Social Network Analysis on Tourists’ Perceived Image of Tropical Forest Park: Implications for Niche Tourism

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Abstract
Tourists’ perceived image is the core of destination marketing. As an important niche tourist destination, the analysis of tourists’ perceived image of tropical forest parks has great value. This study takes the Yalong Bay Tropical Paradise Forest Park as a case site and collects a total of 1,44,022 words from online travel reviews on Ctrip.com via the Python web crawler technology. Firstly, through high-frequency word analysis, we identified 77 core elements and a total of five image themes, which are attraction image, emotional image, service facility image, crowd image, and activity image. Secondly, building on Net Draw analysis, a network structure diagram of the tourist’ perceived image of the Yalong Bay Tropical Paradise Forest Park is constructed. Finally, the overall network and individual network of tourists’ perceived image are analyzed. The results indicate that low overall network density is in possession of core and periphery. Guojianglong Cable Bridge, battery car, and glass path enjoy both high degree centrality and betweenness centrality. They also show significant advantages of structural holes. Therefore, they are on the top of the network. The academic and practical value of tourism image projection and development in tropical forest park is discussed.

Keywords
Tourists’ perceived image, tropical forest park, niche tourism, Social Network Analysis (SNA), Yalong Bay

Introduction
With the continuous increase of tourism consumers’ curiosity and esthetic ability, as well as more and more significant difference in personal tourism preferences (Kelly et al., 2020; Xin & Shi, 2015), highly standardized mass tourism no longer meets consumers’ growing needs. Therefore, niche tourism with small scale, specialized, personalized, and flexible features have turned out to be an essential part of tourism destinations’ strategies among competition and development (Robinson & Novelli, 2005). As for tourism companies and destinations, the only way to find their own competitive advantages in the tourism ecosystem is to continuously enhance their capability of market perception, strengthen connection and interaction with consumers, and improve self-adaptive ability (Day, 1994; Felicity et al., 2018). In addition, the starting point of their marketing strategy is to precisely identify niche tourism market, tourist demand, and tourism preference elements. In this process, tourists’ perceived image plays an important role.

Forests are the most general public green happiness of mankind that have undergone a historical transition from “cutting trees” to “caring trees” during the process of developing and utilizing (Luo et al., 2019). In recent years, the pro-natural tourism market has been gradually booming for taking forests as the activities’ background and objects such as forest baths, forest nature education, and forest wellness (Ohe et al., 2017; Sierra-Huelzé & Kainer, 2018). As a unique forest resource in tropical regions, tropical rain-forest is favored by eco-tourists because of fruitful and unique biological resources (such as flange and strangulation.). Studies have shown that exposure to nature can bring significant and diverse mental health benefits (Bratman et al., 2019), which have become more apparent after the COVID-19 (Buckley & Westaway, 2020). Therefore, forest parks are popular among niche tourists as pro-natural recreation and tourism destinations.

Hainan Province, located at the southernmost tip of China, established the only tropical rain-forest national park among China’s top ten national parks in 2019. Hainan’s forest
tourism has good development opportunities. However, the current image elements of Hainan’s tourism destinations are labeled as traditional 3S (Sun, Sand, and Sea), lacking effective development, and expansion of the dominant niche market of forest tourism. Therefore, this article is based on the case of Yalong Bay Tropical Paradise Forest Park in Hainan Province, and the following three questions are raised:

What are the tourists’ perceived images of Yalong Bay Tropical Paradise Forest Park?

What types of social network relationship do these perceived images have?

What is the value of social network analysis on tourists’ perceived image in niche tourism research?

To answer these questions, relevant literature will be reviewed and Hainan Yalong Bay Tropical Paradise Forest Park will be taken as a case to study via python language to crawl online review data. And then, the tourists’ perceived image of tropical rain forest park is identified from the perspective of tourist experience. In addition, the social network analysis (SNA) between the perception images is carried out to guide the projection and development of the tourism image of tropical rain forest park more scientifically.

Literature Review

Hutchinson earned acclaim for introducing the concept of “Niche” in 1957 (Hutchinson, 1957). In fact, the term “niche” can refer to the adequate position in which creatures can make use of their resources in the presence of competitors. In the 1980s, American business school scholars introduced the term into the field of marketing (Song, 1996). Philip Kotler defined Niche as “a narrower definition of certain groups” in his book Marketing Management, which refers to a small market and its needs are not well served, or “have basis for gaining profits” (Felicity et al., 2018). Afterward, this concept was introduced into tourism research, and the concept of niche tourism is mostly derived from the idea of “Niche Marketing” (Robinson & Novelli, 2005).

