Research Article

Tourism Destination Image Perception Model Based on Clustering and PCA from the Perspective of New Media and Wireless Communication Network: A Case Study of Leshan

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Received 15 January 2022; Revised 8 February 2022; Accepted 9 February 2022; Published 15 March 2022

Academic Editor: Xin Ning

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The consistency of tourists’ perceptions of a destination and the public’s evaluation of that perception is the foundation of destination image construction. In this paper, the principal component analysis method is used to analyze the tourism competitiveness of Leshan based on the wireless communication platform, and the obtained multisource geographic data are clustered according to the theme, using LDA (latent Dirichlet allocation) document theme generation model and topic clustering technology of K-means clustering algorithm. The hot events and hot topics that tourists care about in scenic spots are quickly extracted during the time span of this study. The model shows that tourists’ destination image perception is an important antecedent variable of tourists’ behavior intention, and perceived value and local attachment are two important intermediary variables. As for the overall effect of tourists’ behavior intention, tourists’ destination image perception has the greatest effect, followed by perceived value, and local attachment is the smallest.

1. Introduction

Since the reform and opening up, with the continuous improvement of people’s living standards, China’s tourism and related industries have developed rapidly and have become an important component of modern service industry, accounting for an increasing proportion of the national economy [1]. However, with the development of tourism, the competition among tourist destinations has become more intense, and the perception of tourists’ destination image has become more important. The destination image has become another important consideration beyond the factors such as travel distance, travel time, transportation mode, and travel cost [2, 3]. Many documents show that tourists’ destination image perception affects tourists’ individual cognitive characteristics, tourists’ behavior characteristics, and destination selection strategies. However, carefully examining the existing achievements, the author found that in this field, a large number of studies still remain at the level of countermeasures, while the theoretical research results are not sufficient [4]. Leshan focuses on deepening the tourism reform, actively building the top ten cultural tourism destination brands, strengthening the construction of tourism infrastructure and public service facilities, and promoting the transformation and upgrading of tourism [5].

A tourist destination is traditionally thought of as a distinct geographical area, such as a country, an island, or a city [6], but it can also be viewed by visitors as a tourism marketing and planning management entity that enforces policies and laws [7]. At the same time, the destination can be a perceptual concept, which consumers can subjectively understand depending on their travel route, cultural background, tour purpose, educational level, and previous experience [8]. The impression of scenic spots and the choice of travel destinations are influenced by tourists’ destination image perception information [9]. These contents of other tourists’
evaluations will have a direct impact on potential tourists’ travel plans [10], such as consumption plans, plans for activities to participate in, and the overall journey schedule. Most online travel notes reflect tourists’ true feelings about people, scenic spots, behaviors, product evaluations, and services, among other topics. Their free, open, and shared qualities can accurately reflect tourists’ perceptions of destination images [11]. However, most research currently focuses on the national and inter-provincial levels, with little research on the competitiveness of tourism destinations in different cities across the province, particularly evaluation research on the competitiveness of tourism destinations in Leshan prefecture-level cities.

In recent years, image perception [12] has become a research hotspot, which means that the construction of tourist destination image perception should not only attach importance to foreign tourists but also attach importance to the perception and evaluation of local residents. In the construction of index system, most scholars focus on the development level of tourism, basic facilities, tourism resources and environment, economic and social development level, etc., and seldom involve the analysis of tourism-related enterprises. However, in quantitative research, the analysis methods mostly focus on principal component analysis, cluster analysis, entropy method, and so on. In the existing literature, there is relatively little research on Leshan tourism, and there are few studies from the perspective of the county. This paper uses Leshan tourist destination as an example and simultaneously uses the internal and external public as the research object, quantitatively measuring the destination image perception of foreign tourists and Leshan locals. We can grasp the cognitive differences between domestic and foreign publics on Leshan tourism destinations using principal component analysis and other methods and further explore the causes of their cognitive differences, in the hopes of providing a foundation for Leshan to build a unified and unified tourist destination.

