ISSN 2663-1563 Vol. 6, Issue 4: 1-5, DOI: 10.25236/AJAGE.2024.060401

Study on the Spatial Distribution and Accessibility of Cultural Facilities in Suzhou, China

Dai Siyu[1,a,*]

[1]*Gold Mantis School of Architecture, Soochow University, Suzhou, China*
[a]*2509169280@qq.com*
[*]*Corresponding author*

Abstract: *Based on the POI data of cultural facilities in Suzhou, this study analyzes the distribution characteristics and accessibility of cultural facilities in Suzhou, using standard deviation ellipse, nearest-neighbor analysis, isochronous circle analysis, etc. The study also explores the accessibility of large-scale cultural facilities in Suzhou from the perspective of supply and demand. It is found that the spatial distribution of cultural facilities is "dense in the south and sparse in the north", and the accessibility of cultural facilities shows a decreasing trend from Gusu District to the periphery. Overall, there is still an imbalance in the regional development of cultural facilities in Suzhou.*

Keywords: *Cultural facilities; Spatial distribution; Accessibility; Suzhou City*

1. Introduction

The concept of public cultural services was first mentioned in China in 2005. In recent years, the Public Libraries Act and other relevant regulations have been introduced and implemented in China[1]. China's system for building public cultural services is becoming more and more complete. A reasonable spatial layout of urban public cultural facilities helps to better build a balanced public cultural service system and shape a strong urban cultural atmosphere[2]. In recent years, Chinese scholars have adopted various methods to study the spatial layout of cultural facilities, such as kernel density estimation[3] and standard deviation ellipse[4]. Meanwhile, scholars use accessibility to measure the equalization of public services and explore topics such as social equity and spatial justice, and common research methods include service area analysis[5] and network analysis[6].

Suzhou is one of the first demonstration areas of public cultural service system in China and is known as "heaven on earth". Based on POI data, this study investigates the spatial layout of cultural facilities in Suzhou through standard deviation ellipse and nearest neighbor index and the accessibility of cultural facilities in Suzhou through isochronous circle analysis, which is of great significance to the construction of an equalized and standardized public cultural facilities supply system in Suzhou.

2. Spatial distribution characteristics of cultural facilities

The study area of this paper is Suzhou City, a prefecture-level city and megacity under the jurisdiction of Jiangsu Province, which is located in East China. Suzhou City contains the main urban area and four vicarious municipalities. The main urban area of Suzhou consists of six precincts: Gusu District, Xiangcheng District, Huqiu District, Industrial Park, Wuzhong District, and Wujiang District. In addition, there are four county-level cities in Suzhou: Kunshan City, Zhangjiagang City, Changshu City, and Taicang City. Combining the Amap POI classification system with the Notice of the Municipal Government on the Issuance of the Public Cultural Facilities Layout Plan for Suzhou Urban Area (2015-2030), the public cultural facilities in Suzhou are classified into the following four categories: reading, exhibition, performance, and mass activities. The WGS_84 coordinate system was converted, and after data screening and cleaning, a total of 1769 points were obtained as public cultural service facilities.

In order to explore the spatial agglomeration characteristics of cultural facilities in Suzhou City, this study conducts distributional characterization by means of standard distance and directional distribution tools and measures the degree of distributional aggregation of cultural facilities by means of average nearest-neighbor analysis.

ISSN 2663-1563 Vol. 6, Issue 4: 1-5, DOI: 10.25236/AJAGE.2024.060401

2.1. Standard Distance and Distribution Direction

Figure 1 shows the distribution of standard distances and directions for various types of cultural facilities. By using the standard distance tool to generate a standard distance circle to obtain the average center of the distribution of cultural facilities in the region, the size of the circle reflects the closeness of the distribution of facilities, according to which the centripetal force of various types of cultural facilities can be compared with the strength of the point. The Direction Distribution Tool is used to measure the direction of distribution of cultural facilities. The long axis of the ellipse indicates the direction of distribution of cultural facilities, the short axis indicates the range of distribution of cultural facilities, and the center of the ellipse is the same as the center of the standard distance circle.

