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Spatial heterogeneity and its influencing factors of Douyin network: Attention to 5A-level scenic spots in China

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Abstract: Based on the network attention data of Douyin's fans, this article analyzes the spatial heterogeneity and driving factors of network attention to 5A-level tourist attractions in China using rank-size, kernel density, and nearest neighbor index. The results show that: (1) From the perspective of the rank-size curve, and the fractal dimension q , the structure of the scale sequence shows that the development of highly ranked scenic spots is well established, while the development of medium, and low-ranked scenic spots is incomplete. The general structure of Douyin's attention level in scenic spots exhibits obvious imbalance characteristics. (2) From the perspective of spatial patterns, it presents a distribution pattern with "one core and one belt" in general, with high-aggregation scenic spots mainly distributed in the Yangtze River Delta and others mainly distributed in the belt of Beijing, Tianjin, Hebei, Henan, Jiangxi, Hunan, and Hubei provinces. In terms of aggregation patterns, low and lower-attention scenic spots tend to be in an aggregated state, while medium, higher, and high-attention scenic spots tend to be in a dispersed state. (3) In terms of influencing factors, the main factors are the construction of scenic spot promotion platforms, marketing scenic spots, and regional economic development. The secondary factors include the development of the vitality of the tourism market, transportation convenience, and regional population support. General factors include the support of the modern service industry and the level of Internet development.

Keywords: China; 5A-level tourist attractions; network attention; spatial heterogeneity; Douyin

1 Introduction

The development of Internet technology has made the use of computers and mobile phones increasingly common, and the number of Internet users is continuously growing. With the continuous development and growth of the online user base, as well as the increase in the Internet penetration rate, online information search has become an important tool to assist tourists in making travel decisions. Tourists can easily and conveniently access travel information on Internet platforms. Tourists' attention to travel-related information can reflect the footprint of netizens and potential tourists searching for travel-related information, becoming one of the important indicators to measure the influence of tourism.

Network attention refers to the network data left by the public on various social media platforms, including their attention, search, browsing, and other activities. It represents the public's interest and popularity in a specific subject or object on social media platforms, to some extent reflecting the level of public attention towards it (Feng, 2022; Lu et al., 2022b; Tang & Xu, 2021; Zhang & Huang, 2021). With the development of Internet technology, Internet promotion has become an important means of advertising and marketing for tourist attractions (Liu et al., 2022). In recent years, network attention has been widely applied in tourism research. In the context of big data, the network attention of tourist attractions can to some extent reflect the characteristics of tourists' demands and behavioural intentions. Therefore, utilizing network attention to guide tourism practices holds significant importance. By focusing on tourism network attention, we can understand the spatio-temporal characteristics and evolutionary patterns of the network attention of

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tourist attractions, and acquire information such as the travel preferences of potential tourists in a timely manner. This helps to achieve precise market promotion, convert it into actual passenger flow, and promote research on related tourism issues.

2 Literature Review

2.1 Network attention

It can be seen from the review of the relevant literature that, in terms of data sources, most studies have focused on using the Baidu index as a measure of network attention to conduct research on tourist attractions (Jiao et al., 2022; Su & Kang, 2022; Wang et al., 2022; Yan et al., 2021; Yao & Liu, 2020; Zhang et al., 2022). For example, Jiao et al. (2022) examined the distribution pattern and the driving mechanisms of network attention to 300 classic red tourism attractions in China, using the Baidu index as the data source. Some scholars have explored the effectiveness of online promotion of scenic spots using various social media tourism data (Duan et al., 2020; Knight, 2014; Lu et al., 2022a; Li, Tao, et al., 2021; Zang & Wang, 2020; Zhao, Zhao et al., 2022) as indicators of network attention. For example, Zhao, Zhao et al. (2022) analyzed spatial differences in network attention and its influencing factors for desert scenic spots at the A-level in China using data on the search engine index, tourism website index, social media index and short video index. In terms of research methodology, most studies focus on exploring the spatio-temporal differences in attention to scenic spots using various measurement indicators (Lu et al., 2022a; Zhang et al., 2023). For instance, Lu et al. (2022a) combined methods such as mathematical statistics, spatial analysis, and geographic detectors to analyze the spatio-temporal differences and influencing factors of tourism in Xi'an. Regarding the scope of the research, the study encompasses multiple scales, including national (Lai, 2022; Liang & Lijun, 2023), provincial (Alvarez-Diaz, M. et al., 2020), and urban (Ding et al., 2022; Xue & Bai, 2023) levels. Research has shown that network attention serves as an important indicator for measuring the level of information dissemination and public interest in tourist attractions. Not only does network attention benefit the positioning of tourist attractions, the precise planning of tourism, and the promotion of unique features of tourist attractions, but it also has significant implications for enhancing the quality of tourist attractions (Krisjanous, 2016; Luo et al., 2023).

