Analysis of new retail location based on GIS spatial analysis—Take Starbucks and Luckin Coffee for example

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ABSTRACT:

This paper selects nine administrative districts in Shenyang, and compares the spatial distribution patterns and factors influencing the location of the new retail brand Luckin Coffee and the classic traditional retail brand Starbucks in Shenyang. The results show that the traditional retail Starbucks tends to be distributed in a single-center pattern, while the new retail brand Luckin Coffee tends to be distributed in a multi-center decentralized pattern. According to the significance of the influence on spatial layout, the most important factor influencing the location of traditional retail Starbucks Coffee is the density of commercial plazas, while the most important factor influencing the location of new retail brand Luckin Coffee is the density of commercial office buildings. The new retail brand Luckin Coffee, with its Internet gene, weakens the spatial resistance of its store location.

1. INTRODUTION

With the progress of science and technology and the rapid development of network technology, China's economic and social development has been paid more and more attention. With the rise of mobile Internet, the traditional retail industry has been further broken through and China has the most potential economic development of China, people's living standards and quality of life have been greatly improved. Online shopping has made a leap, but the brick-and-mortar traditional retail industry has experienced an overall decline. Traditional retail enterprises have to rethink, in the continuous exploration, looking for new development direction, put forward the new retail and traditional retail channels, new marketing means, new intelligent technology and traditional service experience coexist in the "new retail" mode of management(Li Yuhong, 2018).

According to the requirements of "Opinions on Promoting Innovation and Transformation of Physical Retail", the development mode and management level of physical retail industry should be promoted continuously. Combine traditional business advantages such as logistics supply chain and offline customer service with information and network information flow and electronic capital flow; To promote the development of retail enterprises, and gradually to the network and intelligent new business model transformation. At the same time, with the continuous attempts and active promotion from all walks of life, some new retail brands have shown strong market benefits and vitality. Under these new business models, Luckin, the new retail benchmark, added 1,221 stores in 2021, up 25.4 percent from the same period last year. By the end of 2021, Luckin had 6,024 stores, 4,397 self-owned stores and 1,627 franchised stores, surpassing Starbucks China's 5,557 stores in total. From this point, it can be seen that the development of the new retail industry is not to be underestimated, because of the progress of The Times, the development of residents' economy, residents' living habits, living environment changes, urban spatial form and

other factors, the development of the new retail industry is particularly necessary to carry out an in-depth discussion.

Taking the new retail representative brand Luckin coffee and the classic traditional retail brand Starbucks coffee in the city as the research object, the spatial distribution characteristics and spatial distribution forms of the two brands in the city are discussed from a micro perspective by using ArcGIS tools. At the same time, this paper also analyzes the difference between the two in geographical location and management concept, and points out the difference in location choice between the new retail industry and the traditional retail industry in the city(Zhang Yuan Yi, et al.2018).

From the theoretical point of view, under the background of the rapid development of the Internet, the new form of business generated by new retail is gradually becoming the focus of scholars. The research on new retail includes its concept, motivation, characteristics and other aspects. At present, there is a little lack of research on location selection of new retail. Based on the environment of new retail, this paper selects "Luckin Coffee", a typical new retail enterprise with representative significance, and uses GIS technology to conduct empirical research and analysis on it. This paper discusses the factors influencing the location of new retail space, which can provide some reference for the spatial planning and site selection of new retail industry(Wang Fan, et al.2020).

From the perspective of practice, the retail industry as an important industry in a city, its overall depression has brought great impact on it. The retail trade based on network technology and thought is the inevitable result of realizing the change of retail trade. After the release of the Opinions on Promoting the Innovation and Transformation of Physical retail, the new retail industry will be an important turning point, which will be the key point to promote the improvement and transcendence of regional economic competitiveness. Therefore, a study on the spatial pattern and location selection of China's overall development of new retail formats, but also provides an important reference for the construction and planning of new retail formats(Dong Lun.2019).

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From the perspective of time development, it has been nearly 6 years since the new retail was proposed, and it is in the stage of vigorous development. Under this background, "Luckin Coffee" has grown into a mature coffee retail business model. New retail unique mode of operation and the system architecture is still at the prototype stage, but in the current network development and integration with the traditional retail, still have to continue to develop potential, this paper USES operation is relatively mature new retail benchmarking brand good coffee concept and spatial pattern, the site selection of new retail industry development and progress in the future to provide the reference.