In recent years, niche tourism has often been mentioned by tourism policies and strategy documents, which is generally opposite to “mass tourism.” Robinson and Novelli (2005) argue that the services feature of niche tourism is targeted and personalized. On the one hand, they deem that niche tourism can be divided into macro-niche market such as cultural tourism, rural tourism, and sports tourism, as well as micro-niche market including geological tourism, gourmet tourism, bicycle tourism. On the other hand, niche tourism specifically refers to extremely precise and small markets, which are difficult to be further divided. Niche tourism can not only be examined on the basis of tourist behavior, but also should include geographic dimensions which mainly refer to those characteristic destinations, such as wine growing areas.

Eco-tourism as a micro-niche market includes micro-niche markets such as wetlands, forests, and lakes, while forest tourism belongs to micro-niche tourism market with unique market demand. With the continuous improvement of forest park systems at national, provincial, and municipal levels in China, and the establishment of the top 10 national park pilots, forest tourism has shown tremendous green advantages in attracting a group of people who are favored nature and fascinated to the forest environment. Yalong Bay Tropical Paradise Forest Park is a unique niche tourist destination for its geographical location and biological resources located at 18° north latitude.

The existing studies on forest tourism especially niche tourism mainly focus on forest landscape, forest protection, and forest stakeholders (Chaplin & Brabyn, 2013; Kuvan, 2005; Matilainen & Lähdesmäki, 2014), with a lack of the process of extracting forest tourism elements from the perspective of tourists’ experience and sufficient attention to tropical rain-forests. However, the functional and material consumption patterns of tourists have gradually given way to symbolic and spiritual experience patterns (Kumar, 2016) and people are more concerned about the symbolic value, spiritual significance, sharing, and communication that can be brought by tourism. Meanwhile, the core elements of a tourist destination can represent the destination’s unique brand and establishing and maintaining the emotional connection between the destination and tourists, so that the destination’s brand can possess personality traits, radiate human touch and rejuvenate, and the quality and culture of the destination can be conveyed to tourists at well (Ekinci & Hosany, 2006). Therefore, it is significant for the development of tourist destination’s core elements through extracting core elements of tourist network reviews to obtain the tourists’ gaze points and concerns.

In the theory of tourism decision-making and tourism behavior, the perceived image is an important factor that affects potential tourists’ choice of tourism destination (Chon, 1990; Gartner, 1991). In the competition of the international tourism market, the strategic positioning of the tourism market is the process of tourists’ perception of a tourism destination to establish a distinctive tourism image (Crompton et al., 1992; Echtner & Ritchie, 1993). If the image perception characteristics of the destination are not prominent and the marketing management is not effective, the tourist’s travel choice probability will be greatly reduced (Mayo & Jarvis, 1981). Destination management should provide a special, long-term, effective, and attractive tourism perceived image for the target source market of tourism (Hassan, 2000). Therefore, accurate identification the perceived image of tourists is an important task in destination strategy.

With the development of big data and the expansion of self-media, the content generated by online tourists has
become an important source for obtaining tourists’ perceived image. The main data sources used have also shifted from structured data to unstructured data. Compared with traditional research methods that use questionnaire surveys to obtain structured data, User Generated Content (UGC) provides a “thematic” perspective for exploring the perceived image of tourists, which is more authentic, reliable, and intuitive (Mak, 2017). Traditional content analysis focuses on element extraction and image classification, but pays less attention to the dynamic nature of the image. Therefore, dynamic perception image analysis based on social network analysis is necessary.

Data and Methods

Social Network Analysis (SNA)

SNA originates from the interactive study of sociology on actors and their relationships on the network (John, 2018a). It was first proposed by Georg Simmel who advocated a sociological study based on “relationship.” He believed that society itself is nothing but a network of relationships and it should not exist without interaction (Neuwirth & Levine, 1972), leading to a boom in social network research in sociology. With the promotion and improvement of SNA, it mainly forms an analysis framework which includes the overall network structure and individual network structure. Overall networks mainly includes measurement indicators such as network mode and density, correlation, distance, reciprocity, and clustering. Individual networks mainly include measurement indexes such as centrality and structural holes (Ekinci & Hosany, 2006).

Tourism is a complex ecosystem with multi-elements inter-dependence with each other (Björk & Virtanen, 2005), which are filled by overlapping multiple relationships between those elements. Such overlapping relationships correspond to the research method of SNA (Liu, 2015). Stokowski (1995) first applied SNA to tourism research to test the relationship between tourists’ behavior and tourists’ groups, which gradually evolved into a tourism research paradigm (Scott & Cooper, 2007; Wang et al., 2009). Therefore, tourism researchers have conducted a great deal of research based on this paradigm. A review of research by Zhang et al. (2019) showed that SNA mainly focuses on tourism destination network, academic research network of tourism and relative network of certain tourism population. So far mass tourism research based on SNA has accumulated rich results, but the study of SNA based on forest tourism and niche tourism is still limited.

