



Research on Urban Renewal Based on the Application of Big Data——Taking Wuyishan City as an Example

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Abstract. At the present stage, my country's land has transformed from incremental expansion to stock optimization. Urban renewal, which is a necessary and planned reconstruction of areas in the city that are no longer suitable for modern urban social life, has gradually become the key to improving the quality and connotation of urban space. important way. During the urban construction and later development of Wuyishan City, there have been problems such as urban vitality that needs to be improved, public space quality is not high, various facilities are insufficient, and the living environment needs to be improved urgently. Based on this, this project focuses on the relevant research background and the current technological development trend, uses physical space data and social space data to conduct spatial quantification analysis, comprehensively discusses the renewability of Wuyishan urban area, and puts forward auxiliary planning suggestions. After specific analysis, the corresponding results were finally obtained, such as traffic improvement optimization plan and facility configuration optimization plan, and these suggestions were recognized by the project team of Tongji Planning Institute, providing them with certain help, proving the importance of big data comprehensive research has helped Urban renewal a lot.

Keywords: Urban Renewal, Big Data, Traffic situation, heatmap.

1 Introduction

In 2022, the Chinese national urbanization rate has reached 65.22%, the rapid development brought that the quality of urbanization is lacking, which brings problems such as incomplete infrastructure, road traffic congestion, and irrational spatial planning within the Wuyishan city, therefore, urban renewal, which is the planning, renovation and reconstruction of existing urban areas to improve the quality and sustainability of the urban environment, infrastructure, economy, society and culture, is the inevitable for the future development of the city. Although there have been many theory and successful practices in urban renewal in recent years, from Calthorpe Peter mentioned TOD conceptual model^[1] in 1993, to Michael Breheny^[2] who put forward the concept of compact-city, to Andrew Blowers and Katby Pain^[3] summarized the narrow concept of "ecological modernization", to Scholar Li Li used data circulation, case retrieval and learning-based generation to compare three urban renewal methods^[4], and Dong Xiaodi

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proposed various renewal plans for Tangzimidao Lane in Shenyang^[5]. Beijing 798 Art District, Shanghai Xuhui Binjiang "People's Waterfront" and Guangzhou Red Brick Factory^[6], there are still few complete systematic analysis methods based on multifaceted physical spatial data and socio-spatial data to provide strong technical support for the application of big data for urban renewal in China. This study proposes to utilize multi-source big data to deeply analyze the deep-seated causes of the current urban problems in Wuyishan city, and to provide a data basis for further urban regeneration proposals and auxiliary planning solutions for further urban renewal plans.

2 Materials and Methods

This study uses physical spatial data (road traffic data, remote sensing images, etc.) and social spatial data (Baidu heat map, historical information, etc.) to conduct spatial quantitative analysis using ArcGIS in terms of urban vitality and infrastructure support.

The first part of the analysis of urban vitality is mainly through the analysis of traffic accessibility and spatial vitality. Traffic accessibility will use Baidu map to monitor traffic congestion in Wuyishan city area within a certain research time frame, and determine the direction of traffic pressure for the morning and evening peak hour crowds, and then analyze the information of public transportation and the number of parking spaces in the urban area as the auxiliary information; the spatial vitality aspect Mainly through the ArcGIS analysis of the heat map of the time period, this paper through the python assisted access to the Baidu heat map data has a total of 0-7 eight levels of heat value, corresponding to the color of gray, purple, blue, blue, green, green, yellow, orange, red, mainly divided into red and orange on behalf of the activity of the highest strength of the high-heat zone, yellow and green on behalf of the second-high heat zone, green, blue, purple and gray on behalf of the activity of the low strength of the low heat zone; secondly, the population concentration of different road areas will be calculated, and the population concentration formula is as follows:

$$R_{pop_i} = \frac{pop_i \sum pop_i}{ter_i \sum ter_i} \quad (1)^{[7]}$$

Where R_{pop_i} denotes the population agglomeration of region i , pop_i and ter_i denote the population and area of region i , respectively, and \sum is calculated as the accumulation of a certain attribute in a large region.