Based new retail background, in shenyang for the study of the city, to city inside the new retail brand has a representative and classic traditional retail brand starbucks coffee as the research object, is covered with store nine regions within the scope of the retail business and office layout situation, population density, the spending power of factor analysis, discuss the location factors.

2. DATA AND RESEARCH METHODS

2.1 Research Area and Data Acquisition

Shenyang was selected as the research city. By April 2022, there were 74 Luckin Coffee stores and 53 Starbucks stores in Shenyang, covering Shenhe District, Heping District, Dadong District, Huanggu District, Yuhong District, Tiexi District, Hunnan District, Shenbei New District and Sujiatun District. This paper analyzes the layout of retail business and office buildings, population density, shop rent and consumption power in the nine regions covered by the store, and discusses the influencing factors of site selection(Gao Bin.2019).

All the data were obtained in March 2022. The map vector data of nine districts in Shenyang, POI data of 74 Luckin coffee stores and 53 Starbucks coffee stores, POI data of 880 office buildings and 218 commercial squares in nine districts in Shenyang were obtained by Ammap. Obtain the average rental prices of office buildings and shops in nine districts of Shenyang from the official website of Anjuke.com. The population data of nine districts of Shenyang was obtained from the official data of the seventh national census(Mo You.2020).

2.2 Research Method

2.2.1 Multi-distance spatial clustering analysis: The Multi-Distance Spatial Clustering Analysis tool is a method for analyzing the spatial patterns of event point data based on Ripley's K function. The feature of this method is that the spatial correlation of sample point locations within a certain distance range can be analyzed and aggregated. The formula is as follows(Xue Bing, et al.2018).

$$L(d) = \sqrt{\frac{A\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j\neq 1}^{n} K_{i,j}}{\pi n(n-1)}}$$
(1)

Where A represents the region, N represents the number of points, D represents the distance and $K_{i,j}$ represents the weight. When the distance between i and j is less than or equal to d, the weight is (if there is no boundary correction) 1, and when the distance between i and j is greater than D, the weight is 0. After applying edge correction, the weight of $K_{i,j}$ changes slightly.

If the observed value of the function lies in the proposed confidence region, it is concluded that the sample points are randomly distributed. If the observed value of the function is above the upper limit of the proposed confidence region, the conclusion sample is a cluster distribution. If the observed value of the function is below the lower limit of the proposed confidence region, it is concluded that the sample is discretely distributed. Through multi-distance spatial clustering analysis, Ripley's K function of the locations of Luckin Coffee and Starbucks coffee stores in Shenyang was fitted to judge the distribution characteristics of the stores.

2.2.2 Average Nearest Neighbor Index: The average nearest neighbor index can be used to measure the balanced distribution of multiple objects in a region. The distance between the sample data stores and their nearest stores is collected, and the ratio of the theoretical nearest neighbor distance to the actual nearest neighbor is calculated to obtain the spatial distribution degree of the sample data (Tang Shanshan.2018)

$$r = \frac{1}{2\sqrt{n/A}} = \frac{1}{2\sqrt{D}}$$
(2)

$$R = \frac{r}{r_E} = 2\sqrt{D}r \tag{3}$$

where R is the average of the actual nearest distance, r_E is the average distance of the nearest points in the random distribution, and D is the point density.

When R=1, the target stores are randomly distributed; When R>1, it indicates that the target stores tend to be uniformly distributed; when R<1, it indicates that the stores tend to be clustered and distributed; and the smaller R is, the higher the degree of agglomeration in space.

2.2.3 Kernel density analysis: Kernel density analysis is one of the most direct and effective methods to judge the spatial aggregation, which can visually show the spatial distribution. In this paper, kernel density analysis was used to discuss the clustering and distribution of Luckin Coffee and Starbucks stores. The predicted density of the new (x,y) position is determined by the following formula.

$$Density = \frac{1}{(radius)^2} \sum_{i=1}^{n} \{\frac{3}{\pi} \cdot pop_i [1 - (\frac{dist_i}{radius})^2]^2\}$$
(4)

where pop_i is the population field value at point i, which is an optional parameter. dist_i is the distance between point i and the (x,y) position.

3. EXPERIMENT AND RESULT ANALYSIS

3.1 The spatial distribution type of Luckin Coffee and Starbucks

Multi-distance spatial clustering analysis was used to fit Ripley's K function of Luckin Coffee and Starbucks coffee in Shenyang, and the results were shown in Figure 1 and Figure 2.





