The Research on Spatial-temporal Characteristics of Tourist Flow in Lanzhou Based on Sina Microblog Big Data

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Keyword: Microblog, Checkin Data, Spatial-Temporal Characteristics of Tourist Flow, Lanzhou

Abstract: Along with the popularization of e-commerce, the wide use of smart mobile devices and the social networking activity is increasingly frequent, social network location service information represented by the microblog has increased gradually and also provided new data sources and perspectives for the study of spatial-temporal characteristics of tourist flow. In accordance of Sina Microblog LBS (Location-based Service) checking data, the paper applied kernel density estimation method offered by GIS to research the space-time characteristics of Lanzhou city tourism flow from the dimension of time and space (season, time and region). The Results show that: Seasonal variation of tourist flow is obvious, there exist great differences in winter half year and summer half year, the double peaks’ feature is outstanding; April and June to August are all peaks. In the spatial density, it has the typical structural feature, which manifest as core-periphery structure features. From the first and fourth quarter to the second and third quarter, tourism activity expresses the situation which spread from the urban area to rural area. And the winter half year and the summer half year in special period are clearly convergent and divergent. In time period, tourist flow presents the skewed pyramid structural feature. It will reach to the summit from 11:00 to 13:00; tourism activities are throughout the most of scenic spots in Lanzhou from 11:00 to 18:00; and tourism activities are restricted to the main urban area and newly added district where have good tourist accommodation reception facilities from 19:00 to 10:00 at the next day. The turnout of females is more than males, at the same time, female tourists often fasten on main city, and male tourists prefer the suburban forest parks where they can go on rich outdoor activities, which reflecting the tourism time’s preference about gender. Tourists inside the province mainly trend to main cities’ scenic spots in the choice of tourism space, but they also have a definite preference about peripheral area’s tourist resources; while foreign tourists mainly fasten on main urban area and some strongly recommended areas. From the view of tourism flow activities track, it shows up the obvious “axis-point” position. Main urban area is the highly gather palace about tourist flow. Attracted by strip urban morphology of river valley, e-w trending backbone network and main scenic spots, it leads to the tourist flow have an obvious axis distribution character in space, among which Lanzhou Yellow River Scenery Line is the highly collective space area for tourists. Most of tourists’ behaviors trace acts as: Zhongshan Bridge-Baita Mountain Park-City God Temple-The Yellow River Mother Sculpture-Waterwheel Museum Park. However, in external zone, because of the lack of tourism traffic route and the highly scattered scenic spots, the tourism activity trajectory represents the clear character of scatter. Neither main urban area nor external zone forms the closed tourist circle.

Introduction

Along with the popularity of “Internet +”, the widespread use of mobile devices and the increasing of social networking activity, the data is exploding at an unprecedented speed, the rapid development of the era of big data and the arrival of LBS service produced before some massive high precision and wide range of data. It not only has a profound impact on the change of economic system and human society, but also the reconstruction of the global real space and virtual space structure [1].
According to the 35th survey report of the CNNIC (The China Internet Network Information Center), it shows that the number of China's Micro blog users reaches 249 million, the use rate of Internet users approach 38.4%, of which the number of mobile phone micro blog users reaches 171 million, the utilization rate approach 30.7% [2], the number of Sina Weibo month active users (MAU) reaches 1.98 billion in March of 2015, and the number of daily active users (DAU) reaches 89 million[3]. Sina Weibo is one of the most influential and representative social tools, especially the development of location-based services LBS applications, has become an important way to acquire information of geographical space. Tourist flow is the foundation of tourism activities and tourism infrastructure, it has become a tourist system central nervous system and the link for connecting tourist source and tourist destination[4]. Such research mainly focus on the tourism flow pattern[5-7], spatial-temporal characteristics of tourist flow [8,9], tourist flow driving force[10,11], displacement dynamic prediction research[12,13]. Currently studies on tourism base on Weibo are quite few. This paper using sina weibo data collected a year of tourists LBS sign in lanzhou city, with the help of kernel density function to analyze the characteristics of lanzhou city tourist activity space, hope that through the introduction of LBS sign-in data in such aspects as tourism research method, the analysis of characteristics of space provides guidance for lanzhou city tourism development planning.