The second part of the infrastructure support analysis is mainly through the convenience of various types of infrastructure facilities for analysis, based on the "Urban Residential Planning and Design Standards", Gaode map POI data will be divided into education, culture and sports, medical care, municipal services, disaster prevention, recreation, commercial and other categories, and calculate the degree of support for various types of facilities in several major neighborhoods, the statistical results as a complementary information to analyze the analysis of the infrastructure supporting the degree of perfection of the analysis;

3 Results and Discussion

3.1 Transportation accessibility analysis

Problems in traffic accessibility are analyzed mainly through the overall distribution of road traffic in Wuyishan City District, the road network system, the monitoring of the traffic situation at different times of the day, and the allocation of parking spaces in urban neighborhoods:

(1) According to Figure 1 shown below, the overall traffic situation in Wuyishan City is quite good, and the road network communicating with neighboring counties and cities is relatively complete, but National Highway G322 passes through Wuyishan Resort, and G327 passes through the Resort and the area in front of the Railway Station, which overlap with the internal traffic functions of the city, and combined with the traffic posture of 4 times \times 7 days of monitoring the traffic situation at various times of the day, it is found that the morning and evening peaks and the main congested road sections of the city of Wuyishan City at the usual time are also concentrated in this part of the road. Such overlapping traffic functions of the road will interfere with the urban life function and resort tourism function of the whole city of Wuyishan, which not only reduces the capacity of the road, but also increases the danger of the traffic; in addition, the national highway G322 and G327 in the south converge at Shangpu Bridge, surrounded by the light rail station and the south entrance of the national park, and the transit of the heavy transport vehicles will affect the tourist area and the city's image, while also interfering with the organization of tourist traffic.



Fig. 1. The main traffic road map and road network system in Wuyishan City

(2) And the city's internal road network system, the north-south direction of Anguo Avenue, Baihua Road, Wujiu Road, Chongxi East Road, as well as the Ning Shang Expressway (local vehicles in the urban section of the free passage), but due to the five north-south corridor construction are concentrated in the vicinity of Wuyi Avenue, accompanied by Anguo Avenue, transit traffic interference, resulting in north-south traffic flow is mainly concentrated in the Wuyi Avenue, the peak period of traffic pressure is huge; The north-south of Wuyishan City, a long and narrow distance of nearly 30 kilometers, public transportation travel time of up to 1 hour or more, the average spacing of east-west arterial roads is 2 kilometers, it is difficult to assume the role of north-south road connection, so Wuyishan City, whether east-west or north-south road network system is not perfect enough, it is difficult to support the development of a belt city such as Wuyishan City.

(3) For the allocation of parking spaces in urban neighborhoods, according to research in urban areas, there are about 18,000 cars, public parking spaces about 13,000, parking supply and demand disparity is obvious. Old part of the city due to historical reasons, the proportion of allocated parking spaces is low, and the supply of on-street parking spaces accounted for a high proportion of 24.33%, much higher than the standard requirement of 15%, there are a large number of on-street parking phenomenon, non-motorized vehicles and pedestrians access to space is limited.