2.2 Short videos and Douyin

Short videos not only serve as a means of entertainment and documenting daily life but also possess multiple functionalities such as fan interaction, professional learning, and live shopping. As a result, the download and viewing figures of short video applications have surpassed those of traditional news media (Ding et al., 2022). Research on "short videos + tourism" has also emerged in large numbers, such as Xu et al. (2023) exploring the factors influencing the willingness of short video platforms to search for travel information, providing theoretical and practical insights for improving users' willingness to use short video platforms as a source of travel information, thereby making rational travel decisions. Shu et al. (2023) explained the transformation of virtual and reality in tourism short videos, highlighting insights for tourism marketing practices. Fang et al. (2023) pointed out that short-form travel videos are popular and can spark travel inspiration. In addition, scholars have studied the impact of destination short videos on customer attitudes (Cao et al., 2021), the impact of short videos on willingness to share online (Zhao, Shen et al., 2022), and the impact of short videos on tourists' destination decisions (Jiang et al., 2022).

In this regard, as an emerging media form, Douyin (a Chinese social media platform) has garnered significant attention from a large user base due to its unique operational mechanisms and marketing strategies. By 2022, Douyin had reached a daily active user base of 500 million, establishing itself as a popular short video application (Liu et al., 2022). Academic research has shown that analyzing the user's network attention can not only be used to study the power of dissemination and the effects of networked information on the Douyin platform, but also to some extent reflects the level of public's interest and the variations in interest in different scenic spots. In a sense, the number of Douyin's fans for a scenic spot is an important indicator for measuring the online development of the scenic spot and users' attention, representing the quality of physical construction, influence, and attractiveness of the scenic spot. With the rise and development of the short video + tourism model, there has been an increasing amount of research in the field of tourism based on the perspective of Douyin short videos. For example, Mao et al. (2023) studied how the novelty of travel-themed short videos on Douyin and the shooting angles influence potential tourists' behavioural intentions. Zeng and Li (2019) explored the constituent elements and the formation process of interactive communication in Douyin tourism short videos from a sociological perspective. However, most current

research is mainly focused on examining the perspectives of problem solving and strategic thinking about customer attraction in the context of short video promotion; there is a lack of analysis of the relationship between short video promotion and physical development in the context of the digital economy (Zhang *et al.*, 2019).

In summary, scholars both domestically and internationally have conducted increasingly comprehensive and in-depth research on network attention towards tourist attractions, which has laid the theoretical and methodological foundation for tourism-related studies. However, there is still relatively limited research on spatial differences in network attention towards tourist attractions and driving factors from the perspective of short videos + tourism. It is worth noting that 5A-level tourist attractions, as the highest standard for quality grading and development of tourist attractions in China, have a significant impact on the measurement of network attention levels towards tourist attractions. Currently, there is scarce research in academia on the attention and spatial differences of short videos towards 5A-level tourist attractions. Therefore, this study aims to use the number of fans on the Douyin platform of tourist attractions as a measurement indicator to explore the network effects and influencing

mechanisms of network attention towards 5A-level tourist attractions in China. It hopes to objectively analyze the current development status of network attention towards 5A-level tourist attractions in China under the new scenario of short videos, and provide valuable strategic recommendations for the construction of related tourist attractions, the integration of virtual and real economies, and the enhancement of the soft power of tourist attractions.

3 Data Sources and Research Methods

3.1 Data sources

This study takes into the account the 318 5A-level tourist attractions identified on the official website of the Ministry of Culture and Tourism of the People's Republic of China as research subjects (Table 1). Meanwhile, utilizing the Baidu Maps coordinate system, the latitude and longitude coordinates of each attraction were obtained, resulting in spatial location data for the attractions (Figure 1).

Table 1: Statistical analysis of Douyin accounts for China's 5A-level tourist attractions

provincial-level administrative division	the number of 5A-level tourist attractions	the number of official Douyin accounts for tourist attractions	the number of accounts with a fan base exceeding 10,000	in total
Beijing	8	8	26	34
Tianjin	2	1	2	3
Hebei	11	7	81	88
Shanxi	10	9	98	107
Inner Mongolia	6	3	5	8
Liaoning	6	9	2	11
Jilin	7	12	13	25
Heilongjiang	6	8	3	11
Shanghai	4	7	2	9
Jiangsu	25	51	11	62
Zhejiang	20	30	143	173
Anhui	12	20	46	66
Fujian	10	17	27	44
Jiangxi	14	41	52	93
Shandong	14	22	32	54
Henan	15	33	43	76
Hubei	14	25	44	69
Hunan	11	18	67	85
Guangdong	15	24	17	41
Guangxi	9	12	9	21
Hainan	6	7	11	18
Chongqing	11	15	2	17
Sichuan	16	24	32	56
Guizhou	9	17	10	27
Yunnan	9	13	24	37
Tibet	5	8	1	9
Shaanxi	12	36	42	78
Gansu	7	11	3	14
Qinghai	4	4	0	4
Ningxia	4	4	1	5
Xinjiang	17	29	20	49
in total	318	525	869	1394