Researched Area

The research scope in this paper covers lanzhou city district scope, including six districts and three counties, with a total area of 13085.6 km$^2$.

Lanzhou is located in the geometric center of the mainland territory. It is the marginal area of Qinghai-Tibet Plateau, Inner Mongolia Plateau and the Loess Plateau, and also transitional area of China Eastern Monsoon Region and the northwest Non Monsoon Region. Rich tourism resources and products are attract more and more tourists. In 2014, the number of tourists in the city break through 33.9109 million person-time, average annual growth of 30.13%;Tourism revenues exceed 26.8 billion yuan, with an average annual growth of 30.22%.

The Sources and Processing Methods of Data

This paper takes Sina Weibo users attendance data as research object, with the advantage of open platform of sina weibo and “locomotive” data collector, on the basis of structure analysis, combined with the design data acquisition rules needed for the research topic, by searching the lanzhou tourism keywords get the complete data flow. The data acquisition time is from September 1, 2014 to August 31, 2015, covering the whole year. In the specific data, according to the need of study, the Sina public platform can provide relevant data eventually collected user information (location, gender), user attendance data (check-in time, longitude and latitude) and user sign in content elements, collecting a total of 3416 attendance data.

In the specific course of the study, first of all we need to convert baidu open platform LBS address information into latitude and longitude coordinates, and then collect coordinate data into ArcMap on its properties prepared and spatial matched, GIS platform can use location data conversion and Lanzhou City administrative divisions association graph matching. Spatial distribution characteristics and visual expression methods using GIS spatial analysis tool of kernel density estimation method.

Spatial-temporal Characteristics of Tourist Flow

The collecting attendance data stratified by time, “longitudinal” decomposition followed by 12 monthly and quarterly data, stratified by time of “horizontal” extraction to 4h for some period of time will be a natural, decomposition 23:006:00, 7:0010:00, 11:0014:00, 15:0018:00, 19:0022:00 a total of 5 time. Similarly to the 3416 valid sign in place time properties have also been “horizontal”
Tourism Flows Have Obvious Spatio-Temporal “Seasonal” Changes

Tourism flow pattern has an obvious seasonal change in summer half year and the winter half year. April to October is the peak season for tourism. Tourism flow spatio pattern has obvious spatial convergence and divergence characteristics winter segregation in “city”, summer spread to the suburb. Leading tourism products and tourism conditions (especially climate conditions) is the key factors which the spatio-temporal pattern of formation of “cohesion” and “tension”.

Tourism flow showed the “twin peaks” features. The first peak of tourists appear in April, the second peak appeared in July -August, it is consistent with national legal holidays.

The tourism flow has obvious spatial distribution imbalance, spatial convergence and divergence of effect is apparent(Fig.1), the core (Main city) - edge (Outlying suburbs) characteristics significantly. In the first and forth quarter, the tourist flow mainly concentrated in the main urban areas of Chengguan District, Qilihe District, Anning District and Xigu District, but in outlying areas, except Lanzhou New District and the district Xinglong Mountain in Yuzhong County have a small amount of the distribution, the rest are belong to blank area, it is closely related the Lanzhou tourism climate and scarce winter tourism projects . The second and third quarter as temperatures rise, the number of holidays and the arrival of the tourist season, frequent outdoor recreation, tourism flows from the city to the surrounding rural areas and scenic spots gradually spread. Urban climate on the “heat island” gradually cooling, rural tourism products become gradually pursue outdoor choice for travelers.