3.2 Space activity analysis

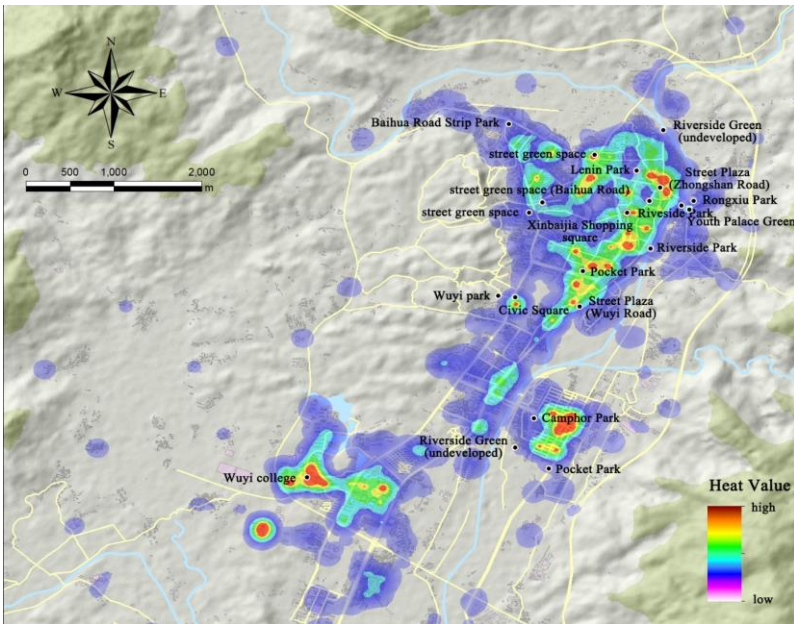


Fig. 2. The heat map of Wuyishan City's working day average

From the calculated averaged heat map Figure 2, it can be seen that the population heat area residential population is mainly distributed in the western part of the old city of Wuyishan City Area and Wuyi College in the south, and the commuting population is mainly concentrated in the northern part of the old part of the city, and the population heat of the area shows a pattern of high in the north and low in the south, given that the Baidu heat map reflects the population vitality including both the indoor and outdoor populations, so the analysis of the vitality of the outdoor street is supplemented by Given that the Baidu heat map reflects population vitality including indoor and outdoor population, the analysis of outdoor street vitality is supplemented by the analysis of population concentration in the road area, and the results show that several roads in the western part of the old city have a generally high population concentration, which is the area of constant flow of population, but this part of the area is the unrenovated dining and drinking neighborhoods, and the high vitality area in the north has a low population concentration; in addition, the new urban area in the central part of the city is not in a good position in terms of the overall performance of the heat map (Figure 2) and the concentration of the population (Figure 3), and the utilization of the urban area is rather much lower.

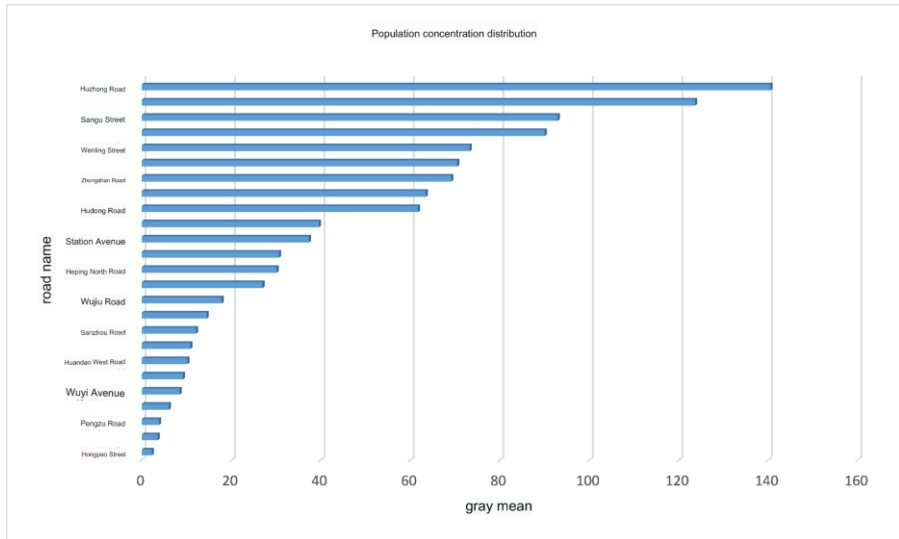


Fig. 3. Distribution of population agglomeration

To summarize, crowd activities are highly concentrated in space, and the lots with high thermal value show that crowd vitality is obviously concentrated in space in the northeastern part of the old city without renovation and renewal, specifically in the street square of Zhongshan Road, Lenin Park, the new Baijia Shopping Plaza, Wenling Street, the residential area along Zhongshan Road, and Wuyi North Railway Station, and the number of open spaces in the crowd-concentrated area is insufficient, and the construction period is long, which is unable to satisfy the demand of the crowd. The crowd concentration and heat low value area instead in the new plaza park, crowd concentration distribution is more uneven, the new Citizen's Square, small Wuyi Park,

Camphor Park, Wuyi and Park and other open space is obviously difficult to attract the local residents in the afternoon, night to go to the activities and leisure, which may be the distance reason, the place of facilities supporting the reason.

