Cultural Heritage by Periods

The results of the spatial distribution of the center of gravity and standard deviation ellipse of the cultural heritage in each era were obtained by using mean center and standard deviation ellipse analysis (Figure 5). In general, the center of gravity of the cultural heritage distribution in the five periods shows a trend of “North-South-North”. During the Sui-Tang to the Mid-Qing Dynasty period (581–1840), the centers of gravity of cultural heritage distribution were relatively concentrated and were located roughly in the southern part of the Jimei and Tongan districts. During the Late Qing Dynasty to ROC period (1840–1949), the center of gravity of the heritage distribution gradually shifted southwards to Siming District. In the PRC period (after 1949), the center of gravity of the heritage distribution shifted northwards to the northwestern part of Huli District.
Based on parameters such as the rotation angle, the length of the long axis, and the length of the short axis of the standard deviation ellipse, the spatial distribution of the cultural heritage by periods was comprehensively analyzed, as shown in Table 2. On the whole, the cultural heritage of the five periods shows a distribution pattern of “Southwest-Northeast”, and its spatial distribution characteristics can be roughly divided into three phases. The first phase is the Sui-Tang to Mid-Qing period (581–1840), with a rotation angle range of 19.91°–28.84°, a long axis length range of 18.74–19.97 km, and a short axis range of 10.16–11.03 km. The ellipse of this phase has a larger area, a higher oblateness, and a longer short axis, indicating a pronounced degree of spatial dispersion and orientation of spatial distribution. The second phase is the Late Qing Dynasty to ROC period (1840–1949), with a rotation angle range of 28.24°, a long axis length range of 9.57 km, and a short axis length range of 6 km. Compared with the previous period, the corner of the ellipse...
changes drastically, indicating that the spatial distribution direction of the cultural heritage changed during this phase; the ellipse has a smaller area, a lower flatness, and a shorter short axis, indicating that the spatial agglomeration of the cultural heritage is higher in this phase and that the orientation of the spatial distribution is weakened. The third phase is the PRC period (after 1949) when the standard deviation ellipse has a rotation angle of 9.18°, a long axis length of 13.52 km, and a short axis length of 9.53 km. Compared with the previous period, the corner of the ellipse changes drastically, indicating that the direction of the spatial distribution changed during this period; the ellipse has a larger area, a lower flatness, and a longer short axis, indicating a lower degree of clustering and a further weakening of orientation.

Table 2. Spatial distribution’s center of gravity and standard deviation ellipse parameters by period.

<table>
<thead>
<tr>
<th>Historic Stage</th>
<th>Areal Coordinates</th>
<th>Directional Angle</th>
<th>Long Axis (km)</th>
<th>Short Axis (km)</th>
<th>Oblateness</th>
<th>Shape Area (km²)</th>
<th>Moving Direction</th>
<th>Moving Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sui-Tang to the Five Dynasties period (581–979)</td>
<td>118.13° E, 24.62° N</td>
<td>28.84°</td>
<td>18.74</td>
<td>10.95</td>
<td>0.41</td>
<td>644.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Song to Yuan Dynasty period (979–1368)</td>
<td>118.11° E, 24.66° N</td>
<td>28.63°</td>
<td>19.97</td>
<td>11.03</td>
<td>0.44</td>
<td>692.64</td>
<td>Northwestern</td>
<td>4.94</td>
</tr>
<tr>
<td>Ming to Mid-Qing Dynasty period (1368–1840)</td>
<td>118.11° E, 24.59° N</td>
<td>19.91°</td>
<td>19.66</td>
<td>10.16</td>
<td>0.48</td>
<td>627.25</td>
<td>Southern</td>
<td>8.23</td>
</tr>
<tr>
<td>Late Qing Dynasty to ROC period (1840–1949)</td>
<td>118.07° E, 24.46° N</td>
<td>28.24°</td>
<td>9.57</td>
<td>6</td>
<td>0.37</td>
<td>180.35</td>
<td>Southwestern</td>
<td>14.11</td>
</tr>
<tr>
<td>PRC period (After 1949)</td>
<td>118.08° E, 24.54° N</td>
<td>9.18°</td>
<td>13.52</td>
<td>9.53</td>
<td>0.29</td>
<td>405.12</td>
<td>Northern</td>
<td>8.45</td>
</tr>
</tbody>
</table>

In summary, an examination of the overall situation indicates that Xiamen’s cultural heritage exhibits a predominant “Southwest-Northeast” distribution pattern. A closer look at the spatial evolution across distinct historical periods reveals a trend showing that the center of gravity for cultural heritage sites initially moved southwards before shifting northwards once again. Notably, the years 1840 and 1949 emerged as critical turning points, marking transitions in the spatial distribution from an initial dispersal to a phase of increased agglomeration and, ultimately, a return to a state of dispersion.

3.1.3. The Spatial Associations and Aggregation Characteristics of Cultural Heritage by Periods

Using the Create Fishnet function in ArcGIS, Xiamen was divided into 6841 basic cells, with each cell having an area of 500 m × 500 m. The number of existing sites and the five periods of cultural heritage in each basic cell are counted separately to generate the spatial distribution map of Xiamen’s cultural heritage by period; this map can objectively reflect the spatial distribution of the heritage and is conducive to the subsequent global spatial autocorrelation and local spatial autocorrelation analysis.