Despite of the high density districts of tourist flow were gathered in Main city, there are some differences between the four administrative districts of the aggregation intensity, tourist attractions and tourism service facilities of the Chengguan District gathered is the highest, which was highly segregated in the distribution area of famous scenic spots (Lanzhou Yellow River Bridge, Wuquan Mountain, Baita Mountain, Waterwheel Garden, Zhangye Road Pedestrian Street, Zheng ning Road Snack street); Qilihe District mainly segregated at the Yellow River Mother scenic spots; Anning District due to the influence of area conditions, and more suburban “Nongjiale”, in the summer half year, attracted a large number of tourist flow, relative to industry the main function of Xigu District, the tourism resources and environmental constraints is one of the few areas of tourist flow.
Tourism Flow Time Change.

Within a day, from 5:00 start, travel activity gradually increased, the period of 11:00 to 13:00 reached the peak, but in 14:00 to 21:00 basic remain stable state, 23:00 to 6:00 period of tourism activities in the dormant state.

Based on kernel density method 5 times tourist flow distribution basically comply with the overall characteristic of the “core-periphery”. From 23:00 to 6:00 tourist activities mainly concentrated on Chengguan District, Qilihe District, Anning District, Xigu District, Lanzhou new district. From 7:00 to 10:00 tourists gradually to the surrounding attractions in the District of Lanzhou in diffusion of high density, it is related the tourists in the city of accommodation for visitors to choose the aircraft transport. From 11:00 to 14:00 and 15:00 to 18:00 tourism flow changes to the most obvious point appeared in the peripheral Lutusi Yamen Scenic, Tulugou Scenic, Shifogou National Forest Park, Xinglong Mountain, which shows a significant attraction in the outskirts of the city the main tourist attractions. From 19:00 to 22:00 tourism activities mainly distributed in Chengguan District, especially in the Zhengning Road snack street, Xiguan cross, Public ane, Farmers lane.

Different Characteristics of Tourist Has Differentiated Tourist Preferences

According to the tourist properties will be divided into four different attributes: male and female tourists, Gansu tourists and foreign tourists. From the gender perspective, the number of women is slightly more than the male attendance number and with the arrival of the tourist season in the higher proportion of women.

In the tourist season choice, both male and female showed a typical “Sawtooth” volatility characteristics (or” double peak structure “). The travel peak appeared in April and August, the other seasons is obviously insufficient. The time from8:00 to 13:00 is mostly a women's frequent periods of traveling, relatively less volatile men. The male tourists tourism activities are mainly distributed in the urban area and the surrounding rural tourism; female tourists mainly concentrated in the main urban areas. The reason is the male tourists prefer outdoor activities and female tourists prefer leisure shopping.

Gansu tourists prefer the spring peak in April, a small peak in October, outsiders prefer summer, a small peak in May, reached peak at 7-8 months of travel. In the 5 periods of the day, gansu tourists prefer morning and the sign appeared a peak at 8:00-9:00, while outsiders tend to the afternoon and night, the leisure tourists and local morning activities. The reason is the local tourist leisure activities on the morning.

Tourist Track Has Obvious “Core-Periphery” Structure

For the exit flow mainly went to the Hexi Corridor(Dunhuang, Wuwei, Zhangye is the first choice), but to the East (Xi’an) and West (Xining, Qinghai, Gansu Xiahe, Linxia) and South (Jiuzhaigou) flow is very little. This is the future oriented of Lanzhou that highly concerned about the regional tourism cooperation.

Lanzhou city tourism flows have significant spatial feature of the axis(Downtown)-point (periphery). The tourist flow mainly concentrated in urban areas while the periphery area of tourist attraction is obviously insufficient. Main urban area is the highly gather palace about tourist flow. Attracted by strip urban morphology of river valley, e-w trending backbone network and main scenic spots, the tourist flow is lead have an obvious axis distribution character in space, among
which Lanzhou Yellow River Scenery Line is the highly collective space area for tourists. Most of tourists’ behaviors trace acts as: Zhongshan Bridge-Baita Mountain Park-City God Temple-The Yellow River Mother Sculpture-Waterwheel Museum Park. However, in external zone, for the lack of tourism traffic route and the highly scattered scenic spots, the tourism activity trajectory represents the clear character of scattering. Neither main urban area nor external zone forms the closed tourist circle.