2. Related Work

Tourism image is the subjective impression and feeling formed by the external environment of the tourist destination acting on the tourists’ brains, according to literature [13], and it is one of the most important factors in the tourism behavior process. [14] Bibliography tourists will correct their perceived image based on real entities participating in tourism activities, according to research, and then form an impression of the tourist destination. This demonstrates that tourist destination image building is a long-term and ongoing process, with the end result affecting tourists’ tourism evaluation, satisfaction, and loyalty. According to literature [15], the scientific planning, soliciting opinions, brand identification, and publicity steps should be followed when positioning tourism brands [16]. According to the data, China’s tourism industry’s Internet penetration rate surpassed 10% in 2015, signaling the industry’s entry into a new stage of internetization. Tourist satisfaction and experience are important factors affecting the competitiveness of tourist destinations, according to literature [17, 18]. Simultaneously, some scholars believe that the method for constructing the index system should not be too subjective, and that the evaluation index system should be based on the diamond model [19, 20].

This paper holds that tourists’ destination image perception is a comprehensive concept, which is the sum total of impressions on various elements of tourist destination. It is the general, abstract, and generalized cognition and evaluation of the general quality level and characteristics of the tourist destination by the public, the intangible value to promote the internal and external spiritual values of the region, and a rational representation of the reality of the tourist destination. Literature [21] has systematically analyzed the regional differences and dynamic changes of China’s tourism development by econometric analysis method. The results show that the relative differences of regional tourism income in China are gradually decreasing, but the absolute differences are expanding. Literature [22] comprehensively and quantitatively evaluates the development quality of China’s tourism industry from five aspects: product quality, environmental quality, factor quality, industrial growth mode, and industrial operation quality. Literature [23] analyzes the relationship between inbound tourists, domestic tourists, total tourism revenue and time, and per capita national income in China’s tourism industry by using regression analysis and holds that there is a significant positive correlation between the three major tourism economic indicators and time and per capita national income. Literature [24] defines tourist destination image perception as tourists’ impression of their unusual place of residence. Literature [25] holds that tourists’ destination image perception is an individual’s cognition, impression, prejudice, emotion, and so on to a specific place. Cognitive factors refer to the tourists’ cognition and belief in the destination; emotion is the tourist’s feeling and emotional response to the destination. Intentional factor is the behavior of tourists, which is a kind of current consumption behavior, that is, tourists’ intention and specific tourism behavior. Literature [26] further studies the formation factors of tourists’ destination image perception, which include advertisements, news, popular culture, information obtained from relatives and friends, and their own real visits. Scholars have made a comprehensive summary of the formation stages and influencing factors of tourists’ destination image perception, but the specific division is general and there is no solid theoretical foothold.

3. Research Method

3.1. Spatial Cognition and Spatial Structure of Tourist Destination Image. Regional research has evolved into a regional school of geography, and it has a long and important history in geography. Geography, according to the regional school, is a science concerned with regional differentiation. Geography is the study of the earth’s surface’s regional differentiation characteristics, with the region as its research focus [7]. The phenomenon of regional differentiation of geographical environment occurs when the entire geographical environment and the characteristics of its components are divided in a specific direction, resulting in the
formation of multi-level natural regions. Tourist destination is a typical geographical space that serves as the objective object of tourist destination image perception. As a result, the two laws of geography—the law of regional differentiation and the theory of spatial hierarchy—are certain to have a significant impact on the creation and evolution of tourist destination images. The two main perspectives and fields of local sense research are local experience and local feelings formed between people and specific places. People’s emotional evaluations of specific places and emotional attachment are the main components of local emotions [25]. The image of a tourist destination is inextricably linked to a sense of place (see Figure 1). The sense of place is the foundation of tourist destination image planning and interacts with the image of the destination.

On the one hand, the social image comes from the superposition of individual image and collective image. However, on the other hand, social images will also be influenced by induced images, which can be divided into images guided by tourism agencies and mainstream media and images influenced by history, legends, and allusions. Tourists’ impression of tourist destination largely depends on the “image” of tourist experience, that is, the tourists’ personal feelings at present. Therefore, according to the terminology relation and category logic established in this paper, tourist destination image only exists in individual image, so there is no collective image or social image. After experiencing the tourism experience, tourists have a deep perception of the destination image, which is accumulated as a positive or negative impression of the destination.