By using global spatial autocorrelation analysis on the existing Xiamen cultural heritage, we can analyze the spatial association of cultural heritage in the overall region, detect its clustering characteristics, and analyze the overall distribution pattern (Table 3). The results of the analysis, as indicated by Moran’s I index of 0.40 for the existing cultural heritage and a significant Z value, suggest that there is a positive spatial correlation. This implies that areas with a higher density of cultural heritage sites tend to be adjacent to one another, forming clusters. Conversely, areas with fewer cultural heritage sites are similarly neighbored by regions with sparse heritage distributions. By analyzing the spatial distribution pattern of heritage by period, Moran’s I index is 0.04, 0.06, 0.22, 0.37, and 0.15 respectively, indicating that the distribution of Xiamen’s cultural heritage in each period presents an aggregation state, and this aggregation state shows a trend of “strengthening first, then weakening”.
Table 3. Spatial distribution’s center of gravity and standard deviation ellipse parameters by period.

<table>
<thead>
<tr>
<th>Historic Stage</th>
<th>Moran I</th>
<th>Z</th>
<th>Distribution Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sui and Tang Dynasties to PRC period (After 581)</td>
<td>0.40</td>
<td>83.31</td>
<td>Clustered</td>
</tr>
<tr>
<td>Sui and Tang Dynasties to Five Dynasties period (581–979)</td>
<td>0.04</td>
<td>7.72</td>
<td>Clustered</td>
</tr>
<tr>
<td>Song Dynasty to Yuan Dynasty period (979–1368)</td>
<td>0.06</td>
<td>10.25</td>
<td>Clustered</td>
</tr>
<tr>
<td>Ming Dynasty to mid-Qing Dynasty period (1368–1840)</td>
<td>0.22</td>
<td>35.86</td>
<td>Clustered</td>
</tr>
<tr>
<td>Mid-Qing Dynasty to ROC period (1840–1949)</td>
<td>0.37</td>
<td>81.08</td>
<td>Clustered</td>
</tr>
<tr>
<td>PRC period (after 1949)</td>
<td>0.15</td>
<td>25.02</td>
<td>Clustered</td>
</tr>
</tbody>
</table>

The global spatial autocorrelation analysis reflects the degree of spatial clustering of cultural heritage as a whole, but it ignores possible instability and fails to reveal patterns of local spatial associations. To reflect the distribution characteristics of the cultural heritage in each district, it is necessary to identify the statistically significant hotspots, cold spots, and spatial outliers of the existing cultural heritage using the clustering and outlier analysis tool. There are five spatial association patterns identified by the autocorrelation model: high–high cluster (HH), high–low cluster (HL), low–high cluster (LH), low–low cluster (LL), and not significant.

As shown in Table 4, from an overall perspective, the proportions of the area occupied by the not significant, HH, LL, HL, and LH clusters of the existing Xiamen cultural heritage are 89.27%, 1.11%, 0.66%, 1.72%, and 7.24%, respectively. From the perspective of the spatial distribution by period, during the Sui-Tang to the Five Dynasties period (581–979), four spatial association patterns emerged: HH, LL, HL, and LH clusters, accounting for 0.06%, 98.66%, 0.23%, and 1.05% of the area, respectively. During the Song to Yuan Dynasty period (979–1368), there were five spatial association patterns: not significant, HH, LL, HL, and LH clusters, accounting for 0.10%, 0.09%, 97.22%, 0.50%, and 2.09% of the area, respectively. During the Ming to Mid-Qing Dynasty period (1368–1840), the proportions of the area occupied by the not significant, HH, LL, HL, and LH clusters were 84.91%, 0.50%, 8.46%, 1.10%, and 5.03%, respectively. During the Late Qing Dynasty to ROC period (1840–1949), the proportions of the area occupied by the not significant, HH, LL, HL, and LH clusters were 14.24%, 0.60%, 82.30%, 0.40%, and 2.46%, respectively. During the PRC period (After 1949), there were only four spatial association patterns: HH, LL, HL, and LH clusters, with area proportions of 0.19%, 98.13%, 0.26%, and 1.42%, respectively. From the above analyses, it is clear that significant heterogeneity exists in the spatial association patterns of the cultural heritage by period.

Table 4. Clustering and outlier analysis of Xiamen’s cultural heritage.

<table>
<thead>
<tr>
<th>Historic Stage</th>
<th>Not Significant (%)</th>
<th>High–High Cluster (%)</th>
<th>Low–Low Cluster (%)</th>
<th>High–Low Outlier (%)</th>
<th>Low–High Outlier (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sui and Tang Dynasties to PRC period (After 581)</td>
<td>89.27</td>
<td>1.11</td>
<td>0.66</td>
<td>1.72</td>
<td>7.24</td>
</tr>
<tr>
<td>Sui and Tang Dynasties to Five Dynasties period (581–979)</td>
<td>0.00</td>
<td>0.06</td>
<td>98.66</td>
<td>0.23</td>
<td>1.05</td>
</tr>
<tr>
<td>Song Dynasty to Yuan Dynasty period (979–1368)</td>
<td>0.10</td>
<td>0.09</td>
<td>97.22</td>
<td>0.50</td>
<td>2.09</td>
</tr>
<tr>
<td>Ming Dynasty to mid-Qing Dynasty period (1368–1840)</td>
<td>84.91</td>
<td>0.50</td>
<td>8.46</td>
<td>1.10</td>
<td>5.03</td>
</tr>
<tr>
<td>Mid-Qing Dynasty to ROC period (1840–1949)</td>
<td>14.24</td>
<td>0.60</td>
<td>82.30</td>
<td>0.40</td>
<td>2.46</td>
</tr>
<tr>
<td>PRC period (after 1949)</td>
<td>0.00</td>
<td>0.19</td>
<td>98.13</td>
<td>0.26</td>
<td>1.42</td>
</tr>
</tbody>
</table>