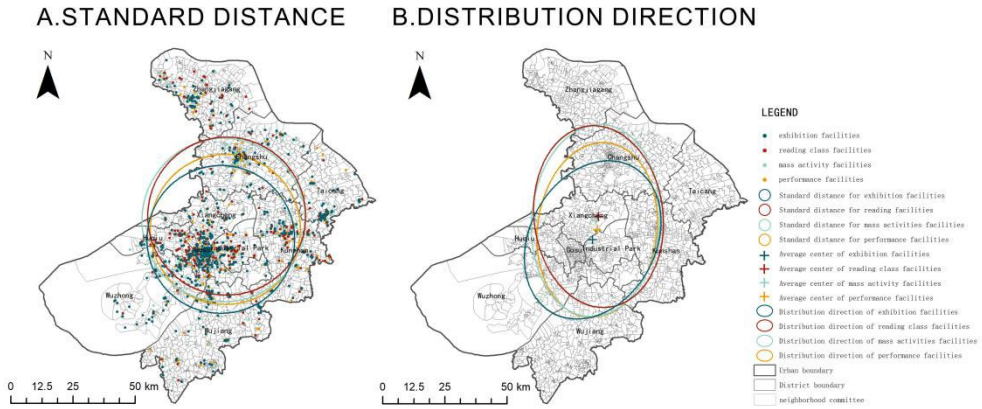

Figure 1: Standard distance and distribution direction of various types of cultural facilities

Combining the calculation results and Figure 1, it can be seen that the distribution center of Suzhou cultural facilities is located near the junction of Xiangcheng District and Suzhou Industrial Park, and the central element is located in Gusu District, indicating that the distribution of public cultural facilities within the city area develops in the direction of "south-west-nnorth-east" in general. A comparison of the standard deviation ellipse reveals that the overall distribution of performance, mass activity, and reading facilities is relatively similar, while the overall distribution of exhibition facilities tends to be in the south-west direction compared with the remaining three types of facilities. The average center and central elements of the distribution of various types of cultural facilities are located in Gusu District, Xiangcheng District, and Suzhou Industrial Park, which is relatively overlapped with the geographical center of the region. Combined with the standard deviation ellipse, it is found that the trend direction of its distribution also shows the trend of radiation to the north and south from Gusu District, Xiangcheng District, and Suzhou Industrial Park.

2.2. Average nearest neighbor analysis

This paper uses the average nearest-neighbor analysis to calculate the actual average distance between various types of cultural facilities in Suzhou City and compare it with the expected average distance under the assumption of random distribution mode in order to judge the distribution mode of cultural facilities within the study area. If the nearest-neighbour ratio is greater than 1, the distribution pattern of cultural facilities is random distribution; if the nearest-neighbour ratio is less than 1, the distribution pattern of cultural facilities is agglomeration distribution, and the smaller the value of the nearest-neighbour ratio, the higher the degree of agglomeration. As shown in Table 1, the distribution patterns of all types of cultural facilities are agglomerative, with the highest degree of agglomeration for exhibition facilities and the most balanced distribution for mass activity facilities.

Table 1: Average nearest neighbor index of various cultural facilities in Suzhou City

Types of cultural facilities	Observed mean distance	Nearest neighbor ratio	Z-score	P-value	distribution pattern
Exhibition facilities	762.157983	0.412285	-31.681678	0.000000	congregate
Reading facilities	1316.199070	0.483802	-18.527574	0.000000	congregate
Mass activities facilities	1950.803558	0.583892	-12.203134	0.000000	congregate
Performance facilities	1128.837431	0.440260	-21.092752	0.000000	congregate

ISSN 2663-1563 Vol. 6, Issue 4: 1-5, DOI: 10.25236/AJAGE.2024.060401

3. Accessibility analysis of cultural facilities

3.1. Isochronous circle analysis of cultural facilities

Taking Suzhou City as the spatial measurement range, the accessibility of all cultural facilities in Suzhou City is comprehensively examined to measure the difficulty for Suzhou citizens to reach each cultural service facility. Considering the large area of Suzhou City and the fact that traveling by car is more common within the city, this paper adopts global accessibility, i.e., the accessibility of each community and village point to the cultural facilities by car, to measure the accessibility, reflecting the difficulty of getting to the target at any one point in the larger study area.

The isochronous circle model refers to the farthest distance that can be covered based on the road network structure under a specific time constraint. In this study, the isochronous circle model is used to measure the cost of passage time from various types of cultural facilities to various regions of Suzhou City, with various types of cultural facilities in Suzhou City as the research object. With the help of network analysis tools in ArcGIS, the cost of travel time between the starting point and the destination is calculated more precisely based on the real road network with real travel paths. The study generates a traffic network based on OpenStreetMap data in Suzhou, calculates the traffic access time at different speeds according to the road class, and measures the range of access time from the cultural facilities to each area in 5 minutes, 10 minutes, 15 minutes, and 30 minutes, with each cultural facility as the starting point.

As shown in Figure 2, the 5-minute service areas of all types of cultural facilities show the following distribution: the main urban area has better coverage, forming a centralized and continuous pattern of Gusu District, Suzhou Industrial Park, Xiangcheng District, and Huqiu District; most county-level cities have a point distribution according to the core of their location; and Kunshan City is more special, with a wider coverage of the 5-minute service area. The 10-minute, 15-minute, and 30-minute living circles of various cultural facilities have wider coverage, and it is worth noting that the 30-minute living circle covers almost the entire city area.