Measuring dimension is another important component of assessing tourists’ perceptions of a destination. What to measure and what to measure are the attributes or characteristics of which components of the destination image are measured in the measurement dimension. One believes that image influences perception, while the other believes that image shapes attitude. Scholars who believe that images affect perception tend to prioritize destination attributes in the destination image measurement dimension. When the research results of measurement dimensions of destination image at home and abroad are combined, it is concluded that whether the image is based on cognition or attitude may result in different measurement dimensions in actual measurement, but the research shows that the view that the destination image includes both cognitive and emotional components is in the mainstream. The spatial distribution patterns of tourists at different spatial scales are studied with the help of nuclear density analysis using Weibo data with location attributes sent by Leshan tourists. Kernel density analysis is a technique for converting discrete points in space into a grid density map, which is widely used in density mapping and hot spot detection [16, 17]. The following is the formula:

$$f(s) = \sum_{i=1}^{n} \frac{1}{h^2} k\left(\frac{s - c_i}{h}\right), \quad (1)$$

where it represents the distance attenuation threshold, $n$ represents the number of elements with the distance $s$ less than $h$, and $k$ represents the spatial weighting function. The geometric meaning of this equation is that the density value decreases with the increase of $c$ distance. When the distance reaches $h$, the density decreases to 0.

Cognitive map is an “abstract substitute” for cognitive environment (space) in mind after people acquire spatial information through various means, also known as "mental map" [10]. Tourism destination image is the perception of tourism subject and its stakeholders to the special geographical environment and space of tourism destination. Spatial perception is an organic part of tourism destination image, an internal description or understanding of the relationship between structure, entity, and space, and an internal reflection of space and thought.

The emotional intensity of tourists is quantified in this paper by calculating the emotional score of comment data. In Chinese grammar, adverbs are used to restrict or modify verbs and adjectives. Among them, adverbs of degree are important factors that influence emotional tendency in this study, as they can significantly enhance or weaken emotional tendency, and adverbs of degree have a high probability of appearing in travel commentary texts with emotional tendency. When negative adverbs are used to modify emotion, the meaning of the emotion is frequently reversed. Analyzing and judging the text’s emotional tendency solely on the basis of the polarity of emotion words will lead to errors in the analysis and judgment. After adding the weight, the formula for calculating the emotional score is as follows:

$$S = \frac{\sum_{p=1}^{N_p} wp_i + \sum_{n=1}^{N_n} wn_i}{N_p + N_n}, \quad (2)$$

where $S$ stands for the final emotional score of comment information, $p$ stands for positive emotional words, $n$ stands for negative emotional words, $N_p$ is the number of positive emotional words, $N_n$ is the number of negative emotional words, and $w$ stands for the weight of degree adverbs.
3.2. The Construction of Leshan Tourist Destination Image Perception Model. The concept of tourist destination image perception is very complicated. Individuals should not only consider their own knowledge and beliefs about various attributes of tourist destinations but also consider their overall memory and expression of emotions. Tourists’ understanding or belief in a particular attribute of a tourist destination is called cognitive image, while emotional image depicts tourists’ emotions or feelings about various characteristics of the destination [12], and overall image refers to people’s overall impression of the destination [13].

Most tourist destinations in China are currently highly homogenized in terms of products and services, making it difficult to meet tourists’ novelty-seeking psychology and personalized needs, resulting in a low rate of repeat visits. Maintaining a good relationship with the old tourist market costs far less than opening up a brand-new tourist market for tourist destinations in the mature stage of development. In terms of emotional image, tourism destination managers should pay special attention to the development of related service items that can demonstrate humanistic care for visitors, making them feel valued. The external publicity of tourist destinations can be promoted through cognitive and emotional aspects, in order to improve the overall image and, ultimately, improve tourists’ revisiting behavior. The external economic conditions and infrastructure conditions of tourism activities are covered by regional economic and social development. Regional GDP per capita is a key indicator of the level of economic development in a region. The development of tourism is dependent on the development of the regional service industry, and the scale of development of the tertiary industry in the three industrial structures is the foundation of the service industry’s development. At the same time, the level of tourism infrastructure construction and economic development is reflected in regional transportation infrastructure construction.