In order to explore the spatial association status of Xiamen’s cultural heritage in each district, five spatial association patterns were visualized and analyzed, and the results are shown in Figure 6. Overall, Xiamen exhibits HH, HL, and LH heritage clusters but lacks
LL clusters. Predominantly, HH clusters are found in the Gulangyu, southwestern Siming, southeastern Jimei, and central Tongan and Haicang districts; none of these are present in Xiangan. Conversely, HL and LH clusters are widely dispersed, often corresponding to singular heritage sites, whereas LL clusters are rare and situated on the district outskirts. Hereafter, we comprehensively analyze the local spatial association patterns of Xiamen’s cultural heritage by period. During the Sui-Tang to the Five Dynasties period (581–979), LL and HH clusters were concentrated in central Huli District, while HL and LH clusters were sporadically distributed. During the Song to Yuan Dynasties period (979–1368), new HH clusters emerged in central Tongan, with LL, HL, and LH clusters more pronounced across all the districts. In the Ming to Mid-Qing period (1368–1840), HH clusters characteristically appeared in central Tongan and Haicang, Gulangyu, and southwestern Siming, with a minor cluster in southeastern Jimei; HL and LH clusters expanded amidst a decline and dispersion of LL clusters. Throughout the Late Qing to ROC period (1840–1949), HH clusters persisted in Gulangyu, southwestern Siming, and central Haicang, whereas Tongan’s cluster decreased and Jimei’s southeastern cluster expanded, introducing a new HH cluster. Meanwhile, HL and LH cluster regions shrunk, but LL clusters saw a marked rise. After 1949, under the PRC, HH clusters remained in Gulangyu, southwestern Siming, southeastern Jimei, and central Haicang, albeit with reduced coverage. HL and LH clusters continued to dwindle, and LL clusters became more widespread.

Figure 6. Clustering and outlier analysis of Xiamen’s cultural heritage.
3.1.4. The Causes of the Spatial and Temporal Distribution of Cultural Heritage by Periods

The spatial and temporal evolution and distribution of Xiamen’s cultural heritage are closely related to its urban development. During the Sui-Tang to the Five Dynasties period (581–979), Xiamen was successively under the jurisdiction of Nanan County and Tongan County, with the establishment of “Jiaheli” [37]. During the Song to the Yuan Dynasty period (979–1368), most of Xiamen was governed by Quanzhou’s Tongan County [38], and the cultural heritage sites in ancient Tongan County were relatively dispersed. In 1394, during the 27th year of Ming Emperor Hongwu’s reign, the ancient city of Xiamen was founded, signifying the beginnings of urban spatial development [39]. Subsequently, Yue Port in Zhangzhou overtook Xiamen Port as Fujian’s largest foreign trade hub; later, however, Xiamen Port emerged as a maritime center following Yue Port’s decline [40]. In addition, during Zheng Chenggong’s rule in Xiamen, he fostered the development of the ancient cities of Xiamen and Gulangyu Island, enhancing foreign trade significantly. By the end of the Ming dynasty, Xiamen had grown expansively, mainly around the current Siming North Road, the southern part of Xiahe Road’s middle section, Datie Street, and Kaiyuan Road near the coast, and between Zhenbang Street and Xiaozou Road, forming a core area of heritage concentration [41]. The center of gravity of cultural heritage in this period gradually moved southwards, with the emergence of a core area of heritage concentration in the ancient city of Xiamen and Gulangyu Island. Post-1840, following the Treaty of Nanjing, Xiamen was designated one of five trading ports and officially opened in 1843. In 1902, the Qing government sanctioned the “Xiamen Gulangyu Land Concession Regulations” [42], with Gulangyu Island becoming a “tenancy of nations”, leading to the construction of various foreign establishments, including consulates, hospitals, and churches, forming a large heritage area. In the early to mid-20th century, Mr. Chen Jiageng established Jimei School Village and Xiamen University [43,44], creating a distinctive cluster of cultural heritage in the Jimei and Siming districts. During the same period, a large number of overseas Chinese returned to Xiamen, starting the golden period of modern urban construction in Xiamen, the period of urban expansion from the original commercial port and Zhongshan Road to the southeast of the island; the “four vertical and one horizontal” urban road network and the large-scale building of the Riding House were begun [45]; compared to the previous period, the center of gravity of cultural heritage shifted drastically, moving towards the ancient city of Xiamen, which is now in the southwestern part of Siming District, with a large concentration of cultural heritage in the Xiagang area and Xiamen University. In 1938, Xiamen was occupied. The island and Gulangyu were liberated in the Battle of Zhangxia in October 1949, and the Xiamen Municipal People’s Government was formed on October 21st of the same year. Subsequently, Mr. Chen Jiageng returned to develop Jimei School Village, significantly contributing to the region’s cultural heritage.