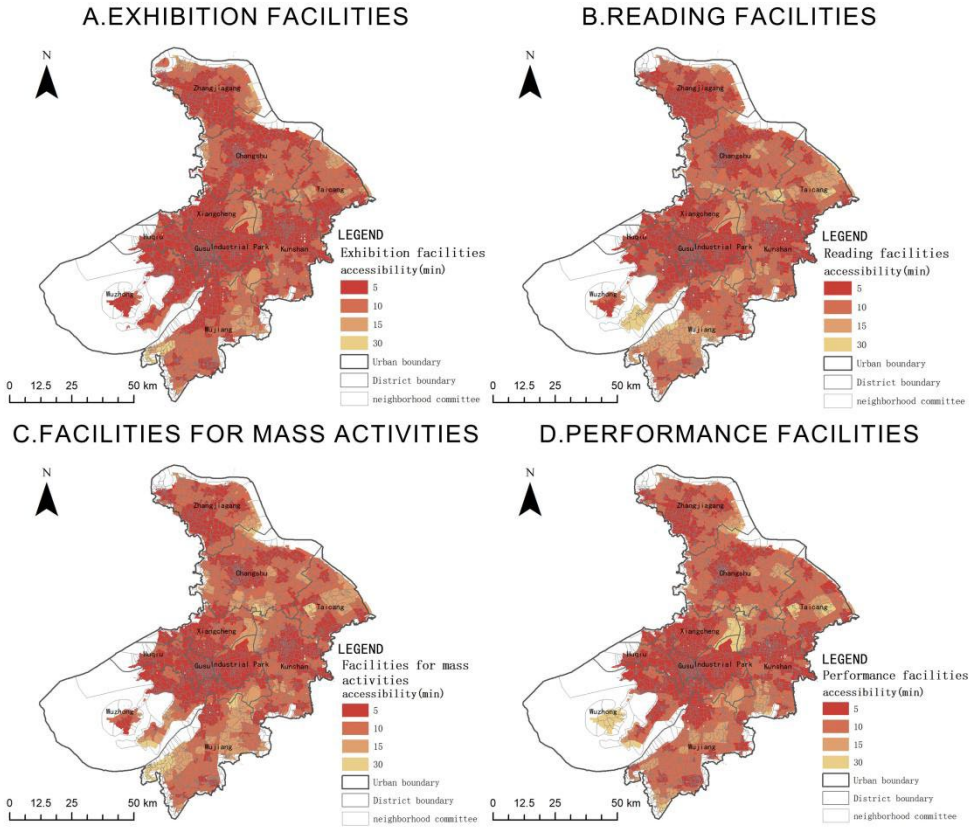

Figure 2: The isochronous circle of various cultural facilities in Suzhou

ISSN 2663-1563 Vol. 6, Issue 4: 1-5, DOI: 10.25236/AJAGE.2024.060401

3.2. Accessibility analysis of large-scale cultural facilities

According to the Notice of the Municipal Government on the Issuance of the Layout Plan of Public Cultural Facilities in Suzhou Urban Area (2015-2030) and the current situation of cultural facility construction in Suzhou, facilities at the urban level and with a floor area of more than 5000 square meters are screened as large-scale cultural facilities. A total of 44 large-scale cultural facilities are screened in this study, which are 9 exhibition and display facilities, 8 reading facilities, 21 mass activity facilities, and 6 performance-viewing facilities.

Taking the neighborhood committee as a unit, extract the center of mass of the cell point data within each neighborhood committee and aggregate the population data. The two-step mobile search method (2SFCA) is used to calculate the accessibility of large cultural facilities, and the supply, demand, and origin-destination time cost are substituted into the Gaussian two-step moving search method formula to calculate the comprehensive accessibility of large cultural facilities in Suzhou.

The accessibility values are summarized using the neighborhood committee as a spatial unit. As shown in Figure 3, the accessibility of cultural facilities in the main urban area shows a decreasing trend from Gusu District to the periphery, and the areas with higher accessibility of cultural facilities in the four vicarious municipalities are mainly distributed in their administrative centers. The accessibility of large-scale cultural facilities in the main urban area is significantly better than that in the vicarious municipalities. Gusu District and Suzhou Industrial Park in the central part of Suzhou belong to the central city of Suzhou, although relatively densely populated, but dense roads, the supply of various cultural facilities is sufficient, and thus the comprehensive accessibility is higher; Zhangjiagang City, Changshu City, Taicang City, as a county-level city of Suzhou City escrow, the population is medium, and the road network is relatively well-developed, but due to the number of cultural facilities is small, small-scale, the comprehensive level of accessibility is lower; Kunshan City, although it is a Although Kunshan is a county-level city, but its location adjacent to the central city, by the central city cultural facilities radiation, accessibility level is relatively high compared to the other three county-level cities.