Figure 1. Starbucks Ripley's K function curves.

Figure 2. Luckin Coffee Ripley's K function curves.

As can be seen from the figure, the observed values of R-K function curves of Starbucks coffee and Luckin Coffee are all above the expected value, which indicates that Starbucks coffee stores and Luckin Coffee stores show agglomeration distribution in Shenyang, and the distribution is significant. The R-K curve of Luckin Coffee and the R-K curve of Starbucks are both relatively smooth, indicating that both pay more attention to the linkage scale effect in the layout of stores. Starbucks' R-K curve shows individual inflection points, which is consistent with Starbucks' store opening strategy. It still tends to lay out stores in a region, then continuously open branches in that region to occupy the local market. The R-K curve of Luckin Coffee is relatively smoother, which indicates that Luckin is more inclined to expand the service scope and improve the delivery efficiency by expanding the market coverage area.

The average nearest neighbor analysis tool of spatial analysis tool was used to calculate the Starbucks coffee stores and Luckin coffee stores in Shenyang. The nearest neighbor ratio between Starbucks coffee and Luckin coffee was obtained.

Project	Starbucks	Luckin Coffee
Average observation distance	0.0124	0.0106
Expected observation	0.0196	0.0154
distance		
Nearest neighbor ratio R	0.736131	0.684142
Z-score	-3.674997	-5.198035
P-score	0.000238	0.000115

Table 1. Average Nearest Neighbor Analysis Results.

Analyze the ratio of nearest neighbor data, shenyang starbucks coffee and Luckin's nearest neighbor ratio less than 1, the R - K before and function analysis conclusion, said the two stores are in the spatial distribution of the concentration distribution, at the same time, when the nearest neighbor ratio R value less than 1, the smaller R said stores on spatial agglomeration degree is higher, It can be concluded that the degree of agglomeration of Luckin coffee stores in Shenyang is slightly stronger than that of Starbucks stores.

3.2 Kernel density analysis

The kernel density analysis tool was used to process the spatial point data of office buildings, commercial squares, Starbucks stores and Luckin coffee stores in Shenyang city, and the pixel size was set as 10 meters. The results are shown in Figure 2 and Figure 3.



Figure 3. Results of kernel density analysis of Luckin coffee.



Figure 4. Results of kernel density analysis of Starbucks.

The core density of Starbucks coffee stores in Shenyang showed a moncentric structure, and the high-value area was basically covered by the high-value area of office buildings and commercial squares in Shenyang, which was basically consistent with the distribution of business districts. High density areas of Starbucks coffee stores are distributed in Shenhe District, Heping District and other downtown areas, which shows that the location of Starbucks coffee stores is more inclined to high-level economically developed areas and areas with good commercial development.

Luckin Coffee presents a multi-point layout in Shenyang, and the location of its stores does not completely coincide with the highvalue area of the business district. In addition to the downtown area where businesses are concentrated, the second-level stores choose to be arranged in various university towns and office building clusters in the city.

Use the store data to build a 1km buffer and analyze the number of shopping areas and office buildings covered within the store buffer.



Figure 5. Coverage of Starbucks in the business circle.



Figure 6. The coverage of Luckin coffee in the business circle.

Brand	The number of business districts covered by 1km	The total number of business circle	Coverage Rate
Starbucks	118	218	54.13%
Luckin coffee	132	218	60.55%

Table 2.	1km	commercial	area	coverage	statistics
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Figure 7. Coverage of Starbucks in office buildings.



Figure 8. Coverage of Luckin Coffee in office buildings.

Brand	Number of office buildings covered by 1km	The total number of office buildings	Coverage Rate
Starbucks	568	880	64.55%
Luckin			
coffee	650	880	73.86%

Table 3. Office building coverage Statistics.

According to the above data, the location of the new retail brand Luckin Coffee store is less dependent on the business district than Starbucks. Luckin Coffee is more inclined to close to high-end office building group. This is related to the new retail characteristics of Luckin Coffee. Compared with the functional consumption scene and leisure nature of Starbucks, Luckin Coffee focuses on convenient and fast retail mode, so it chooses high-end office buildings to reduce delivery time and cost.

The location of Starbucks coffee stores prefers areas with higher level of economic development, and the commercial center is the center of gravity of its spatial location. Luckin Coffee is more inclined to high-end office building layout.