In summary, spatially, Xiamen’s cultural heritage overall exhibits an aggregated distribution pattern; temporally, its evolution shows an initial dispersion followed by concen-
tration and subsequent dispersal, with the center of gravity shifting from north to south and back to north, demonstrating heterogeneous local spatial correlations across different eras. The spatial–temporal patterns of cultural heritage mirror the historical trajectory of Xiamen’s urban construction. During the Sui-Tang to the Song-Yuan period (581–1368), Xiamen was under the jurisdiction of both Nanan and Tongan counties, with urban development concentrated in ancient Tongan County, which was home to several heritage cores. With the establishment of the ancient city of Xiamen during the Ming dynasty (1394), the city’s urban space grew, and the heritage core gradually shifted southwest, leading to a new concentration in the ancient city. Post-1840, Gulangyu Island evolved into a “public concession”. In the early to mid-20th century, with the return of overseas Chinese, the construction of the ancient city of Xiamen reached its peak. Multiple factors during the Late Qing to the ROC period (1840–1949) realigned the heritage center towards the Xiagang area and Gulangyu Island. Following the establishment of the PRC (after 1949), Xiamen’s urban development extended to areas beyond Xiamen Island, with significant cultural heritage developments in the Jimei and Haicang districts.

3.2. Spatial Distribution and Protection System Construction of Cultural Heritage by Resource Types

Exploring the spatial distribution characteristics of cultural heritage by resource types aids in establishing a comprehensive and continuous conservation pattern, transitioning from point-specific to broad, regionalized preservation. This study categorizes Xiamen’s cultural heritage into five types, based on existing research and Xiamen’s specific heritage resources, to discuss the construction of protection systems for the different types. Xiamen’s cultural heritage is divided according to material composition into ancient architectural structures, important modern and contemporary historic sites and typical buildings, ancient cultural sites, ancient tombs, and cave temples and stone carvings. The analysis reveals that Xiamen is home to 146 ancient architectural structures, 513 important modern and contemporary historic sites and typical buildings, 40 ancient culture sites, 43 ancient tombs, and 34 cave temples and stone carvings. These categories exhibit notable spatial distribution variances, as well as differences in their conservation and reutilization approaches (Table 5).

Table 5. Resource types of cultural heritage in Xiamen.

<table>
<thead>
<tr>
<th>Resource Types of Cultural Heritage</th>
<th>Count</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ancient Architectural Structures Type</td>
<td>146</td>
<td>18.81</td>
</tr>
<tr>
<td>Important Modern and Contemporary Historic Sites and Typical Buildings Type</td>
<td>513</td>
<td>66.11</td>
</tr>
</tbody>
</table>
Table 5. Cont.

<table>
<thead>
<tr>
<th>Resource Types of Cultural Heritage</th>
<th>Count</th>
<th>Proportion (%)</th>
<th>Pictures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ancient Culture Sites Type</td>
<td>40</td>
<td>5.15</td>
<td></td>
</tr>
<tr>
<td>Ancient Tombs Type</td>
<td>43</td>
<td>5.55</td>
<td></td>
</tr>
<tr>
<td>Cave Temples and Stone Carvings Type</td>
<td>34</td>
<td>4.38</td>
<td></td>
</tr>
</tbody>
</table>

3.2.1. Ancient Architectural Structures Type

The types of ancient architectural structures include historical palaces, residences, temples, ancestral halls, city walls, pagodas, etc. In protecting these ancient architectural structures, it is important to conduct comprehensive research into the layout, style, construction techniques, spatial environment, and cultural traditions of the existing buildings. These aspects should be systematically documented, with protection measures tailored to each structure’s classification. A holistic approach is necessary to manage the surrounding environment; the aim is to preserve the information embodied in the building from each historical period. Adhering to the principle of minimal intervention, preservation efforts should focus on restoring historical features as they were, while integrating new additions compatibly and employing reversible methods for meticulous conservation.

By calculating the global autocorrelation index of the ancient architectural structures in Xiamen, the Moran’s I value of the spatial distribution is 0.16, and the Z value is significant at the confidence level; this indicates that the spatial distribution of ancient architectural structures in Xiamen is positively correlated, and it shows a distribution pattern of aggregation (Figure 7a). The distribution of ancient architectural structure types was analyzed using kernel density analysis, the results of which are shown in Figure 7b. Ancient architectural structure types have small aggregation cores in each district of Xiamen, with the most prominent aggregation cores located on Gulangyu Island in the southwestern part of Siming District and the central part of Tongan District and Haicang District. Statistical analyses of the architectural functions and construction periods...
of the ancient architectural structure types in each district were carried out, and the results are in line with the development of Xiamen City. The ancient architectural structures in Tongan District were mainly constructed during the Song-Yuan dynasty and the Ming-Qing dynasties (979–1840). The ancient architectural structures built during the Song-Yuan dynasty (979–1368) were mainly temples, pagodas, and academies, while those built during the Ming-Qing dynasties (1368–1840) were mainly residences, altars, temples, and ancestral halls. In addition, the ancient architectural structures in the Siming and Haicang districts were mainly constructed after the Ming dynasty (1368), including the city walls and towers, mansions and dwellings, and altar temples and ancestral halls.

