Mechanism of Regional Rural Tourism Development in China Based on Geographical Perspective

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Abstract
This study employed geospatial analysis methods to examine the spatial distribution of national rural tourism characteristic villages in Henan Province and explore the factors affecting their distribution. The results indicate that rural tourism destinations tend to agglomerate within specific regions and are unevenly distributed. The geo-detector was employed in this study and found that geographical conditions, social and economic development, tourism industry development, transportation conditions, and resource endowment were the influencing factors that were highly relevant to rural tourism development and the interaction between each factor presented enhanced effects. Overall, this study provides valuable insights for policymakers and practitioners to better understand the influencing factors and mechanism of rural tourism development through geographical perspective with new methods and suggests that rural tourism development should be based on the objective foundations, improving infrastructure supply, constructing closer relationships between each influencing factors of rural tourism development to promote future development.
Keywords: Regional Rural Tourism, Mechanism, Geographical Perspective, Geo-Detector, China.

Introduction
  Rural tourism has been indicated to be a fruitful area since the early nineteenth century for the relevance of socioeconomic development (Oppermann, 1996; Quaranta et al., 2016;

Rosalina et al., 2021), Rural tourism has been indicated to be a fruitful area since the early nineteenth century for the relevance of socioeconomic development (Guan & Huang, 2022; Lane et al., 2022; Lane, 1994; Sharpley & Roberts, 2004) which is highly relevant to sustainable development goals towards the achievement of the universal 2030 (Home | UNWTO, n.d.) Rural tourism has been proven to be an effective means of addressing a range of issues such as population decline, economic changes, community regeneration, and reductions in agricultural incomes while also satisfying the mental and physical needs of society in the world and China (Deller, 2010; Xu et al., 2021; H. Zhang et al., 2021; X. Zhang et al., 2022; Zheng et al., 2022). Both developed and developing countries are interested in rural tourism development with a variety of measures to promote local development around the world. For example, in China, there are 6819 national tradition villages, and 1199 national characteristic key villages have been selected in the whole country in five batches to support rural area development, which has forced rural tourism development powerfully. And based on the foundation of national rural tourism key villages, provinces in China, such as Henan Province, have selected the provincial rural tourism key villages that reflect the local characteristics and benefits to the local rural tourism development and encourage many other villages to try to promote rural tourism, mostly focusing on economic benefits. According to the government report for Henan, about 1/3 of the villages in Henan have been developed for rural tourism. Not only in Henan province but also in the whole country.

Rural tourism is based on the countryside. Recreation grew in the nineteenth century as a response to the stress and squalor of the expanding industrial cities (Lane, 1994; Kaptan Ayhan et al., 2020a). The phenomenon of rural tourism that attracted scholars from the 1960s to the 1970s, 80s, and 90s from Europe to North America, Australia, and Asia (Guan & Huang, 2022; Bento et al., 2022; Kaptan Ayhan et al., 2020; Gartner, 2004; Lane, 1994; María Yagü Perales, 2002; Sharpley & Roberts, 2004). Scholars tried to define this phenomenon in academic vision until 1994, when Lane provided an acceptable definition of rural tourism and its characters, which has been widely referenced by the following scholars. Hence, in this study, rural tourism means that tourism is located in rural areas, in rural scale, character, and function, reflecting the differing and complex patterns of rural environment, economy, history, and location (Lane, 1994; Sharpley & Roberts, 2004; Kaptan Ayhan et al., 2020; Wojciechowska, 2022; Lane et al., 2022).

With the development of rural areas, the evolution of rural tourism has presented new characteristics and faced new challenges. Firstly, rural tourism is considered to be an important leisure platform, communication platform, and living platform (Qingfu, 2022) to younger tourists while they were seeking the real authentic with high quality of rural tourism resource supply requirements with variety of dimensions (Gao et al., 2020; Moore et al., 2021; Guan & Huang, 2022; Lane et al., 2022). More and more young people tend to travel in rural areas, which enriches the meaning of rural tourism (Lim et al., 2023). Secondly, rural tourism has a certain vulnerability that can be easily influenced by an objective environment such as a pandemic or war. For example, during the period of COVID-19, rural tourism had been negatively affected, with tourists tending to seek a safe or low-risk destination in scarcely populated areas around (Seraphin & Dosquet, 2020; Silva, 2021; Vaishar & Šťastná, 2022), The local people have become the main resource for visitors, which has important effects on the post-COVID-19 era. Thirdly, rural tourism development has already become a systematic program and a highly relevant spatial pattern with a variety of factors such as infrastructure,