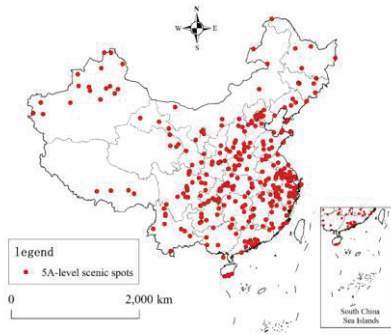


Figure 1: Spatial distribution of China's 5A-level tourist attractions

The number of Douyin's fans of a scenic spot represents the level of users' attention and recognition towards the related tourist destination. Therefore, this study adopts the number of Douyin's fans to characterize the development level of network attention towards tourism destinations. Through data comparison analysis, it was found that the official Douyin account of scenic spot and the Douyin travel blogger accounts with more than 10,000 fans have a higher quantity and quality of Douyin, and they can be regularly updated, indicating good validity of the data. Therefore, this study selected data of official accounts of 5A-level scenic spots and travel bloggers on Douyin with a fan count of over 10,000 (as of August 23, 2023). The data were filtered and organized, excluding invalid data. The specific search process is shown in Fig. 2. The influencing factor data were sourced from official statistical yearbooks, national economic and social development statistical bulletins, official websites of tourist attractions, etc. Some missing data were obtained from official platforms of various regions (such as the Communication Administration Bureau and the Department of Culture and Tourism).

3.2 Research methodology

3.2.1 Rank-size

The rank-size method can sort the attention of scenic spots in descending order, thus establishing a pairwise correspondence between scale and rank. In this study, the Zipf index of this method is used to investigate the relationship between rank and scale of attention to scenic spot. The calculation formula is as follows:

$$\ln P_r = \ln P_1 - q \ln r. \quad (1)$$

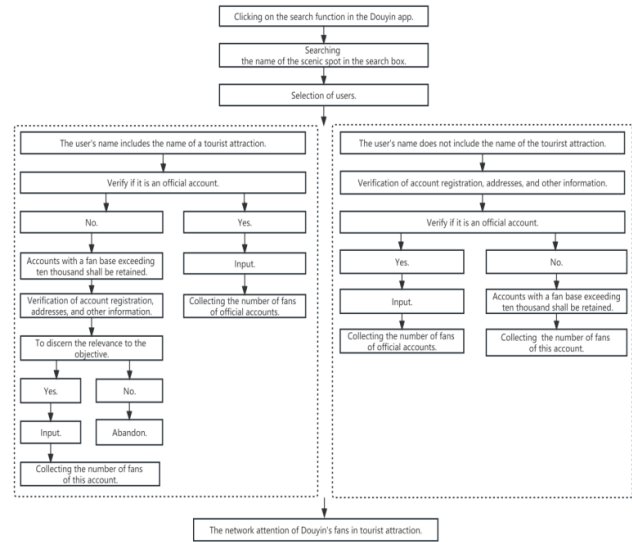


Figure 2: Data retrieval route

In the equation, P_r represents the attention level of the scenic spot with the rank of r ; P_1 represents the highest attention level; r represents the rank of the scenic spot; and q represents the Zipf index. A q value close to 1 indicates a relatively ideal rank-size structure, forming a stable development structure. When $q > 1$, it indicates a prominent development of high-ranking areas, while the development of middle and low-ranking areas is not sufficiently complete, resulting in an overall imbalance in the scenic spot system. In contrast, when $q < 1$, the opposite is true.

3.2.2 Analysis of classification and kernel density

Although the Jenks spatial classification method can group the attention of scenic spot networks, it is difficult to identify the core of the aggregation to reflect the spatial clustering status. Therefore, this study, based on the Jenks classification, adopts the kernel density analysis method to determine the local focus situation of network attention to scenic spots (Yang et al., 2022). The calculation formula is as follows:

$$f_k(x) = \frac{1}{nh} \sum_{i=1}^n K\left(\frac{x - x_i}{h}\right), (x \in R). \quad (2)$$

In the equation, $f_k(x)$ represents the kernel density at point x ; n represents the number of points within the neighborhood; h represents the bandwidth; and $x - x_i$ represents the distance from the estimation point x to x_i .