3.2.2. Type of Important Modern and Contemporary Historic Sites and Typical Buildings

The cultural heritage of the important modern and contemporary historic sites and typical buildings includes war sites, old sites of major historical events and important institutions, memorial sites for the activities of revolutionary figures, and martyrs’ graves. The typical buildings are religious buildings, industrial buildings and appurtenances, former residences of celebrities, financial and commercial buildings, medical and health buildings, and buildings or structures of a typical style that are representative of a certain region, with special forms and styles; these buildings are intact in terms of structure and form. In contrast to the ancient architectural structures, the functional uses of these important modern and contemporary historic sites and typical buildings have greatly evolved; moreover, many remain in active service today. In addition, the property rights issues associated with modern buildings are complex. More adaptive conservation strategies are therefore necessary. These strategies should steer clear of a one-size-fits-all approach, such as pure museumification or creating mere specimens, and ensure that protection measures are appropriately tailored to each site’s unique circumstances.

By calculating the global autocorrelation index of the important modern and contemporary historic sites and typical buildings, the Moran’s I value of their spatial distribution is 0.40, with a significant Z value at the confidence level. This indicates that this type of cultural heritage is positively correlated and demonstrates a clustered spatial pattern (Figure 8a). Kernel density analysis was utilized to explore the distribution of this cultural heritage, with the results presented in Figure 8b. The heritage is primarily located in the southwestern part of Siming District and on Gulangyu Island in Siming District, as well as the southeastern part of Jimei District. The most significant aggregation core is found on Gulangyu Island in Siming District; it is characterized predominantly by foreign buildings, foreign consulates, cultural and educational structures, medical facilities, and financial and commercial edifices. In contrast, the southwestern part of Siming District and the southeastern part of Jimei District are characterized by red cultural heritage and Jiageng-style campus buildings.
3.2.3. Type of Ancient Culture Sites

The type of ancient cultural sites includes all kinds of cultural remains with historical, artistic, and scientific value, including places of early human activities, all kinds of ruins, and densely excavated sites of artifacts with clear locations. Ancient cultural sites are evidence of the level of material production of early mankind. However, due to the late start of protection efforts in China and the lack of systematic summaries and theoretical research, issues such as constructive destruction and insufficient archaeological excavation efforts exist. Correctly handling the discursive relationship between the protection and reuse of ancient cultural sites, categorizing ancient sites by different functions, times, and materials, taking targeted protection measures, and implementing comprehensive remedial actions for the site itself and its surrounding environment from a holistic perspective are key to the protection of these sites.

By calculating the global autocorrelation index of ancient culture sites in Xiamen, the Moran’s I value of their spatial distribution is 0.06, and the Z value is significant at the confidence level, indicating that the spatial distribution of the existing Xiamen ancient culture sites is positively correlated and that the overall pattern of spatial distribution presents a state of aggregation (Figure 9a). The distribution of ancient culture sites was analyzed through kernel density analysis, the results of which are shown in Figure 9b. These types of cultural heritage sites are relatively small in number and are distributed in each district of Xiamen, with the most prominent aggregation cores located in the southwestern part of Siming District and the central part of the Tongan and Jimei districts. The ancient culture sites in Tongan District were mainly constructed during the Sui-Tang to Song-Yuan Dynasty period (581–979), whereas those in the Jimei District were mainly constructed during the Song-Yuan Dynasty and the Ming-Qing Dynasty period (979–1840) and are dominated by kiln sites and city wall sites. The ancient culture sites in the southwestern part of Siming District were mainly constructed during the Ming to Mid-Qing Dynasty period (1368–1840), with the Yanping culture sites built during Zheng Chenggong’s rule over Xiamen as the main source.
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3.2.4. Type of Ancient Tombs

The cultural heritage of ancient tombs includes imperial tombs, tombs of celebrities or nobles, and common tombs, wherein the shape and structure of the tombs, as well as the remains within, are either still preserved or have been moved entirely to a site with its distinct territorial demarcation. The design and dimensions of these tombs mirror the diverse material cultures and regional customs of varying social strata across historical periods. Currently, the widespread destruction of such sites is alarming, with many undergoing only salvage excavations; the systems in place for their protection require substantial enhancement. Furthermore, utilizing digital technologies like three-dimensional laser scanning in preserving ancient tombs and conducting archaeological research permits rapid and precise documentation and archiving of these tombs’ present conditions, establishing a robust dataset for future safeguarding, restoration, and reconstruction efforts.

By calculating the global autocorrelation index of the ancient tombs in Xiamen, the Moran’s I value of their spatial distribution is 0.019, and the Z value is significant at the confidence level, indicating that the spatial distribution of the existing ancient tombs of Xiamen is positively correlated and that the overall pattern of spatial distribution presents a state of aggregation (Figure 10a). Kernel density analysis was employed to analyze the distribution of ancient tombs, and the results are depicted in Figure 10b. This cultural heritage consists of small aggregated cores within each district of Xiamen, with the most pronounced clusters found on Gulangyu Island, in the southwestern part of Siming District, and the centers of the Huli and Tongan districts. The ancient tombs in the Siming District date primarily from the Ming through to the mid-Qing dynasty (1368–1840); those in the Huli District span from the Sui to the Tang dynasty (581–907); and those in the Tongan District span from the Song dynasty to the mid-Qing dynasty (979–1840).