tourism resources and development, local communities, local tourism industries, economic development, and so on. For example, H. Zhang et al.,(2021) indicated that many spatial factors, such as historical culture, transportation locations, economic level, and topography, primarily affect the spatial distribution of rural tourism in Portugal (Bento et al., 2022) and rural tourism development in Shaanxi, China (Xu et al., 2021).

Due to the high relevance of rural tourism to local development, scholars have become increasingly interested in researching various aspects of rural tourism. Hence, multidisciplinary research methods have been increasingly used, incorporating psychology, economics, marketing, anthropology, sociology, geography, and other comprehensive disciplines (Breiling, 2005; Kumar et al., 2022; Lim et al., 2023; Sharpley & Jepson, 2011; Wang et al., 2021; Wijijayanti et al., 2020; Zheng et al., 2022). This approach has made rural tourism research more practical and closely related to rural development. In general, previous studies have mainly focused on two extremes with three dimensions. The two extremes are the macroscopic perspective of the world and country to identify influencing factors and patterns (Kaptan Ayhan et al., 2020a, 2020b; Kumar et al., 2022; Lim et al., 2023; Sharpley & Roberts, 2004; Wang & Yotsumoto, 2019; R. Wang et al., 2021; Wijijayanti et al., 2020), and the microcosmic perspective of specific villages and towns (DING Hua, LIANG TIng, XUE Yan-qing, LI Xian-nan, 2020; Vaishar & Šťastná, 2022; H. Zhang et al., 2021; ZHU Yuanyuan, ZHOU Xiaoqi, CHEN Siyun, 2020).

To the dimensions, most research achievements about rural tourism focus on three dimensions: the construction and reconstruction of the relationship between culture and tourism, the analysis of tourism perceptions from both tourists and residents, such as experiences, satisfaction, loyalty, emotions, and authenticity (Kim et al., 2022; Ri et al., 2021; Soszyński et al., 2018; Stokowski et al., 2021); the competition and construction of tourism destinations, industrial economies, tourism marketing, service promotion, and resource development (Fesenmaier, 2017; Guaita Martínez et al., 2019; Seraphin et al., 2018; Wang et al., 2021; Yang & Zhang, 2019; Yee et al., 2018; Zeng & Ryan, 2012; Zhang et al., 2022); Community participation, tourism stakeholders, and man-land relationships are the third dimension; they both share the same platform of the land and the relationship formed based on it (Kamarudin et al., 2020; Wang et al., 2021; Zheng et al., 2022).

Rural tourism cannot be considered in isolation; it is a complex system that involves natural resources, social relationships, and various combinations. Traditional research methods in rural tourism have limitations in providing efficient support for future rural tourism development. Previous studies were too focused on the benefits of rural tourism to economic and social development from a sociological perspective. Few studies have paid attention to the foundation of rural tourism development from an underlying geographical perspective to understand the relationship between economic growth and tourism growth on regional and local levels (Bohlin et al., 2020).

Also, in those prior studies based on geographic perspectives, common methods can only reflect the presentative characteristics of spatial distribution; the interactive factors that have influenced the distribution have not yet been deeply explored. New methods, such as geo-detector (J. Wang & Xu, 2017) yet have been implied efficiently to detect influencing factors and inner interactions of different factors that are highly relevant to future rural tourism

development. Therefore, there is an emergency need for rural tourism research from a new perspective and method to ensure the high-quality development of rural tourism in a theoretical way.