Principal component analysis (PCA) is a method to explain most of the variables in the original data by using fewer variables through linear transformation, that is, a large number of highly correlated variables are transformed into a few independent or unrelated main variables, and the original variable information is kept as much as possible.

The steps of principal component analysis in this paper are as follows:

(1) Standardize and test the selected index data
(2) Carry out principal component analysis to obtain the initial eigenvalue and cumulative contribution rate of the matrix, and extract the principal component according to the principle that the eigenvalue is greater than 1
(3) Calculating a feature vector matrix according to the factor load matrix

Calculating the scores of each principal component according to the eigenvector matrix. The weight is the proportion of variance contribution rate of each principal component, and the weighted comprehensive evaluation model is

$$F = \sum_{i=1}^{k} W_i F_i (i = 1, 2, \cdots, k).$$

Among them, $F$ is the score of comprehensive component, $W_i$ is the weight of principal component $i$, and $F_i$ is the score of principal component $i$.

(1) According to the scores of each principal component and the corresponding weights, the economic radiation capacity of each district and county is calculated and ranked by using the weighted comprehensive evaluation model.

According to the evaluation scores of the competitiveness of tourist destinations in each city, taking the square Euclidean distance as the measurement standard, and using the cluster method of inter-group connection, Leshan Mountain Scenic Area is divided into different types. The formula of Euclidean distance is

$$D(x_i, x_j) = \sum_{i,j} (x_i - x_j)^2,$$

where $D(x_i, x_j)$ represents the distance between $i$ city and $j$ city, $x_i$ represents the tourist destination competitiveness score of $i$ city, and $x_j$ represents the tourist destination competitiveness score of $j$ city.

Clustering analysis is the process of categorizing physical or abstract sets into multiple classes made up of similar objects, with the goal of having high data similarity within each class. Cluster analysis is now widely used in a variety of fields, including pattern recognition, data analysis, image processing, and market research. Clustering analysis algorithm allows scattered scenic spot data to be clustered into several clusters based on natural scenic spot attributes, and then each cluster can be analyzed to achieve the best tourism planning scheme. $K$-means is a clustering analysis method [18]. For data set \{a_1, a_2, \cdots, a_M\} to cluster into $M$ clusters, each cluster $a_m$ has a centroid. If there is a centroid in $\mu_k$, the centroid distance is defined as $\mu_k$, $k = 1, 2, \cdots, K$. The $K$-means clustering formula is as follows:

$$J = \sum_{m=1}^{M} \sum_{k=1}^{K} \frac{r_{mk}}{m_k} ||a_m - \mu_k||^2,$$
where \( r_{m,k} \in [0,1] \) represents the Euclidean distance between \( a_{m,k}, \mu_k \), and the smaller the \( J \) value, the more compact the data objects in the cluster.

In this paper, the LDA (latent Dirichlet allocation) text modeling model [22] is adopted, first, the prior distribution of \( \theta, \phi \) is obtained, then the Gibbs sampling method is used to infer the \( \theta \) distribution, and the probability distribution \( \theta \) of LDA’s “document-subject” is used as the vector of each comment information to establish the vector space, and finally, the \( K \)-means text clustering method is used to cluster, and the process is shown in Figure 2.

Scenic spot clusters and their variable attributes can be expressed by the following matrix:

\[
X = \begin{bmatrix}
X_{11} & X_{12} & \cdots & X_{1n} \\
X_{21} & X_{22} & \cdots & X_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
X_{m1} & X_{m2} & \cdots & X_{mn}
\end{bmatrix},
\]

(6)

where \( X_{mn} \) represents the \( n \)-th attribute of the \( m \)-th scenic spot.

If you want to weight the attributes, you can get the general expression of the measure:

\[
D(c_i, c_j) = \left( \sum_{k=1}^{n} |a_{ik} - a_{jk}|^r \right)^{1/r}, \quad r \geq 1,
\]

(7)

where \( c_i, c_j \) is case \( i, j \), \( a_{ik}, a_{jk} \) is the \( k \)-th attribute of case \( i, j \), and each case has \( n \) attributes. When \( r = 1 \), we get Manhattan distance function, and when \( r = 2 \), the Euclidean distance function can be obtained.