3.3 POI industry structure analysis

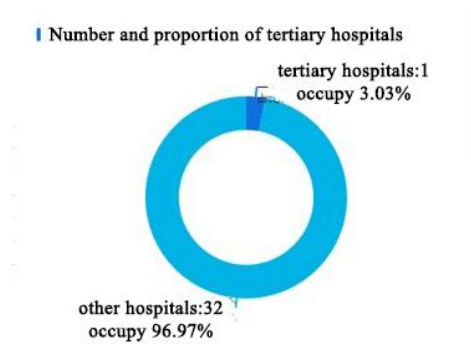


Fig. 4. Statistical ratio of some supporting facilities in the old urban area

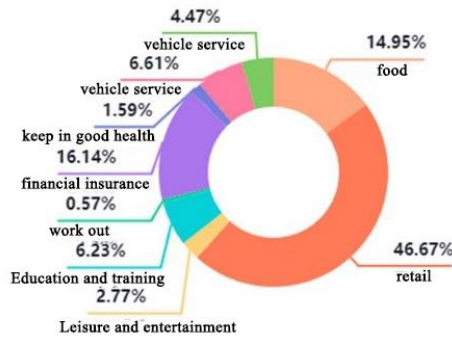
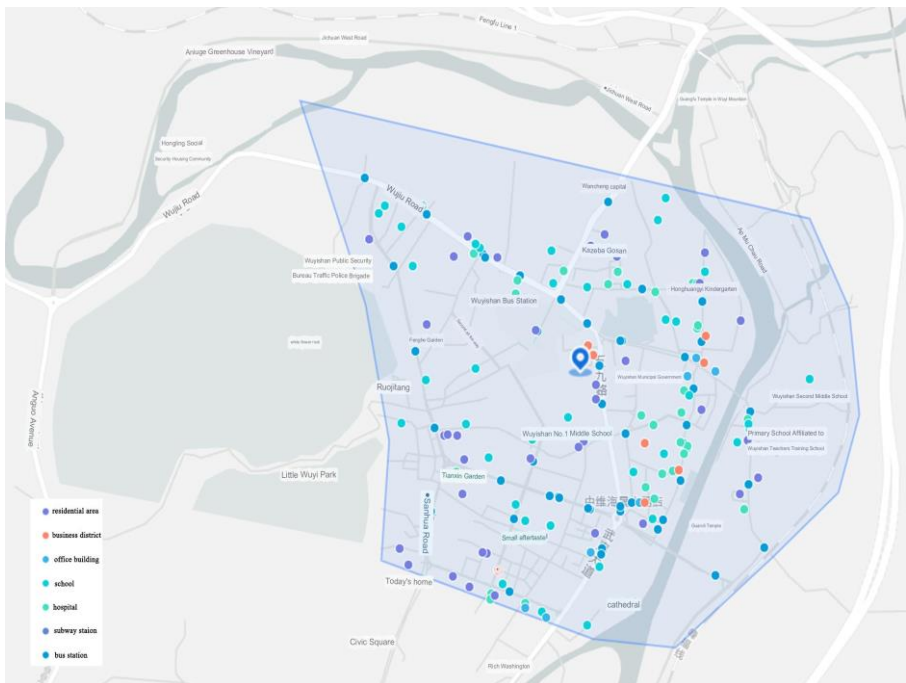


Fig. 5. Commercial business structure in the old urban area

According to Figure 4 and Figure 5, the composition of basic service facilities is shown in the statistical chart. The infrastructure facilities in the old part of the city such as schools and hospitals are relatively complete, but the age of the facilities has lagged behind the normal urban facilities, and the residential buildings that are rented out and inhabited by the people themselves are long in age, most of which are over 20 years old, so the living experience and the environment are not high and there are potential safety hazards; in terms of the scale of the facilities, the many medical facilities in the old part of Wuyishan City are only a third-class hospital, which is not friendly to the old city where many people live, and cannot provide sufficient and effective medical services, and it cannot provide sufficient and effective medical services, which is not in line with the facilities of an international tourist city.

The commercial structure of the old part of the city is relatively balanced, in which the number of retail facilities accounts for 46.67% of the absolute advantage, and the living service facilities and catering facilities are in the second and third places, accounting for 16.14% and 14.95% respectively, which account for a total of 77.76% of the total share of the three, which is visible in the old part of the city, where the living business is more active. However, other types of facilities only accounted for 22.24%, the industry structure and the number of residents is not enough to match the structural imbalance, the lack of leisure and recreation, sports and fitness facilities, and the positioning of the international tourist resort city does not match.