The integration of geography and tourism research in regional areas is still in the early stages, especially in China. The geographical research perspective can provide a new vision for overall understanding and detecting the inner connections of different resources in rural areas and can even facilitate quantitative measurement of tourism elements. It has been promoting rural tourism studies in countries such as Spain, the UK, the USA, Portugal, Australia, Korea, and Japan (Bu et al., 2020; Deller, 2010; DING Hua, Liang et al., 2020; Kang et al., 2018; Kaptan Ayhan et al., 2020; Li et al., 2021; Ri et al., 2021; Truchet et al., 2016). However, traditional statistical analysis and model analysis rely heavily on assumptions, which may not fully capture the complexity of real-world phenomena. The geographical detector approach offers several advantages, including the ability to analyze both qualitative and quantitative data and detect interactions among multiple factors.

Geospatial perspective by analyzing the characteristics of rural tourism distribution using geographical spatial tools and identifying their influencing factors is lacking in China. While China has the second largest population with a high perception of rural populations within the third largest national territorial area in the world.

To well understand the mechanism of rural tourism development in China from a geography perspective Henan province, in the middle of China, with the highest percentage of rural population that is distributed on a variety of landscapes of basins, plains, hills, mountains, and plateaus, was the best representative of China's rural tourism development. This study uses geospatial analysis methods to analyze the geographic and spatial distribution of 424 national rural tourism-characteristic villages in Henan Province, China. The study employs techniques such as the nearest neighbor index, spatial autocorrelation, high/low clustering, hot spot analysis, kernel density estimation method, and Geo-Detector to explore the influencing factors of the spatial distribution of rural tourism. By incorporating a geographical perspective, this study aims to enrich and expand research on regional rural tourism.

Materials and Methods
Study Region
Henan Province in China is a representative region for studying rural tourism. From a geographical perspective, Henan is located in the middle of China and belongs to the transitional zone between the second and third tiers. The terrain of Henan generally slopes from west to east, with the main mountain ranges including Taihang, Funiu, Tongbai, Songshan, Dabie, and Qinling. Two of China's most famous rivers, the Yellow River and Huai River, run through Henan, with the Qinling Mountains serving as the geographical dividing line between the north and south of China.

After nearly 30 years of development, several high-quality rural tourism destinations have emerged in Henan Province. Up to 2021, Henan had achieved 205 national traditional villages, 38 national key rural tourism villages, 3 national key rural tourism towns, and 15 national characteristic towns, which account for 3%, 3%, 3%, and 4% of the same type of resources in the country, respectively. As a largely agricultural province with the highest proportion of the

rural population of more than 50 million rural people within more than 45,000 administrative villages, Rural tourism resources are 70% concentrated in rural areas; rural tourism constitutes the main body of Henan's tourism industry.

These unique geographical features give Henan Province a diverse range of natural landscapes, including mountains in the northwest, plains in the southeast, and a basin in the southwest. This rich natural landscape can cater to the needs of tourists at different levels of tourism and leisure experiences. From a rural tourism development perspective, Henan province is the best selection of regional rural tourism research areas. Rural tourism development in Henan province started in the early 1990s (Zhenbin, 2019). After nearly 30 years of development, Henan Province has seen the emergence of several high-quality rural tourism destinations, which have helped to establish the "Luan Chuan model" as a successful rural tourism development model. In 2021, Henan's rural tourism industry reached a scale of over 70 million, which is one of the largest in China. This can be attributed to China's strong and rapidly increasing demand for rural tourism.

In line with the cultural tourism integration development plan outlined in the "14th Five-Year Plan" of Henan, the province aims to build 50 rural tourism demonstration counties, cities, and districts, 200 eco-tourism demonstration townships and towns, and 1,000 villages with rural tourism characteristics by the end of 2025. The plan also targets receiving approximately 400 million rural tourists and generating a total annual revenue of 300 billion yuan (HCT, 2021). The comprehensive contribution of tourism will account for more than 12% of the province's GDP.

Data Source

This research focuses on analyzing 424 national rural tourism characteristic villages in Henan Province, which were selected by the Ministry of Culture and Tourism and the National Development and Reform Commission of China based on standards of "rich in cultural and tourism resources; the natural ecology and traditional culture are well protected; rural residential development is better; the tourism product system is mature and the quality is high; infrastructure and public services are better; the benefits of employment and prosperity are obviously."