3.2.3 Analysis of nearest neighbor index

Although the kernel density analysis method can determine the clustering status and adjacency relationships of scenic spots in specific spatial areas, it does not reflect the overall spatial clustering status of sample points prominently. Therefore, this study further supplements the analysis based on kernel density utilizing the nearest neighbor index analysis method to determine the clustering types of point data in space (Muchapondwa & Stage, 2013). The calculation formula is as follows:

$$ANN = \frac{\bar{r}}{r_E}, r_E = \frac{1}{2\sqrt{n/S}} \quad (3)$$

In the formula, ANN represents the average nearest neighbor index; $\bar{r}$ represents the average nearest neighbor distance; r_E represents the theoretical nearest neighbor distance; n represents the number of scenic spots; and S represents the area of the study region. $ANN < 1$ indicates that the level of network attention to a scenic spot follows a clustered pattern; $ANN > 1$ indicates that the level of network attention to a scenic spot tends to be scattered.

3.2.4 Geographic explorers

This study uses geographic detectors to investigate the spatial and interaction effects of factors (Li, Wang, et al., 2021; Wang & Xu, 2017; Zhang & Chen, 2008). The calculation formula is as follows:

$$q = 1 - \frac{1}{n\delta^2} \sum_{i=1}^r n_i \delta_i^2 \quad (4)$$

In the equation, q represents the explanatory power of the impact factor on the heterogeneity of the national tourism cyberspace; n and δ^2 represent the sample size and sample variance; n_i and δ_i^2 represent the number of units in layer i and the variance of the dependent variable; and r represents the number of layers for detecting factors.

4 Results Analysis

4.1 Distribution characteristics of rank size

Examining the level of Douyin fans' attention to China's 5A-level tourist attractions, this study was conducted using 1394 Douyin accounts. A fan count rank-size distribution chart of the tourist attractions was created (Figure 3). From

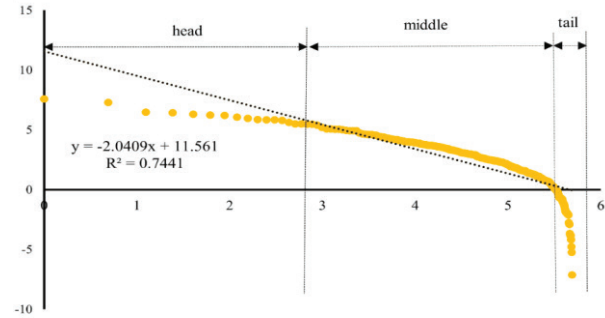


Figure 3: Rank-size distribution of network attention to Douyin's fans

Figure 3, it can be observed that the goodness of fit for the number of Douyin's fans is 0.74, indicating a relatively high level of fit. This suggests that the level of Douyin's fan attention to scenic spots is in line with the rank-size rule. Additionally, $q = 2.0409$, indicating that highly ranked scenic spots are well developed, while lower-ranked scenic spots are less developed. Furthermore, the overall structure of Douyin's fan attention to scenic spots exhibits significant imbalance characteristics. Specifically, the head of high-ranking scenic spots is characterized by a small number and scattered distribution, with no significant difference in Douyin's fans between these spots. The majority of scenic spots have Douyin's fans concentrated in the middle of the fitted curve, and the hierarchical levels are not clear. The tail of low-ranking scenic spots bends downwards in an almost vertical state, indicating a significant difference in the level of attention between these spots. In summary, the Douyin's fan base of scenic spots exhibits a dispersed head, closely packed middle, and vertical tail characteristic on the rank-size curve, reflecting the widespread and significant development of high-ranking scenic spots, while the development of mid-to-low-ranking attractions is insufficient, and the overall structure of attention level is characterized by an imbalance.

4.2 Characteristics of level distribution and spatial agglomeration

Research has shown that if a scenic spot is promoted or marketed with distinctive characteristics, it will generate viral videos and create a multiplied effect in online publicity, thereby attracting public attention to the scenic spot and further enhancing its popularity. Therefore, this study is based on the number of fans of Douyin accounts as an indicator, and through a comprehensive analysis of the short video effects on the Douyin platform of China's 5A-level tourist attractions, a clearer understanding of the online promotional effects of these attractions can be obtained. From Figure 4, it can be observed that there are

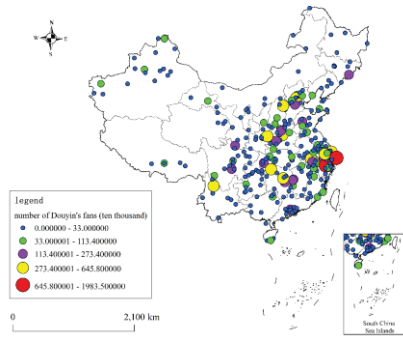


Figure 4: Spatial pattern of fan quantity and attention level on Douyin

Table 2: Douyin's fans and attention levels of China's 5A-level tourist attractions

level	the number of fans (ten thousand)	the number of scenic spots	proportion (%)
low attention	0.000000-33.000000	246	77.4
lower attention	33.000001-113.400000	45	14.2
moderate attention	113.400001-273.400000	14	4.4
higher attention	273.400001-645.800000	11	3.5
high attention	645.800001-1983.500000	2	0.6