4. Results Analysis and Discussion

Because tourism has a distinct off-season, the natural landscape will change dramatically with the seasons. A popular event may only appear for a limited time, and tourist interest in the same event may fluctuate accordingly. This paper selects four representative events and displays them visually with Matlab software, as shown in Figure 3, in order to understand the changing characteristics of tourists’ attention heat over time and analyze the changing ways of topic intensity.

Events in scenic spots show a strong time aggregation, and the starting time, ending time, and fluctuation trend of each topic are consistent with the actual events. The change of visiting time may lead to the difference of tourists’ perception, even the change of tourists’ inner expectation, and there will be differences in the evaluation of tourists in the same scenic spot.

Tourists lower their recommendations for scenic spot playability in their comments, and the overall price-performance ratio of scenic spots falls, causing tourists to question the rationality of scenic spot ticket prices, resulting in a chain reaction. Tourists’ emotional states will have a significant impact on their image perception of scenic spots during their trip. The promotion of the network image of scenic spots can be aided by reducing tourists’ negative emotions as much as possible before and during their travel behavior. Tourist attractions should emphasize real-time and effective public opinion guidance, and all of them require a quick and comprehensive understanding of tourists’ true psychological state. Individualization is becoming more visible in China at the moment, and rapid response to tourism emergencies is especially important. Scenic areas should develop and improve a daily management system...
and emergency response methods for all types of emergencies, strengthen emergency drills, and ensure the tourism industry’s stable and long-term growth.

The natural landscape and cultural landscape in the scenic spot will change during the year, and the information perceived by tourists is not the same. In order to explore the difference of tourists’ perception of Dadu River Gorge Scenic Area during the year, this section uses Python programming tool to get the average emotional score of tourists’ comments, as shown in Figure 4.

There is a big fluctuation in tourists’ overall evaluation of Dadu River Gorge Scenic Area. Before April, the trend of emotional score is relatively stable. From May to July, there is an obvious trough with the lowest value in the whole year. After August, the emotional score rises rapidly, and then falls slowly after reaching the high point. The change trend of water level is basically the same as that of emotional score.

In order to deeply study the specific factors that lead to the fluctuation of the overall emotional value of scenic spots, using the clustering results of hot topics of tourists’ destination image perception information, emotional analysis is applied to the clustered hot topics, and the average emotional scores of different hot topics are obtained, as shown in Figure 5.

During the low water level period, all topics, particularly those describing rivers and scenery, experience periodic lows, and the emotional score drops significantly, falling below the overall emotional score of scenic spots. The core tourism expectation of the tourists’ trip has not been met, resulting in a negative overall impression of the scenic spot by the tourists. Tourist acceptance of ticket prices decreases as the price-performance ratio of scenic spots decreases, resulting in tourists complaining about high ticket prices and low price-performance ratios of trips. Individual emergencies will have an impact on overall tourist satisfaction with scenic spots, lowering the perceived image of other aspects of the tour. EXCEL is used to analyze survey data after it has been collected. The survey results show that the internal public’s perception and evaluation of Leshan tourism destination attributes is inferior to that of the external public. The score of each item’s geo-cognitive attribute characteristics can be found in Figure 6.

Emotion evaluation is an emotion about Leshan destination or a feeling of liking and dislike. The survey found that the public at home and abroad have a relatively consistent view on emotion evaluation. The description of internal and external public emotional images is shown in Figure 7.

Although the specific perception and evaluation scores are different, they all think that Leshan is a relaxing tourist destination, which can effectively relieve people’s pressure and is also a pleasant place, but it is not exciting, let alone unforgettable. It can be seen that the key to Leshan’s tourism development is positive emotional image-building.

Every destination has some people or things that make people interested in tourism and increase tourism attraction. Leshan, as the destination of World Double Heritage, enjoys a high reputation at home and abroad. The investigation shows that the public at home and abroad think that the representative objects of Leshan are scenic spots, people, and things, respectively, but there are some differences in specific evaluation, as shown in Figure 8.