The data used in this study was obtained from official national and provincial websites. The first portion of the data came from official documents that the Henan province's culture and tourism department (https://hct.henan.gov.cn) published online in 2020, 2021, and 2022, which announced the 424 rural tourism characteristic villages. The second part of the data includes basic geographic information data for Henan Province, such as road network data and spatial DEM data, which were obtained from the geospatial data cloud (http://www.gscloud.cn). The third part of the data includes the geographic latitude and longitude coordinates of the 424 rural tourism-characteristic villages. The last part of the data includes information about the local development in economy, population, construction, and other aspects, which mainly comes from the statistical Yearbook of Henan published online.

Methods

This study uses ArcGIS 10.8 and spatial analysis tools like the nearest neighbor index, the index of spatial autocorrelation, high/low clustering, hot spot analysis, and the kernel density

estimation method to look at how rural villages in Henan Province that are good for tourism are spread out. To process the data, Excel is used as a data processing tool. The results of the quantitative analysis are used to detect and discuss the internal interrelationships and driving mechanisms of influencing factors through Geo-Detector.

Spatial Distribution Analysis

The nearest proximity index method (Beck et al., 2019) represents the spatial distribution type and proximity degree index of point-like things. Generally, it refers to the distance between adjacent points to describe the spatial distribution mode of elements, which can be divided into uniform type, random type, and condensed type. The nearest neighbor index formula is as follows:

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

$$R = \frac{r_1}{r_E} = 2\sqrt{D} \times r_1 \qquad (2)$$

Where R is the nearest neighbor index, r_1 is the actual nearest neighbor distance, r_E is the actual nearest neighbor distance, A is the regional area, n is the number of villages with rural tourism characteristics, and D is the distribution density. When R = 1, it means that the characteristic village of rural tourism is distributed with the model. When R > 1, the characteristic villages of rural tourism are evenly distributed. When R < 1, how does it mean that the characteristic points of rural tourism are clustered?

Spatial Autocorrelation

Spatial autocorrelation (Xie et al., 2021) refers to the similarity degree of spatially adjacent points, which can be used to judge the spatial correlation of rural tourism-characteristic villages. The research on the distribution and structure of spatial agglomeration areas mainly includes distribution type, the distribution center of gravity, distribution density, agglomeration characteristics, spatial correlation, and so on. Global spatial autocorrelation refers to the similarity degree of points with spatial proximity or adjacent relationships, which can judge the spatial clustering characteristics of target points, and its expression formula is:

$$\text{Moran'I} = n \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} \sum_{i=1}^{n} (x_j - \bar{x})^2} , i \neq j \qquad (3)$$

Where X_i and X_j in this formula represent the different numbers of rural tourism villages in regions I and J, and the average value is $\bar{x}$; W_{ij} means the weight of space q, which defines the spatial relations of units in the region. N is the total sample volume of characteristic villages in Henan Province.

High/Low Clustering and Hot Spot Analysis

High/Low clustering (Fortuna et al., 2023) is a method used to identify areas with high or low values of a specific attribute or variable. It is based on statistical methods that analyse the spatial distribution of the attribute or variable of interest, and it typically involves dividing the study area into smaller subareas and comparing the values of the attribute in each subarea with those of the whole area. The technique is based on the concept of spatial autocorrelation, which states that nearby locations are likely to have similar values of the

attribute or variable of interest. Hot spot analysis typically involves using spatial statistics tools to calculate a statistic, such as the Getis-Ord Gi* statistic (Manap et al., 2019) or the Anselin Local Moran's I statistic, that measures the degree of clustering or dispersion of the attribute or variable across the study area. Both high/low clustering and hot spot analysis are powerful tools for identifying spatial patterns and understanding the distribution of a specific phenomenon within a geographic area.

Kernel Density Estimation

Kernel Density Estimation (KDE) (Bełej, 2021) can transform discrete point data into a continuous density surface to investigate the further aggregation of point data in the study area. It is a nonparametric method to estimate the probability density function of the occurrence of point sets at different geospatial locations.

$$Rn\ (\ x\ ) = \frac{1}{nh}\sum_{i=1}^{n} k\left(\frac{x-x_i}{h}\right) \qquad (4)$$

Where Rn (x) is the kernel density estimation value, The larger the Rn (x) value, the denser the distribution of point elements is, which means the denser the distribution of rural tourism characteristic villages. N represents the count of characteristic villages, and h > 0 is bandwidth. The kernel function is (x-xi), which means the distance between the estimated value point and the measurement point xi.