**Figure 9.** (a) Analysis of spatial autocorrelation of sites of ancient culture type of cultural heritage in Xiamen; (b) analysis of the kernel density of ancient culture type of cultural heritage in Xiamen.

**Figure 10.** (a) Analysis of spatial autocorrelation of sites of ancient tombs type of cultural heritage in Xiamen; (b) analysis of the kernel density of ancient tombs type of cultural heritage in Xiamen.
3.2.5. Type of Cave Temples and Stone Carvings

The types of cave temples and stone carvings possess both historical and artistic value and include cave temples, stone carvings, rock paintings, and other types. With a clear line of succession and a complete system, they constitute non-renewable and unique forms of cultural heritage. However, their long-term exposure to the natural environment and various internal and external forces means that cave temples and stone carvings are prone to different levels of weathering. The preservation of these stone cultural relics is imperative; in their ongoing protection and subsequent reuse, it is necessary to apply appropriate conservation materials that accord with their environmental conditions and the nature of the stone.

By calculating the global autocorrelation index of cave temples and stone carvings in Xiamen, the Moran’s I value of their spatial distribution is 0.09, and the Z value is significant at the confidence level, indicating that the spatial distribution of the existing cave temples and stone carvings of Xiamen is positively correlated and that the overall pattern of spatial distribution presents a state of aggregation (Figure 11a). The distribution of cave temples and stone carvings was analyzed using kernel density analysis, with the results displayed in Figure 11b. These cultural heritage sites are found in the Siming, Jimei, Tongan, and Xiangan districts, with the most prominent aggregated core located in the southwestern part of Siming District; it was primarily constructed during the Ming to Mid-Qing Dynasty period (1368–1840). Currently, the existing cave temples and stone carvings in Xiamen are well preserved and have been integrated into the local tourism and sightseeing culture.

Figure 11. (a) Analysis of spatial autocorrelation of sites of cave temples and stone carvings type of cultural heritage in Xiamen; (b) analysis of the kernel density of cave temples and stone carvings type of cultural heritage in Xiamen.

4. Discussion

In general, the spatial distribution patterns of Xiamen’s cultural heritage vary across different historical periods. Taking 1394, which is marked by the 27th year of Ming Emperor Hongwu’s reign, as a reference point, the development of the ancient city of Xiamen can be split into two stages. From the Sui-Tang dynasty to the Song-Yuan dynasty (581–1368), Xiamen was governed by Tongan County in Quanzhou [46]. During this period, the urban development of Tongan County was swift, resulting in multiple concentrations of heritage sites. Subsequently, Xiamen Port’s burgeoning foreign trade spurred the growth of ancient Xiamen Caity. Zheng Chenggong’s land developments in the late Ming era further shaped the urban spaces of the Xiagang area and Gulangyu Island [47]. In the modern era, starting in 1840, when Xiamen became one of the five treaty ports and was officially opened in 1843 [48], 18 countries built consulates, hospitals, chapels, villas, etc., on Gulangyu Island, enhancing its urban landscape and creating a heritage hub. From the early to mid-20th century, Xiamen’s urban space completed the first leap in development. From 1902 to 1919, Xiamen’s preparatory period of urban construction, influenced by Nanyang, Taiwan, and
other places of urban construction, a large number of overseas Chinese returned to Xiamen to carry out the transformation of the old city; they started the large-scale modernization of the city; from 1920 to 1937, the golden age of Xiamen’s modern urban construction, large-scale riding buildings appeared in Xiamen’s ancient city and Xiamen’s “four vertical and one horizontal” urban road network formed; from 1938 to 1949, due to funding and other internal and external factors such as war and chaos, Xiamen’s urban construction entered a period of stagnation [23,49]. After the founding of the PRC in 1949, Xiamen’s urban construction gradually expanded from Siming District to the whole island [50].
Overall, the heritage distribution shifted from initial dispersion to aggregation and then back to dispersion, with the center of gravity migrating from ‘south’ to ‘north’ and back to ‘south’ again. Before 1840, the heritage was concentrated in the area of the ancient Tongan County, and the center of gravity distribution of the heritage was relatively stable and roughly located in the southern part of the Tongan and Jimei districts. After 1840, the center of gravity of the heritage was shifted to the Xiagang area and Gulangyu Island due to the multiple effects of internal and external factors. After the founding of the PRC, the center of gravity of the heritage moved to the northwest. In addition, the spatial distribution of Xiamen’s cultural heritage shows a significant positive correlation, and the spatial aggregation in each period shows a trend of “strengthening first, then weakening”. There are four patterns of spatial correlation of the heritage in each district of Xiamen; these patterns show obvious changes over the periods, and such changes are also related to the number of heritage sites, the gathering area, and the urban development of Xiamen.