significant variations in the spatial distribution of different levels of attention in tourist attractions. Specifically, high-attention attractions are mainly distributed in Zhejiang Province, with the Hengdian World Studios and Putuo Mountain scenic spots performing exceptionally well. Tourist attractions with higher attention are mainly concentrated in the Yangtze River Delta, Shanxi, Shaanxi, and Henan provinces, as well as the Yunan and Hunan provinces. Tourist attractions with moderate attention are clustered in Beijing, Tianjin, Hebei, Shandong, Shanxi, Henan, Guangdong, Chongqing, and Sichuan. On the other hand, tourist attractions with low and lower-attention exhibit a wide range and a scattered distribution pattern.

Meanwhile, the Jenks natural break classification method was used to analyze and examine the spatial structure of the number of fans on Douyin; they were divided into five levels. This analysis aimed to understand the spatial differentiation of public attention. The results are presented in Table 2 and Figure 4. Additionally, to better illustrate the spatial agglomeration of attention to scenic spots, the kernel density analysis method was applied to analyze the spatial agglomeration characteristics of the number of Douyin's fans in 318 5A-level tourist attractions in China. The results are shown in Figure 5.

According to Table 2 and Figure 4, overall, low-attention scenic spots account for 77.4% of the total number of scenic spots, while the proportion of high-attention scenic spots is 3.5%, and only 0.6% are high-attention scenic spots. This indicates that low-attention scenic spots still dominate in China and reflects the urgent need to further enhance the online popularity and dissemination of 5A-level tourist

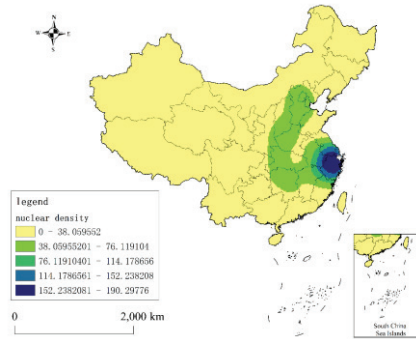


Figure 5: Density analysis of Douyin's fans for China's 5A-level tourist attractions

Note: The map is drawn based on the standard map of the Ministry of Natural Resources of China (Map Approval Number GS(2019)1822), and the base map remains unmodified. Data for Hong Kong, Macau, and Taiwan are not available.

attractions. In terms of spatial pattern, there is a clear radiating pattern from provinces such as Zhejiang, Hunan, Anhui, and Shanxi towards the surrounding areas, forming three relatively dense spatial agglomeration areas: the Yangtze River Delta, Beijing-Tianjin-Hebei, and Sichuan-Shaanxi-Chongqing. It exhibits the characteristic of "low-level surrounding high-level." There are 14 moderate-attention tourist attractions, accounting for 4.4% of the total. These include Jiuzhaigou Valley, the Palace Museum, Wugong Mountain, etc. This also objectively reflects the good endowment of the tourism resource to attractions and their potential impact on the attention effect of the Internet. The proportion of low and lower-attention scenic spots is as high as 91.6%, with a total of 291 sites distributed throughout the country. Representative scenic spots include Lingwu Shuidonggou Tourist Area, Tashilunpo Monastery scenic spot, and Zhashilunbu Monastery scenic spot, indicating a clear underdeveloped state in western provinces such as Qinghai, Xinjiang, and Sichuan.

According to Figure 5, it can be observed that the overall attention on Douyin for 5A-level tourist attractions exhibits a spatial agglomeration pattern characterized by a structure of "one core and one belt." Specifically, it not only forms a core area in the Yangtze River Delta, but also forms a core belt that encompasses Beijing, Tianjin, Hebei, Henan, Jiangxi, Hunan, and Hubei provinces. As for the core area of the Yangtze River Delta, centered around Zhejiang, it forms a core region of agglomeration and development, including Shanghai, Jiangsu, Anhui, and other areas. In addition, except for the Beijing, Tianjin, Hebei, Henan, Jiangxi, Hunan, and Hubei provinces region, the core density of scenic spots in other areas is relatively low. A comprehensive analysis reveals that the high popularity

of China's 5A-level tourist attractions on Douyin is predominantly concentrated in regions with developed tourism economies, abundant tourism resources, and distinctive branding campaigns. Furthermore, these highly popular attractions tend to generate a spillover effect on other regional tourist attractions.