3.3 OLS regression analysis

Rule layer	Index layer	Data source		
Maulaat		Data from the		
requirement	Population density	seventh		
	i opulation density	National		
		Census		
Commercial and	Density of			
office buildings	shopping malls and	Amap POI data		
cluster	office buildings			
Low level	Shopping malls, office rents	Anjuke Website		

Table 4. Model index selection.

Based on the above data, the spatial relationship modeling of the data was used to analyze the influencing factors of the location of Starbucks coffee and Luckin Coffee stores in Shenyang by OLS. The analysis results are shown in Table 5 and 6.

Variate	Coefficient	T value	P value
Population density	-1.14E-05	-1.00461	0.00601
Density of office buildings	0.0678	14.5265	0.00016
Density of the mall	0.1713	5.86314	0.00000
Office rent	0.0417	1.43025	0.81478
Shops rent	0.0008	0.0894685	0.16547
R ²	0 789676		

 Table 5. OLS regression results of Starbucks coffee store density in Shenyang.

Variate	Coefficient	T value	P value
Population density	5.93E-06	2.68809	0.00777
Density of office buildings	0.0881246	6.52163	0.0000
Density of the mall	0.0301788	4.51455	0.00142
Office rent	0.0324369	1.51365	0.00653
Shops rent	-0.0150221	-2.65556	0.00416
D 2	0 838308		

 Table 6. OLS regression results of the density of Luckin Coffee stores in Shenyang.

Both the regression results by above knowable, least squares model with Luckin starbucks coffee most of the independent variable performance significantly, the fit of the model of the R2 value reached 0.838 and 0.789 respectively, the fitting equation can explain the density of population density, the density of shopping malls, office buildings, shops of rental, office, etc. The change of the dependent variable at 83% and 78%, It can be seen that the two OLS models constructed have a high degree of fit. By analyzing the regression model results of Shenyang Starbucks coffee as the dependent variable, it can be concluded that the significance of the impact of mall density on Starbucks coffee is 0.00000, which indicates that the area with active business and office is more favored by Starbucks location. The population density factor shows a negative correlation in the distribution of Starbucks stores, with T value of -1.00461 and P value of 0.00601 being significant. Since the data used to analyze the population density are the data of permanent residents in the region, it can be seen that the proportion of regional residents is not an important reference factor for the location of Starbucks. Its focus is more on the office and leisure flow in the region. In terms of rent at the low price level, it has a weak impact on the location of Starbucks stores. The P value of office rent is at the level of 0.81478, and the P value of shop rent is at 0.16547. P>0.05 means that it has no significant impact on the distribution of stores. Considering the store layout and proximity to customers is of great significance for Starbucks, so the level of ground rent has no significant impact on the distribution of Starbucks stores.

Based on the analysis of the regression model results of Shenyang Luckin Coffee as the dependent variable, it can be concluded that the P value of office building is 0.0000, which is the most important factor affecting the location and selection of Luckin coffee stores. Secondly, office rent and population density are also positively correlated with the density of Luckin Coffee stores. Shop rent in the model is the only negative value among all factors, and a T value of -2.65556 indicates that it has a negative correlation effect on the spatial location of Luckin coffee stores. Luckin coffee consumption operation concept analysis, a new retail Luckin coffee consumption form mainly since the lift and delivery, does not set store consumption within the scene, so the new retail brand Luckin coffee for store location is not necessarily required to open in the commercial areas, highly active main cost-effective Luckin pay more attention to cost control, Therefore, it can be seen that choosing to layout stores in areas with low shop rent is the operation means of Luckin Coffee to control the cost.

4. CONCLUSIONS

For large cities with economic transformation and rapid development, the vigorous development of new retail formats forces practitioners to study the structure and distribution patterns of retail space from big data, so as to optimize the location choice and spatial configuration of retail stores. This paper draws the following conclusions through research:

The location structure of traditional retail Starbucks mainly shows a monocentric distribution. The location structure of Luckin Coffee, a new retail brand, tends to be multicenter and distributed. Luckin Coffee forms high-value zones in multiple centers within the city, thus covering a larger market area and facilitating delivery services.

According to the significance of the factors affecting the location of traditional retail Starbucks, the most important factor is the influence of commercial square density, followed by office density, population density, rent and other factors. According to the significance of the influence, the most important factor is the density of office buildings. The stores of Luckin Coffee do not necessarily need to be set in the core business district, eyecatching and commercial areas. Through its new retail Internet gene, the space resistance is effectively weakened.

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