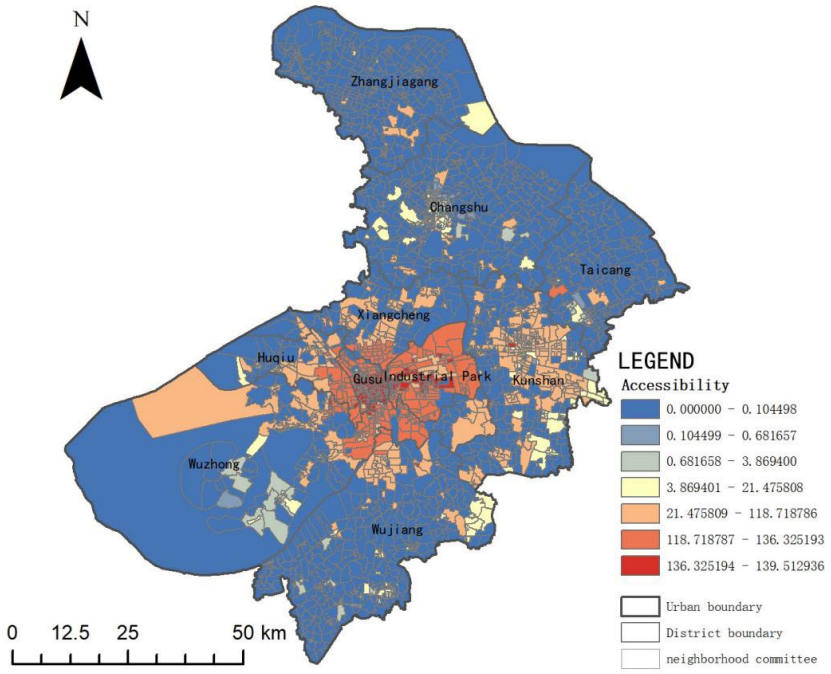

Figure 3: Accessibility analysis of large-scale public cultural facilities in Suzhou

4. Conclusion

Through the analysis of this study, it was found that the level of accessibility of public cultural facilities in Suzhou is relatively high, and all districts and counties have various types of cultural facilities. The distribution of public cultural service facilities in the main urban area of Suzhou is centered on Gusu District and Suzhou Industrial Park and radiates in all directions; the four county-level cities generally show a trend of development and layout in the direction of "south-east-nnorth-west", with the south being

ISSN 2663-1563 Vol. 6, Issue 4: 1-5, DOI: 10.25236/AJAGE.2024.060401

dense and the north being sparse. The distribution of facilities is basically in line with the planning pattern of public cultural facilities in Suzhou. Overall, the layout of cultural facilities in Suzhou is orderly, reasonably distributed, and basically beneficial to the city's residents.

However, we also find that there is still a regional imbalance in the development of urban and rural cultural facilities in Suzhou, with large differences in the accessibility of public cultural facilities between the central urban area and the county-level cities under its administration. Especially in Taicang City, in the northeast of Suzhou, the distribution number, distribution density, and accessibility level of public cultural facilities are far less than those of the central city of Suzhou. Large-scale cultural facilities also have a limited ability to radiate across the city, so there is a greater need to promote the equalization of basic public cultural services in urban and rural areas through the construction of branch libraries, city libraries, and other grass-roots public cultural service facilities so that urban and rural residents can better share equal opportunities and enjoy quality of life.

References

[1] Li Shaohui, Wang Ting. Evolution and Structural Characteristics of Public Culture Service Policy in China [J]. Journal of Shandong University (Philosophy and Social Sciences), 2019(02): 57-67.
[2] Zhao Shitong, Zhang Wenxin. Characteristics of Spatial-Temporal Evolution and Accessibility of Public Cultural Facilities in Beijing [J]. Urban Development Studies, 2020, 27(06): 7-12.
[3] Zhao Jianbin, Tian Jiayu. Research on Spatial Distribution of Urban Cultural Facilities in Taiyuan Based on POI Data [J]. Urbanism and Architecture, 2021, 18(12): 44-46.
[4] Xuewen Z, Xiaoxia Z, Zhimei D, et al. Spatial Layout and Coupling of Urban Cultural Relics: Analyzing Historical Sites and Commercial Facilities in District III of Shaoxing[J]. Sustainability, 2021, 13(12):6877.
[5] Zhifeng J. Exploring the spatial dynamics of cultural facilities based on multi-source data: A case study of Nanjing's art institutions [J]. Open Geosciences, 2023, 15(1):20220532.
[6] Meng Tian, Yao Wenfei, Yun Jiayue, et al. Study on the Impact of Urban Park Accessibility on Residents' Usage Behavior and Health[J].Urbanism and Architecture, 2024, 21(01): 87-90+127.