The public perceives the Leshan Giant Buddha and Mount Emei as the pride of Leshan, which is a major factor in the city’s tourism appeal. At the same time, Leshan is home to both modern and ancient celebrities, such as Guo Moruo and Su Dongpo, so celebrities can be considered as representatives of Leshan tourism, with 33.24 percent of people agreeing. Leshan Giant Buddha and Mount Emei are regarded as the representatives of Leshan by 98.37 percent of the general public. Only 14.36 percent of people believe Guo Moruo and Su Dongpo can represent Leshan tourism, while only 7.99 percent believe things can represent Leshan, indicating that Leshan is under-publicized. The price-performance ratio of scenic spot tickets and tourist
commodities, as well as the hospitality of locals, are all factors to consider. As a long-term resident, the internal public is more concerned with the coordinated development of tourism and towns, rather than just the development of tourism and the perfection of tourist attractions. As long as the typical tourist city with a blend of city and scenery is not fully established, the needs of the public at home and abroad may not always be treated equally, and balancing the related elements of tourism and urban development is difficult.

People’s acceptance of tourist destination information sources is influenced by time, distance, information-gathering habits, and data-gathering costs. The public, both at home and abroad, has differing opinions on tourist destinations due to the various characteristics of each information source and differing ways of understanding information. The lack of information sources, short stay time, and low level of intervention make it impossible for the external public to fully and systematically understand the nature of tourist destinations, which has an impact on their evaluation of tourist destinations. The path coefficients of two or two of the four variables were calculated in this study, as well as their relationship. The direct, indirect, and total effects of various variables were calculated based on this, and the results are shown in Figure 9. Path 1 is tourist destination image perception vs. tourist behavior intention; path 2 is tourist destination image perception vs. perceived value; path 3 is tourist destination image perception vs. local attachment; path 4 is perceived value vs. local attachment; path 5 is perceived value vs. tourists’ behavior intention; path 6 is local attachment vs. tourists’ behavior intention.

According to the data in Figure 9, as far as the direct effect is concerned, tourists’ comprehensive perception of tourist destination image after visiting has a direct effect on their future behavior intention, perceived value of tourist destination and local attachment. It can be found that tourists’ destination image perception has the greatest connecting effect on perceived value. Perceived value has a direct effect on local attachment and behavioral intention.

Among them, tourists’ destination image perception has the greatest indirect effect on behavior intention; tourists’ destination image perception also has an indirect effect on local attachment, and its standardized path coefficient is 0.401. As far as the overall effect is concerned, tourists’ destination image perception, perceived value, and local attachment all have an overall effect on behavior intention. The
normalized path coefficient of the total effect of tourist destination image perception on local attachment is 0.764. It can be seen that tourists’ destination image perception, perceived value, and local attachment are three significant variables that affect their behavior intention.

5. Conclusion

Leshan’s tourism image will face more opportunities and challenges as it develops through new media. To keep up with the constantly updated information in new media, Leshan’s tourism image in new media must be constantly adjusted, updated, and improved. The image perception model of Leshan tourists’ destination based on clustering and principal component analysis has been successfully applied to discover hot topics and hot events in scenic spots, as well as the start and end times of event topics and specific attitudes of tourists toward specific events. The empirical findings show that the stronger the tourists’ perceived value after their visit, the stronger their local attachment, and the stronger their future behavior intention. As a result, tourists’ perceptions of their destination can have an indirect impact on their behavior intention through perceived value and local attachment, as well as a direct impact on their behavior intention.

The author believes that the most important daily management measure for scenic spots is to divert tourists’ emotions in a reasonable manner, which is also true for other scenic spots. When unforeseeable negative events occur, scenic spots should act responsibly, seek to understand tourists, and reduce the number of negative comments on the Internet.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors do not have any possible conflicts of interest.

Acknowledgments

This work was supported by Sichuan Tourism Development Research Center, the key research base of Humanities and Social Sciences of Sichuan Federation of Social Sciences and Sichuan Department of Education, research on Study on core elements and implementation paths of Leshan city to build “Back Garden” of Chengdu-Chongqing Economic circle (Project no. LY21-07). This work was supported by Soft science project of Leshan Science and Technology Bureau, research on study on the route of Leshan “14th Five-year plan” to construct the whole age section of worldwide study tourism Highland (Project no. 21ZRK190).

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