Geo-Detector Analysis

To further explore the factors that influence the spatial distribution of rural tourism, this study introduced the Geographical Detector Analysis (J. Wang & Xu, 2017) was developed. This model is used to identify the interactions of multiple factors with four different types of interaction models: distribution and factor detector, risk area detector, interaction detector, and ecological detector. The interaction detector is applied to analyse the interaction between influence factors, that is, to judge whether the explanatory power of the corresponding variable is enhanced or weakened when two influence factors interact with each other. The ecological detector is used to analyse the significant influence of different factors on the spatial differentiation of a phenomenon.

These models are used to detect and analyse whether the average explanatory power level of the same impact factor is significantly different between different levels and types. This study uses the geographical detector approach to comprehensively analyze the influencing factors of spatial differentiation in rural tourism development levels in Henan and investigate the relationships among these factors.

Results
Spatial Pattern
Spatial Distribution Analysis

The theoretical Nearest distance is $r_E \approx 15.170$km, and the actual Nearest distance is R1 ≈ 9.983km by using the Spatial Statistics tool Average Nearest Neighbor in ArcGIS 10.8. The Nearest neighbor index value is R=0.658037, R<1, which means that the rural tourism characteristic villages of Henan as a whole present a cohesive distribution trend.

Spatial Autocorrelation

Through Moran's I (whose value distribution interval is [-1, 1], when the value of Moran's 1 is positive and significant, inter-regional agglomeration distribution is presented; otherwise, off-line distribution is presented). (The larger Moran's 1 value is, the higher the spatial autocorrelation degree of point elements is.) Quantifying the distribution of rural tourism characteristic villages in Henan Province shows that the Moran's I index is 0.861776 (>0), Z =62.918315, p=0.00000. The values of Moran's I indicating that the spatial distribution of rural tourism characteristic villages in Henan Province shows obvious spatial autocorrelation and tends to be clustered distribution mode.

High/Low Clustering and Hot Spot Analysis

Combined with Getis-Ord Gix hot spot analysis, all provinces show a different level of cluster. And the Long Hai railway line from San Menxia to Shang Qiu can be the boundary of clusters. In these regions, there is no significant cluster presented. According to the result, the high clusters are more focused in the north part of the province, mostly distributed in the north of the Yellow River, and present characteristics near the Tai Hang mountains and along the Yellow River. Opposite the northern places, in the south of the province, low clusters tend to be distributed along the local main rivers, such as the Huai River, few distributed near the mountains (Figure 1).

Figure 1. High/Low Clustering and Hot Spot Analysis of rural tourism in Henan.

Kernel Density Estimation

As shown in Figure 2, the hot spot analysis results of rural tourism in Henan province were further verified through spatial and density analysis, which showed that rural tourism in the province can be divided into provincial core agglomeration areas and regional agglomeration areas. In the northern part of Henan province, there is a relatively high level of spatial agglomeration in the junction of northern Henan, where the rural tourism in those place shows a powerful cluster and could be a core of northern areas. In the south of the Yellow River, rural tourism with Songshan Mountain as the core is also obvious and shows a trend of expanding to the periphery. Rural tourism with Jiaozuo, Jiyuan, and other places as the main areas is developing rapidly and may connect the rural tourism cluster along Taihang Mountain with the rural tourism cluster around Songshan Mountain in the future, forming a higher level of rural tourism leisure space in Henan. Additionally, a regional spatial agglomeration of rural tourism with major cities such as Zhengzhou, Kaifeng, and Puyang as the core is gradually forming. These hot spots of rural tourism build neighboring leisure spaces for local people and cater to different needs of tourists at the regional level.
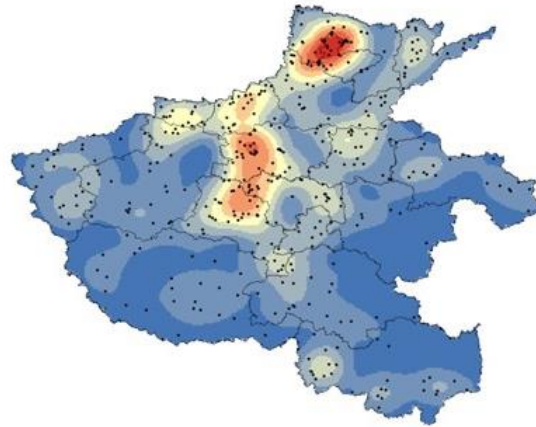
Figure 2. Kernel Density Estimation of rural tourism in Henan.