The cultural heritage of Xiamen can be categorized into five main types, each with distinct spatial distribution characteristics. Understanding the distribution and types of these resources is crucial for devising effective conservation and reuse strategies. By synergizing regional heritage protection with local economic growth, a more systematic protective framework can be established, fostering sustainable development. Reflecting on the concentration areas of Xiamen’s existing cultural heritage and the city’s historical and cultural spatial patterns, the author identifies key heritage sites, like Gulangyu Island, Zhongshan Road, Jimei School Village, Xiamen Harbor, and the Tongan Old Town Historical and Cultural District as central hubs integrating Xiamen’s cultural heritage resources, building a historical and cultural network system, and linking up the Xiamen Cultural Heritage Tourist Route. Taking into account the construction periods and concentration areas, three thematic routes have been developed; these include the ‘Red Culture Theme Route’ (Tongan Barracks Village, Former Site of CPC Xiamen Work Committee, Headquarters of Jinmen County Government, Former Site of the August 23 Artillery Battle in Dadeng, Former Site of Xiamen General Trade Union); the ‘Religious Culture Route’ (Brahman Stupa, Lushan Hall, Tongan Conflcitus Temple, Ma Xiang Yuanwei Hall, Daxiongbao Hall of Nanputuo Temple, Qingjiao Ciji Palace); and the ‘Cultural Heritage and Landscape Theme Route’ (Tingxi Kiln Site, Tongan City Wall, Guilai Garden, Jimei Academic Village, Kah Kee Park, Jinfangshan Stone Carving Group, Shangli Reservoir, Early Buildings of Xiamen University, Hulishan Fortress, Xiamen City Wall, Gulangyu Island). These themed routes offer fresh perspectives for regional heritage protection initiatives in Xiamen (Figure 12).

Xiamen is renowned as a historical and cultural city where cultural heritage occupies a significant portion of the urban space. Currently, as China has shifted towards an era of ‘stock planning’, urban planning requires a greater emphasis on the understanding of historical urban spatial patterns [51]. A thorough analysis of the historical context and the heritage distribution and their intricate interconnections plays a crucial role in weaving the conservation and adaptive reuse of cultural heritage into the fabric of urban spatial planning. In addition, as the cities progress with ‘double urban renovation’, the excavation, transformation, and repurposing of urban land and resources raise vital questions about preserving and uncovering urban history and culture, as well as the crafting of the city’s unique cultural identity [52]. As vital repositories of urban history and culture, the management of cultural heritage sites should transition from mere conservation to the facilitation of a wider array of social functions. This change entails fostering a balance
between traditional values and modern innovation and between preserving the legacy and encouraging growth [53]. Urban planners are tasked with integrating landscape features to aid this transformative process, supporting a paradigm shift in urban planning that contributes to the high-quality advancement of the city.

Figure 12. Xiamen Cultural Heritage Tourist Route.

From an international perspective, the United States and Europe have successively put forward the concept of regional-scale linear heritage, such as the “Heritage Corridor” and “Cultural Routes” [54,55], and large-scale, cross-regional linear cultural heritage has also received more and more attention [18,22,56]. Sustainable cultural heritage tourism, based on global sustainable development and cultural diversity, finds a balance between heritage preservation and economic development. Integrating heritage preservation into the cultural tourism industry can be divided into two parts [57]: (1) The development of heritage tourism routes. These routes can include experiences of intangible cultural heritage, combined with art exhibitions, thematic activities, educational courses, etc. With the help of augmented reality (AR), virtual reality (VR), and other technologies, the uniqueness of the architectural heritage and the unique experience of visiting it are emphasized so that tourists can better understand the historic and cultural significance of the architecture. (2) The creation of heritage industry platforms. Local governments can conduct a comprehensive assessment of the historical and cultural value of local architectural heritage, tap into local heritage features, and create distinctive cultural intellectual properties (IPs). In addition, they can work with local communities to mobilize the public and enable enhanced social participation. Addressing the first part, this research introduces an innovative technical approach based on GIS databases that precisely categorizes cultural heritage data. This method employs spatial analysis to reveal interconnections and create targeted tourism routes, enhancing both the coherence and efficiency of the travel experience through the application of network analysis tools. The use of GIS in conjunction with BIM, AR, and VR enables the correlation of digital models of buildings with geolocation information, enabling the comprehensive management and preservation of heritage while providing a more intuitive and interactive experience. Developing user-friendly interfaces and mobile applications that provide real-time information feedback enables an interactive experience of heritage tourism routes. This integrated technology not only provides a solid foundation for the construction of heritage tourism routes but also promotes the all-round utilization and conservation of cultural heritage (Figure 13). Future research will continue to explore how to combine tools such as BIM, VR, and AR with geographic information system (GIS)
technology to revitalize architectural heritage and urban historical spaces, offering an advanced framework and a guide on sustainable tourism practices that may be used by heritage researchers or managers.

![Diagram of Xiamen Cultural Heritage Tourist Route](image)

**Figure 13. Xiamen Cultural Heritage Tourist Route.**

In particular, it should be pointed out that cultural heritage exhibits various spatial forms and can thus be categorized into point-like, planar, and linear cultural heritage [58]. There is an encompassing relationship between the three; therefore, only point-like cultural heritage is discussed in this study. In addition, although this study collects heritage data from multiple sectors, perspectives, and types to provide a comprehensive overview of Xiamen’s cultural heritage resources, there are still some limitations in the dataset, and some cultural heritage with specific historical and cultural values that are not included in the protection list may not be adequately represented through the existing data access, and our team will complement it in future studies.