3.4 POI Facility Distribution Analysis



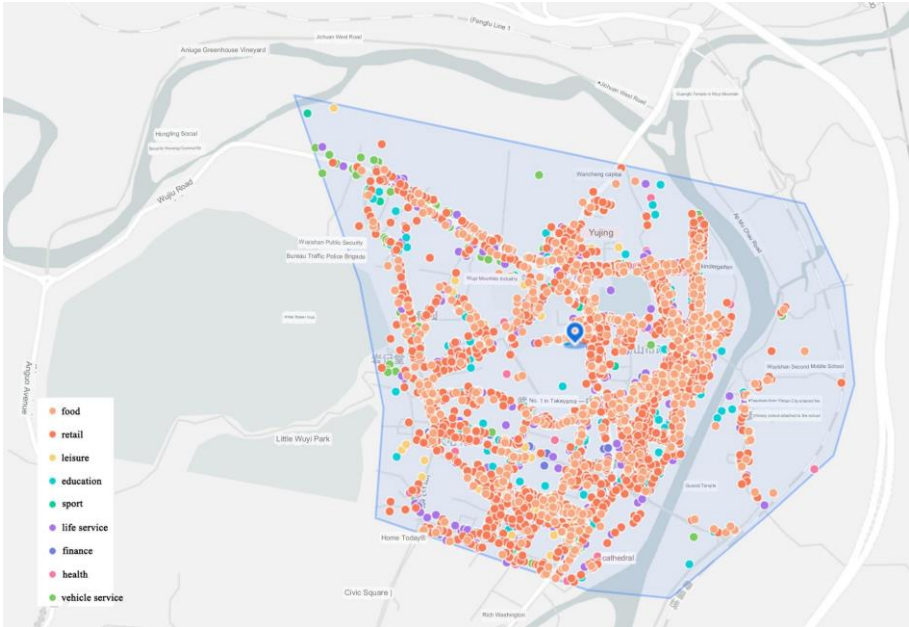


Fig. 6. Distribution of infrastructure in the old urban area

As Figure 6 shows above, hospitals in the old city are mostly concentrated in the east and south of the city, offices and schools are instead concentrated in the center of the city, which is not ideal in terms of office and learning environments due to the impact of the noise level in the center of the city, and these two types of facilities take up the space available for the distribution of other facilities, crowding out the allocation of land resources in the center of the city; as the type of commercial POI with the highest number of shares, the distribution of retail and food service facilities in the old part of the city and resort areas have formed multiple poles, but have not yet formed a continuous band of density, and multiple poles are concentrated in areas with high concentrations of residential neighborhoods, which tends to create a competitive situation.

From the overall distribution of infrastructure in the old part of the city, the layout of the industry is relatively unbalanced, most of the infrastructure are mainly concentrated in the vicinity of business districts and transportation facilities, and combined with the previous analysis of the heat map found that the crowd vitality presents a single nucleus and multiple nodes distribution, spatial overall consistent with the area of the industry concentration, but there are differences in the local areas of the facilities concentration area and the area of the crowd activities, such as the South Heping Road, the area forms a vitality hole, and the vitality of the area needs to be improved.

4 Conclusions

This project combines the completed preliminary analysis of the "Wuyishan City Center Urban Renewal Special Plan and Five-Year Implementation Action Plan" undertaken by Tongji Planning Institute, using traffic situation, parking space distribution and Baidu heat map data, using mean thermal calculation and overall Using analysis technology, we studied the traffic pressure and population agglomeration problems in the main urban area of Wuyishan, and finally obtained the area vitality improvement plan; using POI data from Amap, and using POI business structure and distribution analysis technology, we studied the infrastructure business ratio in the main urban area of Wuyishan. and issues in the main distribution areas, and finally obtained a facility configuration optimization plan; effectively helping to determine the direction and focus of future urban renewal in Wuyishan.

4.1 Transportation Improvement Optimization Program:

Wuyishan City, the main urban area of a number of major transportation functions overlap, transit heavy vehicles affect the effect of tourism city, the old city roads are relatively narrow, there are haphazardly built, and part of the roads in the neighborhood are not individually divided into sidewalks, are mixed pedestrian-vehicle roads, pedestrian access to the existence of safety hazards. In the overall main city of the main road should be traffic diversion, diversion of Wuyi Avenue traffic pressure, will be part of the suburban highway update for bus rapid transit, additional bus special classes, enhance the rate of north-south commuting, relieve the pressure of the inner city; reasonable diversion of traffic and pedestrian flow in the old part of the city, demolition of the two sides of the private construction of private land, add a special sidewalks, and strictly strengthen the internal management of the temporary stops; part of the narrow road into a unidirectional traffic system, appropriately widen some streets and alleys to improve the efficiency of internal traffic; and build parking lots in major crowd-gathering areas, near large-scale commercial facilities, and in open spaces in the countryside to increase the throughput of urban vehicle circulation.

4.2 Facility Configuration Optimization Plan:

In view of the uneven distribution of infrastructure in the old part of the city and resort areas to form poles, as well as the imbalance of business functions, the land resources that do not require the city center, such as offices, schools, etc., are gradually transferred to the outskirts of the city, and medical facilities with high requirements for urban life are leaning on the city center to reduce the distance and time of commuting to see a doctor, and all kinds of commercial business facilities, such as restaurants, health care establishments, etc., are transferred to the suburban residential areas and resorts to do an equal share, so as to increase the vitality of the economic activities of the rest of the area, and to induce the popularity of the business and prevent the emergence of the hole of the vitality of the region, and to assist in updating the business functions.

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