Geo-Detector Analysis

Previous studies had already indicated that geography character, economic development, infrastructure supply, tourism resources, population, tourist source and political factors have significant influence on rural tourism development (Liao et al., 2022; Yunchao et al., 2023). Hence, in this study, five main factors, including geographical conditions, social and economic development, tourism industry development, transportation conditions, and resource endowment, were selected (Table 1). Additionally, eight sub-factors were included, including slope, permanent resident population, GDP, per capita GDP, resident living standard (Engel coefficient), total tourism income, road traffic mileage, and the count of 5A and 4A scenic spots. identified. The slope reflects the geographical conditions, and the items of permanent resident population, GDP, per capita GDP, and Engel coefficient were used to represent social and economic development. 4A and 5A are representative of high-quality tourism resources; hence, the count of 4A and 5A scenic spots was selected.

Different from previous studies, this study emphasizes the local population as the main resource endowment according to the characteristics of current rural tourists, who tend to travel around their residents and pay more attention to the rural experience. The local population constitutes the main body of rural tourism. Also compared with prior studies' research objects that focused on the whole county or multiple regions, the object of this study is a single province, which means all the rural tourism destinations can obtain equal political support from the provincial government according to the management model of the Henan government. Hence, the political factor was abundant in this study.

Table 1
Construction of influencing factors of rural tourism in Henan Province.

City	GS	PRP	GDP	PCG	EC	TTI	RTM	CS
Zhengzhou	1.3659823215926	1262	12003.04	96134	0.2501	1401.1	13722	24
Kaifeng	0.0667155730270813	483	2371.83	49166	0.2356	334	9509	11
Luoyang	3.44146989244406	706	5128.36	72872	0.23228	795.4	19815	32
Pingdingshan	1.65456189345703	499	2455.84	49379	0.29113	277.73	14783	14
Anyang	1.26860513593332	548	2300.48	42185	0.24552	361.73	12992	8
Hebi	1.04268569791089	157	980.97	62736	0.25923	83.73	4639	9
Xinxiang	0.904698825854329	626	3014.51	48229	0.26187	222.31	13546	11
Jiaozuo	1.15308647523525	352	2123.6	60384	0.27227	229.94	8051	7
Puyang	0.0572633116068843	377	1649.99	13908	0.27052	35.5	6991	4
Xuchang	0.563617415942789	438	3449.23	78875	0.25601	87.5+6	10014	11
Luohe	0.0900075200737409	237	1573.88	66239	0.29222	33.9	5434	5
Sanmenxia	3.89762879922879	204	1450.71	71541	0.24317	195.1	10179	14
Nanyang	2.10969577903112	972	3925.86	40315	0.2935	227.12	40138	22
Shangqiu	0.0616267636958489	782	2925.33	37439	0.28242	49.31	24875	4
Xinyang	1.0953184736613	624	2805.68	44922	0.3478	235.9	27119	14
Zhoukou	0.0593620028942102	902	3267.19	36214	0.27984	118.4	24116	3
Zhumadian	0.5125619293931	701	2859.27	40710	0.2716	257	21770	6
Jiyuan	1.15308647523525	73	703.16	96674	0.25338	36.7	2578	3

Note : GS (Geographical condition), PRP (Permanent resident population), GDP (Gross domestic product), PCG (Per capital GDP), EC (Engel coefficient), TTI (Total tourism income), RTM (Road traffic mileage), CS (Resource endowment).
Table 2. Influencing Factors of rural tourism in Henan Province

Main factor	Sub-factor	Code
Geographical condition	Geographical slope	X1
Social economic development	Permanent resident population	X2
	GDP	X3
	Per capita GDP	X4
	Resident living standard (Engel coefficient)	X5
Tourism industry development	Total tourism income	X6
Transportation condition	Road traffic mileage	X7
Resource endowment	Count of 4A and 5A scenic spots	X8

According to the geo-detector analysis, the results indicate that the most powerful influencing factor is the geographical condition (X1), followed by resource endowment (X8), transportation condition (X7), per capita GDP (X4), total tourism income (X6), GDP (X3), resident living standard (X5), and permanent resident population (X2). Overall, the geographical condition has the strongest impact, followed by resource endowment, transportation conditions, tourism industry development, and social-economic development (Table 2 and Table 3).