4.3 Characteristics of spatial proximity and agglomeration

Using the nearest neighbor index formula, an analysis is conducted on the spatial proximity of the level of Douyin's fan engagement for 5A-level scenic spots. This analysis aims to determine the developmental status and types of spatial clustering of the scenic spots. It is worth noting that due to the limited number of highly popular tourist attractions, this study combines the high and higher-attention tourist attractions for calculation, as shown in Table 3. The research findings indicate that, as the concentration level decreases, the spatial distribution of Douyin's fans of tourist attractions exhibits a pattern of initial agglomeration followed by dispersion, reflecting the underdeveloped quality of low-level tourist attractions. Specifically, low and lower-attention scenic spots exhibit a clustered state, while moderate, higher, and high-attention scenic spots tend to have a dispersed distribution state, indicating that such scenic spots have weaker interaction with the public on the Douyin platform. In addition, the number of scenic spots shows a significant decrease as the level of attention increases, and the concentration of scenic spots also decreases to some extent. This partially confirms the changing characteristics of the nearest neighbor index (ANN) of Douyin's attention level for scenic spots, that is, the ANN values for scenic spots with low and lower-attention are all less than 1, while the ANN values for scenic spots with medium, higher, and high-attention are all greater than 1. The *P*-value for low-attention scenic spots is less than 0.01, indicating a significant clustering pattern in spatial distribution (Table 3).

Table 3: Analysis of proximity and aggregation of scenic spots

level of attention	the number of scenic spots	ANN	Z	P	distribution types
low attention	246	0.684190	-9.475993	0.000000	significant aggregation
lower attention	45	0.990576	-0.119584	0.904813	low aggregation
moderate attention	14	1.030877	0.243555	0.807576	random distribution
higher and high attention	13	1.215827	1.488704	0.136565	random distribution

5 Analysis of influencing factors

5.1 Selection of influencing factors

Analyzing the level of Douyin attention towards 5A-level scenic spots and investigating influencing factors and their impact on the level of network attention towards these scenic spots holds significant practical implications for the rational development, integration, and construction of tourist resources. The level of network attention to scenic spots is a product formed by the foundation of tourism resources, the support of scenic spot construction, and the utilization of network-based publicity and marketing (Li & Zhang, 2018; Liu, 2016; Ren *et al.*, 2021; Shu *et al.*, 2020; Zhang & Wu, 2022). Therefore, when selecting influencing factors, not only should the connection with the development environment of scenic tourism, resource quality, and unique advantages be considered, but also the relationship with physical construction support should be taken into account. Furthermore, the effects of network publicity and professional media operation must also be considered. Through the review of existing literature on the factors influencing the network attention of scenic spots, and combining the objectivity and scientific validity of indicator quantification, as well as following the principle of data availability, this study selects eight indicator factors for the study, including marketing and market development of scenic spot, construction of scenic spot promotion platforms, regional economic development level, support of modern service industry, level of Internet development, convenience of transportation, regional population support, and vitality of tourism market development (Table 4).

Specifically, ticket prices are a representative indicator of the marketing market in scenic spots. As one of the important platforms for the marketing and promotion of scenic spots, the number of Douyin accounts can also reflect the level of scenic spot promotion platform construction to some extent. In addition, the network promotion of scenic spots needs to rely on the Internet and use qualitative and quantitative means of promotion to enhance the visibility of the scenic spot, so this study also considers the level of Internet development as an important influencing factor. The level of local economic development can provide support for the construction of scenic spot infrastructure and market-oriented operation, and it has an important economic support for improving the attention to the scenic spot network. Therefore, the regional GDP is selected to reflect the overall development level of the regional economy.

Table 4: Construction of indicator system for influencing factors

primary indicators	secondary indicators	explanation of indicators
the marketing market of tourist attractions (A_1)	ticket price	original price of the scenic spot ticket
construction of scenic spot promotion platform (A_2)	the number of Douyin accounts	the number of Douyin accounts
the level of regional economic development (A_3)	regional GDP	overall level of regional economy
the support of modern service industry (A_4)	the proportion of value added in the tertiary industry	the support for the development of scenic spots
the level of internet development (A_5)	the number of fixed broadband internet access users	the level of regional network development
transportation accessibility (A_6)	passenger turnover	level of regional transportation development
regional population carrying capacity (A_7)	population size of the region	population size in the region
the vibrant development of the tourism market (A_8)	tourism revenue	the economic strength of scenic spots

Table 5: Regression analysis of influencing factors

	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
q	0.09568	0.56652	0.05124	0.01603	0.01211	0.01869	0.01862	0.02151
	5	9	6	2	4		6	3
p	0.000	0.000	0.00481	0.29020	0.43529	0.20915	0.21865	0.15053
				6	4	7	2	

The proportion of the tertiary industry added value can reflect the service support capability of the scenic spot. The passenger turnover represents the total amount of passenger transportation work in a certain period, and it is chosen to reflect the level of transportation development in the region where the scenic spot is located. The selection of regional population size serves as a reflection of the population magnitude supporting the geographic area where the scenic spot is located. In conclusion, this study comprehensively employs the aforementioned eight indicators as independent variables and investigates the mechanism of the influence of spatial heterogeneity in network attention to 5A-level tourist attractions in China, with the number of Douyin's fans as the dependent variable. Regression analysis of the influencing factors is conducted using the geographic detector model, and the coefficients of the various influencing factors are ranked as follows: $A_2 > A_1 > A_3 > A_8 > A_6 > A_7 > A_4 > A_5$ (Table 5).