Conclusions and Policy Suggestions

To make an empirical research on the Lanzhou city tourism spatial and temporal characteristics this paper starts from the introduction of sina Weibo LBS sign data. The results show that: In different seasons, different time scales, different tourists attribute different spatial characteristics of tourist flows. Seasonal variation of tourist flow is obvious, there exist great differences in winter half year and summer half year, the double peaks’ feature is outstanding; April and June to August are all peaks. It is because Lanzhou belong to the temperate continental climate(Four distinct seasons, Summer cool and rainy, cold and dry in winter) that different quarter tourist activities distribution appears obvious difference. In the second and third quarter tourists travel rate is higher because of the good weather conditions, the tourist attractions in a year in the best time to visit, tourism relates to the various parts of the tourism resources in Lanzhou City. Lanzhou winter tourism products lack of tourism activities in the first and fourth quarter is limited to the area of the winter tourism products development with the main city of Xinglong mountain, Anning District ski. In time period, tourist flow presents the skewed pyramid structural feature. It will reach to the summit from 11:00 to 13:00; tourism activities are throughout the most of scenic spots in Lanzhou from 11:00 to 18:00; and tourism activities are restricted to the main urban area and newly added district where have good tourist accommodation reception facilities from 19:00 to 10:00 at the next day. Climatic conditions and holidays are important factors affecting the temporal and spatial variation of tourist flow. Different tourists' attributes and tourism flows spatial and temporal characteristics also have certain difference because the male tourists prefer outdoor activities and female tourists preference for leisure shopping, the number of female tourists attendance is more than male tourists, and female tourists mainly concentrated in the main urban areas; male tourists tourism activities are mainly distributed in the urban area and the surrounding rural tourism. Tourist activity characteristics of tourists in the province and other regions also showed obvious difference, the number of tourists in the province sign peaked in April with a small peak in October, other regions tourists in may appear small peak and the tourism peak appeared in July and August. It is because climate is a small difference in the tourism resource of homogeneity larger, other regions and Lanzhou climate differences larger tourism resources heterogeneity between areas of the province is obvious. In the 5 periods of the day, Gansu tourists prefer morning and the sign appeared a peak at 8:00-9:00, while outsiders tend to the afternoon and night. Tourists in the province in the choice of space tourism mainly tend to urban areas of tourist attractions but the peripheral tourism resources also have certain preferences and outsiders mainly concentrated on urban areas and recommended a higher degree of scenic spots, which attribute to Lanzhou peripheral regional tourism resources and product visibility is low, for the lack of leading products.

The tourist flow has shown the spatial and temporal characteristics, the reason is that the current development of Lanzhou tourism resources and products supply can't meet the demand, and line design is not reasonable. It should attach great importance to the following problems in the process of tourism development in the future:

(1)How to overcome the defects of tourism seasonality. The off-season tourism development of new tourist entertainment products focus on the development of resources and facilities in the multi-functional advantage of off-season, make it play a role to balance the peak difference, to extend the season. The second reasonable arrangement of tourism festivals, cultural celebration of music, arts and entertainment, sports, business forum can put a hold in the off-season without a strong seasonal festivals, in order to promote off-season, extend the season effect. Third, strengthen the development of cultural tourism products.
(2) How to improve the defects of lack of night tourism products. First, in the setting of tourism projects attention the shape of the night landscape attaches great importance to the night landscape scenic and vice King collocation focused in different regions. The set has a different theme night landscape. Second, focus on building projects for night travel service products. Third, construction of Lanzhou city night tourism leisure zone, the spatial pattern of development has become the first-line multi nuclear night tourism circle.

(3) The new discovery and exploitation of tourist market. The future focus of Lanzhou city tourism market development and promotion should be displaced to developed economy, tourists gathered in the Beijing Tianjin Tangshan region, Yangtze River Delta and Chengdu Chongqing region not near the Qinghai and Shaanxi.

Acknowledgments

This research is funded by the Natural Science Foundation of China (41261042) and the Natural Societal Science Foundation of China (14BSH029).

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