Table 3
Result of factor detection through Geo-detector

Y	X1	X2	X3	X4
q	0.658062986	0.087466104	0.220394091	0.43951264
Y	X5	X6	X7	X8
q	0.180329414	0.305524071	0.444905961	0.601854989

Note：X1：Geographical condition；X2:Permanent resident population；X3：GDP；X4：Per capital GDP；X5：Resident living standard; X6：Total tourism income；X7；Transportation condition；X8：Resource endowment.

As shown in Table 4, the interaction detection indicated that there was an obvious positive and enhanced interaction between different factors, showing the effect of the combination of two factors. Among them, the enhancement effect of the combination of permanent resident population with other factors is obvious, especially the enhancement effect of the combination of geography and character. The interaction effects between geography and GDP also show significant enhancement, as well as the interaction effects in combination of transportation conditions, resident living standards, resource endowment, and total tourism income. Other enhanced effects of the interaction between factors have been found in per capita GDP, resident living standards, and transportation conditions. However, the interaction between some factors was not significant. For example, the combination of total tourism income with GDP and the permanent resident population did not produce a significant increase.
Table 4

Result of interaction detection in rural tourism of Henan

	X1	X2	X3	X4	X5	X5	X7	X8
X1	0.658062986							
X2	0.966869378	0.087466104						
X3	0.928616394	0.635334674	0.220394091					
X4	0.958605131	0.617961939	0.88333287	0.43951264				
X5	0.804752471	0.826331235	0.50053948	0.815273971	0.180329414			
X6	0.803355282	0.45157549	0.354550226	0.609019163	0.667191791	0.305524071		
X7	0.879988462	0.67972416	0.574648014	0.913918457	0.862371708	0.52097695	0.444905961	
X8	0.954782088	0.879106407	0.881775464	0.843352757	0.92280973	0.79575009	0.959774597	0.601854989

Note：X1：Geographical condition；X2:Permanent resident population；X3：GDP；X4：Per capital GDP；X5：Resident living standard; X6：Total tourism income；X7；Transportation condition；X8：Resource endowment.

Therefore, the study reveals that geographical conditions are the foundation of the rural tourism industry. Rural tourism villages are usually located on high geographical slopes, which provide rich natural scenic beauty unique to tourists. The resource endowment, representing the proximity of rural tourism villages to high-quality scenic spots, is also an important factor. Scenic spots are crucial in attracting tourists, and the quality of these spots determines the progress of rural tourism development.

While the tourism industry is related to economic development, the availability of transportation is more crucial than local social development. Accessible transportation improves the attraction of local rural tourism resources and enlarges the reception capacity of rural tourism resources. The factors of local social development and the permanent resident population are less important for rural tourism development. This suggests that rural tourism tends to attract tourists from wealthier areas rather than the locals and may have less attraction for the local society's economic development.

It should be noted that the influencing factors on rural tourism cannot be single but rather complex. The results suggest that the explanatory power of the combined effect of the factors is much stronger than that of the single factors. The way the factors interact with each other may have a double factor enhancement and nonlinear enhancement effect. This shows that the spatial differences and factors that affect rural tourism in Henan are both complex and all-encompassing. The spatial distribution of rural tourism is the result of the comprehensive action of multiple factors.