Based on Table 5, it can be observed that the construction of promotional platforms has a relatively significant impact on the network attention to scenic spots, while the level of Internet development has a weaker influence. Specific analysis: first, the tourist attraction promotion platform is an important channel for the attraction to communicate with the public. The public

obtains tourism information by paying attention to hot topics in tourism. Therefore, the spatial differences in its network attention have a direct impact. Second, regions with higher levels of economic development often have higher levels of tourism development, scenic spot service quality, and modernization of online operations. In these regions, scenic spots with better service experiences also tend to attract greater attention from the public online. Furthermore, the development vitality of the tourism market has a significant impact on the network attention to scenic spots. The reason behind this is generally that the level of network attention is positively correlated with the public's willingness to travel. To a large extent, the public tends to choose highly popular scenic spots to visit and engage in actual consumption activities, which in turn affects the local tourism revenue. Finally, the dependence of the attention to scenic spots on the level of Internet development is relatively weak, indicating that the Internet has a limited impact on tourists' motivation. However, it is undeniable that the popularity and accessibility of the Internet still remain as the main factors influencing tourists' willingness to travel. Moreover, the information network has become an important component of smart and digital scenic spot construction. Therefore, the level of Internet development is a progressive rather than a decisive factor.

Table 6: Results of influencing factors to interaction detection

		A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈
q	A ₁	0.095685	-	-	-	-	-	-	-
	A ₂	0.642814	0.566529	-	-	-	-	-	-
	A ₃	0.305793	0.883478	0.051246	-	-	-	-	-
	A ₄	0.168963	0.646955	0.09152	0.016032	-	-	-	-
	A ₅	0.154204	0.880848	0.058977	0.030325	0.012114	-	-	-
	A ₆	0.174978	0.736409	0.057216	0.085037	0.060038	0.01869	-	-
	A ₇	0.239621	0.879109	0.093741	0.068346	0.082278	0.051432	0.018626	-
	A ₈	0.188124	0.602224	0.088701	0.045758	0.050482	0.046473	0.043502	0.021513
re s ul t	A ₁	-	-	-	-	-	-	-	-
	A ₂	⊙	-	-	-	-	-	-	-
	A ₃	○	○	-	-	-	-	-	-
	A ₄	○	○	○	-	-	-	-	-
	A ₅	○	○	⊙	⊙	-	-	-	-
	A ₆	○	○	⊙	○	○	-	-	-
	A ₇	○	○	○	○	○	○	-	-
	A ₈	○	○	○	○	○	○	⊙	-

Note: ‘⊙’ indicates dual-factor enhancement; ‘○’ indicates nonlinear enhancement.

5.2 Interactions analysis of influencing factors

The degree of explanatory power of the interaction effect of influencing factors on the spatial layout of network attention to 5A-level tourist attractions was analyzed using geographic detectors. From Table 6, it can be observed that the explanatory power of the interaction effect of the influencing factors on the spatial distribution of network attention to 5A-level scenic spots is higher than that of single factors, indicating the presence of two effects: dual-factor enhancement and nonlinear enhancement. This suggests that the spatial distribution characteristics of network attention to 5A-level tourist attractions are the result of the combined effects of multiple factors.

In the interaction results of the influencing factors, the q -values of $q(A_1 \cap A_2)$, $q(A_2 \cap A_4)$, $q(A_2 \cap A_6)$, and $q(A_2 \cap A_8)$ are all greater than 0.6, while the q -values of $q(A_2 \cap A_3)$, $q(A_2 \cap A_5)$, and $q(A_2 \cap A_7)$ are greater than 0.85. This indicates that the construction of scenic spot promotional platforms is the dominant factor in enhancing interpretive power through interactions, reflecting the importance of developing scenic spot online promotional platforms.

6 Discussion

From the research results, it can be seen that there is a significant difference in the network attention of China’s 5A-level tourist attractions on the Douyin platform. In

terms of quantity, it mainly shows that there are fewer attractions with high network attention, and they are distributed discretely, while there are more attractions with low network attention, reflecting the uneven level of network attention of attractions. In terms of space, attractions with high network attention are more spatially dispersed, while attractions with low network attention are more concentrated. In addition, the network attention of attractions is influenced by many factors, and from this study, it can be seen that the construction of the attraction’s promotional platform has a significant impact on the network attention of the attraction.