### 5. Conclusions

As a result of the analyses, the following conclusions have been drawn. Temporally, the existing cultural heritage in Xiamen was mainly built during the Late Qing Dynasty to the ROC period (1840–1949). With 1840 and 1949 serving as pivotal years, the distribution of the heritage exhibits a spatial transition characterized by initial dispersion, subsequent concentration, and then a return to dispersal. Additionally, the cultural heritage’s center of gravity has generally migrated in a ‘north-south-north’ direction. Spatially, Xiamen’s current cultural heritage is predominantly clustered, with notable concentrations on Gulangyu Island and the Xiagang sector of Siming District. Four distinct spatial association patterns emerge when considering the heritage across different districts, with clear disparities between the periods. Moreover, a trend is evident in which spatial concentration initially intensifies before diminishing. These changing trends are closely related to the history of Xiamen’s urban development. During the Sui-Tang Dynasty to Song-Yuan Dynasty period (581–1368), Xiamen was part of Quanzhou Tongan County. While minor clusters existed across all the districts, the most significant concentrations were in the region of ancient Tongan County, with its ancient tombs, architectural structures, and stone carvings being predominant forms of heritage. Following the Ming dynasty, factors such as the construction of the ancient city of Xiamen, the development of its port, and the land reclamation efforts spearheaded by Zheng Chenggong shaped the urban landscape. This led to a gradual shift in the city’s cultural epicenter from the Tongan District to the Xiagang area in the Siming District. In the Late Qing Dynasty to ROC period (1840–1949), Xiamen emerged as one of the five treaty ports, which facilitated the advancement of Gulangyu Island—significant clusters of modern and contemporary historic sites and buildings were developed there; this was coupled with the influx of returning overseas Chinese in the
early 20th century, which accelerated the urban expansion around the Xiagang area, transforming it and Gulangyu Island into the primary centers of cultural heritage aggregation. Post-1949, with the establishment of the PRC, Mr. Chen Jiagen’s return to construct the Jimei School Village marked another expansion wave in Xiamen’s urban development, which saw cultural heritage proliferating across the entire island.

The study also analyzes the current distribution characteristics and protection of cultural heritage by resource types. Xiamen’s cultural heritage assets can be categorized into five types, each with a distinct spatial distribution pattern. In the Siming and Tongan districts, a diversity of heritage types is found, while in the Haicang, Jimei, and Huli districts, the heritage is more homogenous. The dispersion of these types mirrors the directionality of urban development, moving from central Tongan District towards southwestern Siming District. The categorization and spatial placement of these resources form the groundwork for their comprehensive protection and adaptive reuse. Ancient architectural structures, primarily located in the central Tongan and Haicang districts, as well as southwestern Siming District, can undergo restoration with the employment of reversible techniques to maintain authenticity. The type of important modern and contemporary historic sites and typical buildings concentrated on Gulangyu Island, in the southwestern Siming and southeastern Jimei districts might benefit from adaptive reuse, like functional conversion, to revitalize them. Sites of ancient cultures in southwestern Siming and the central areas of the Tongan and Jimei districts may be holistically enhanced by considering both the sites and their environments. Ancient tombs, situated on Gulangyu Island, in southwestern Siming, and the central Tongan and Huli districts, necessitate heightened preservation efforts. Cave temples and stone carvings in southwestern Siming should receive consistent upkeep and could be integrated with tourism initiatives. These patterns of spatial distribution across different periods and resource types offer an important basis for the holistic protection of Xiamen’s cultural heritage and thus introduce the proposal for a ‘Xiamen Cultural Heritage Tourism Route’.

In conclusion, Xiamen’s unique geographical location, combined with its historical role in sea defense and military significance, has cemented its important place in history. Transforming from a military outpost to a commercial port city in modern times, Xiamen has achieved a distinctive urban architectural development influenced by both Western and overseas Chinese cultures. This study exposes the spatial and temporal distribution patterns of Xiamen’s cultural heritage at a macro level and proposes conservation and adaptive reuse strategies for different heritage types. Such an approach not only advances the research in cultural heritage preservation through interdisciplinary collaboration but also offers fresh perspectives for safeguarding cultural heritage in Xiamen and other cities undergoing sustainable urban transformation.

**Author Contributions:** J.Z. formulated and evolved the overarching research goals and aims, secured financial support for the project, designed the methodology employed, and performed the validation and revised the paper. X.W. drafted the initial manuscript, created data visualizations, and applied formal analytical techniques to analyze and synthesize the study data. L.J. acquired and managed the data. Z.C. contributed to the acquisition of financial support. S.X. provided oversight and leadership for planning and executing the research activities. N.A. had management and coordination responsibility for the research activity planning and execution. All authors have read and agreed to the published version of the manuscript.

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References

1. De la Torre, M. Values and heritage conservation. *Herit. Soc.* **2013**, *3*, 155–166. [CrossRef]


38. Fang, Y.; Fang, W.; Peng, Y.; Lin, M. *Six Hundred Years of Xiamen City*; Lujiazhang Press: Xiamen, China, 1996. (In Chinese)


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