Conclusions
Geographical spatial analysis provides a comprehensive understanding of a phenomenon's distribution, and the geo-detector model allows for quantitative analysis of the interaction of different influencing factors. Using methods such as ArcGIS 10.8 spatial analysis, this study analyzed the spatial distribution characteristics and influencing factors of rural tourism development in Henan, focusing on characteristic villages. Based on the analysis, the following main conclusions were drawn:

Firstly, the characteristics of rural tourism show a cohesive distribution overall and a state of unbalanced concentration within the region. In the spatial autocorrelation analysis, the significance test showed that the spatial autocorrelation was significant, and there was significant intra-regional spatial autocorrelation. Also, the cluster level of rural tourism presents a state of being higher in the north of the Yellow River and lower in the south. Even in different regions, the distribution does show its characteristics. For example, in the north of Henan, rural tourism spots are mostly distributed among mountains and along rivers. And more likely, located along the boundary are different cities. However, in the south, rural tourism spots are not just distributed in mountains and along rivers; they are also likely distributed around cities and famous scenic spots. More reliance on high-level scenic spots has been the representative characteristic.

Secondly, the density analysis shows that a high-level rural tourism cluster has formed in Henan Province, centered around the junction of Anyang, Hebi, and Xinxiang in northern Henan, as well as the Taihang Mountain and Songshan Mountain areas in northwest Henan. Meanwhile, regional rural tourism clusters are forming around major cities such as Puyang, Kaifeng, Xinyang, and Pingdingshan. Overall, rural tourism spots show a clear distribution pattern along the mountains (including Taihang Mountain, Songshan Mountain, Funiu Mountain, and Dabie Mountain) and rivers (including the Yellow River and the Huai River).

Thirdly, the factors that influence rural tourism in Henan Province are ranked from strong to weak as follows: geographical conditions, resource endowment, transportation conditions, tourism industry development level, and local social and economic development level. According to the analysis, natural factors have a significant impact on rural tourism development and local, top-notch tourism resources are crucial. With the transformation of domestic tourism, the effect of transportation conditions on the expansion and promotion of rural tourism attractions is becoming more and more significant. Improved transportation conditions can reduce the distance between rural tourism destinations and tourist sources and enhance the accessibility of tourist destinations. Since the permanent resident population shows significant enhancing effects with other factors such as GDP, per capita GDP, resident living standard, total tourism income, transportation condition, and resource endowment, This factor should pay attention to future rural tourism development. Therefore, the interaction between different factors with a variety of dimensions should be paid attention to during the process of rural tourism development.

Discussion

Firstly, rural tourism in Henan displays a significant spatial agglomeration characteristic, which provides the necessary conditions for the large-scale and high-quality development of rural tourism. Therefore, building a multi-level rural tourism and leisure supply system with high-quality rural tourism and leisure resorts as the core and rural tourism and leisure resorts around the city as supplements will become the future trend of rural tourism development. This approach can better meet the diverse tourism and leisure needs of residents.

Secondly, rural tourism development in Henan presents a high relationship with tourism resources, which play a fundamental role in the development of rural tourism. However, most rural tourism destinations are currently distributed along specific physical and geographical

landforms, limiting the equalization and diversification of rural tourism distribution to a certain extent. Rural tourism distribution shows a high dependence on high-quality tourism resources. Rural tourism destinations are mostly concentrated around high-quality tourist attractions, and many are rural tourism clusters dependent on scenic spots. The development of these clusters is often closely related to the development of core scenic spots, leading to a lack of their own core tourism attractions and limiting the development of rural tourism.

Thirdly, the foundation of rural tourism development should be understood clearly while proceeding with rural tourism programs. Local economic development, like the scale of GDP and the level of resident living standards, is the fundamental economic basis. The permanent resident population and transportation conditions are closely linked to the resource endowment. For instance, convenient transportation conditions help to strengthen the connection between rural tourism destinations and tourist sources, thus improving the accessibility and tourist reception capacity of rural tourism destinations.

Overall, the study's findings have important implications for rural tourism development in Henan Province and beyond. By understanding the factors that influence rural tourism development and the spatial distribution of rural tourism destinations, policymakers and tourism practitioners can develop more effective strategies to promote sustainable and inclusive rural tourism development in the region. Such as making efficient use of the local natural geographical conditions and advantages of tourism resources. Directing rural tourism construction to the residents at the same time while trying to attract visitors. Strengthen the construction of infrastructure, further enhance the location advantage, and improve the attraction and radiation range of rural tourists, closely combined with the local social and economic development.

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