This study, based on the perspective of short videos on Douyin, explores the spatial differences in the network attention of China’s 5A-level tourist attractions and their driving mechanisms, in order to promote the development of tourist attractions under the background of “Internet +” and “short videos.” It has important implications for strengthening the management of tourist attractions: first, the network attention of tourist attractions can to some extent reflect the degree of public attention and can indirectly predict public tourism behaviour. Second, the network attention towards tourist attractions is not only an important scale for measuring the tourism industry, but also an important part of the management of the online space of tourist attractions. “Internet + tourism” can promote innovation in the development model of tourism and can also make adjustments based on the flow of tourists and online popularity of tourist attractions, providing more precise services for visitors. This study puts forward the following suggestions:

First, improve the level of network attention to tourism. From the research results mentioned above, it can be seen that the network attention of most tourist attractions is low, and these attractions should improve the level of network attention. For example, improving the network promotion and marketing strategies of attractions, developing tourism products that meet the needs of potential tourists, strengthening the construction of network platforms, using popular platforms such as websites, and Kuaishou (short video software in China) to promote and market the characteristics of attractions, providing personalized services, and using policies such as discounts to attract potential tourists in order to enhance the level of network attention of netizens in various ways.

Second, implement differentiated marketing methods. Through the above research, it can be seen that there are significant regional differences in the attention to scenic spots on the Internet, so it is necessary to implement different promotional marketing strategies. In terms of marketing methods, it is recommended to use traditional mass media and modern Internet technology, as there are a large number of mobile users on Internet platforms. It is suggested to strengthen cooperation with major popular social platforms and current popular software to increase the exposure of scenic spots and enhance their visibility. In addition, according to the analysis of influencing factors mentioned above, it can be seen that different factors have varying impacts on tourist attractions, so it is possible to develop differentiated strategies based on the differing characteristics of these influencing factors. It is necessary to strengthen the marketing of different tourist resources, promote the characteristics of scenic spots, and introduce differentiated tourism products.

In addition, it should be pointed out that due to limitations in data availability, this study may not have fully considered certain aspects. First, the data from Douyin only reflect the level of attention for 5A-level scenic spots in a short video app, making it difficult to deeply explore the issue of network attention for 5A-level scenic spots in the entire short-video field. The comprehensiveness of future research can be further improved. Second, this study only analyzed spatial characteristics and did not compare spatial characteristics across multiple time periods, which is also a direction for future efforts. In the future, research methods can be further optimized, such as using predictive research methods. In conclusion, significantly increasing the network attention of scenic spots is an important way for many scenic spots to enhance their competitiveness in online space and to strengthen overall development; it can also accumulate potential for the sustainable and high-quality development of scenic spots.

7 Conclusion

This study analyzes the spatial pattern characteristics of China's 5A-level tourist attractions based on the data of Douyin's fans, using methods such as rank-size, kernel density, and nearest neighbor index. Furthermore, the study investigates the influencing factors of spatial differences in tourist attractions using a geographical detector. The following conclusions are drawn from the analysis:

1. From the perspective of the rank-size rule, the overall fitted curve deviates from the ideal state. The head of the scenic spots has a small number and a dispersed distribution, the middle has a large number with significant differences between them, and the tail has a large number with small differences between them. This reflects the strong spatial influence of highly ranked scenic spots and their high level of network development.
2. From the perspective of spatial differentiation patterns, it is evident that there is a clear radiating pattern from provinces such as Zhejiang, Hunan, Anhui, and Shanxi towards the surrounding areas, presenting a spatial characteristic of lower-level surrounding higher-level. Most scenic spots are primarily distributed in a scattered manner. In terms of spatial agglomeration, there is an overall spatial agglomeration characteristic of one core and one belt, which not only forms the core area of the Yangtze River Delta but also forms the core belt of Beijing, Tianjin, Hebei, Henan, Jiangxi, Hunan, and Hubei provinces.
3. From the perspective of proximity and clustering types, the concentration level of 5A-level tourist attractions exhibits a pattern of initial clustering followed by dispersion as the grade decreases, indicating a significant state of low-quality development in lower-level areas. Among them, low and lower-level attractions show a clustered distribution, while moderate, higher, and high-level attractions exhibit a dispersed distribution status.
4. From the perspective of impact factor, the ranking of the influence degree of various driving forces is as follows: the construction of scenic spot publicity platform > scenic spot marketing market > regional economic development level > tourism market development vitality > transportation convenience > regional population support > modern service industry support > degree of Internet development. The influence of the interaction between two factors is higher than that of a single factor, and it produces two effects: nonlinear enhancement and dual-factor enhancement.

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Data availability statement

All data collected and analyzed in this study can be downloaded from public databases.

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Conflicts of Interest

The authors report no conflicts of interest.

Ethics approval and consent to participate

This research is based on open-source data, so the need for ethics approval was waived.

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