With the rapid development of using big data and social media in tourism, online reviews of tourism become a main source of SNA. Based on the core idea of SNA and focus on the structure and connection between nodes (Wolfe, 1997), Network Text Analysis (NTA) builds a network relationship between words from text data (Zhao, 2011), which provides an effective approach for analyzing large amounts of text and visualizing relationships (Celardo & Everett, 2020). In comparison with traditional text data, the text mining of big data is a process of discovering new knowledge and new models from a large amount of text data (such as e-mails, newspaper articles, and text documents) (Kim & Lee, 2019). Useful information about target mass can be found from mining the data based on reviews and comments (Wang et al., 2020). The thesis mines the data from the tourists’ reviews of Yalong Bay Tropical Paradise Forest Park. In consideration of that certain unusual associations exist within high-frequency words that appear together in the same review and the strength of this association can be expressed by co-occurrence frequency. To some extent, it is consistent with the idea of social networks. Therefore, this paper is based on the analysis of the point, line, and relationship of social network. It takes high-frequency words of tourists’ online reviews as node, the co-occurrence association between different tourists as relationship, and the bidirectional co-occurrence as line to construct the co-occurrence network of the tourists’ perceived image of Yalong Bay Tropical Paradise Forest Park. In addition, the underlying mechanism of complex network representation will be revealed through qualitative or quantitative analysis of network relationship.

Case Study Site

Yalong Bay Tropical Paradise Forest Park is located in Yalong Bay National Tourist Resort, Sanya City, Hainan Province, China. It is the only tropical coastal city in China. It has the following characteristics: (1) it is rich in tropical forest resources and is a representative of tropical forest tourism in Hainan. With a total area of 1,506 hectares, which is the first coastal mountain eco-tourism and eco-resort forest park in Hainan Province. The plant types of there include tropical evergreen rain-forest and tropical semi-deciduous monsoon rain-forest with fruitful resources in biological, geographic, astronomical, hydrological, humanistic, and seascape landscape; (2) unique location advantage. It is located near 18° north latitude (Figure 1), closing to the urban area of Sanya, with convenient transportation and strong accessibility, making it the first choice for the development of tropical rainforest tourism; (3) strong governmental support. The forest park is a green tourism brand built by the Sanya City Government (Explore Hainan website), and has received strong support from the government in terms of external publicity and brand building; and (4) Sanya City is the core area of Hainan’s tourism development, with coastal tourism as its main focus. The research on forest tourism will further enrich the development of tourism products in Sanya City and at the same time promote the development of tropical forest tourism as a niche tourism. Therefore, Yalong Bay Tropical Paradise Forest Park is suitable for a case study.
This study analyzes the connection between different high-frequency words and explores the tourists' perceived image of projection and development of tropical forest park tourism through network text. Follow the steps below for data collection and processing: (1) data collection: crawl online travel review data via Python; (2) data processing: ROST.CM network text preprocessing; UCINET creates a co-occurrence matrix between words and network relationships.

**Data Collection**

In this study, Python is used to scrape data from a website. According to the ranking of Chinese travel websites and the crawlability of tourists' reviews, Ctrip website is finally used as a data source and a total of 2,990 reviews are crawled. After manual checking, it was found that reviews with less than 100 words usually do not contain valid contents and therefore are excluded. After the exclusion of these reviews, 660 reviews are obtained, for a total of 1,440,222 words.

**Data Processing**

The first step is to extract high-frequency words. To ensure the accuracy and completeness of the extracted high-frequency words, this study follows the following steps: text pre-processing—building a custom word list—analyzing word frequency with the software ROST.CM—segmenting words manually—confirming effective high-frequency words. It starts from combining the 660 reviews into a word document and remove pictures and special characters in the travel notes. Then the word document was converted into txt format after merging synonyms, establishing a custom word list about scenic spots and emotions, and excluding irrelevant words. After that, with ROST.CM's function of "Word Frequency Analysis" (Hu et al., 2019; Wang et al., 2019), the top 300 high-frequency words were extracted. However, due to the limitation of the software, words need to be segmented manually again. Some phrases are merged, replaced, corrected, or deleted according to the expression habits of tourists and research topics. For example, phrases related to bridge are all named “Guojianglong cable bridge,” such as "cable bridge," “cableway,” and phrases that are not related to the topic are deleted. The co-occurrence matrix of "row feature words" is extracted by ROST.CM, and words with frequency higher than 50 are selected. Finally, 77 effective high-frequency words are confirmed. According to types of elements, they are divided into five image themes: attraction, emotion, service facilities, crowd, and activity (Table 1).

The second step is to construct a co-occurrence matrix. Based on the 660 reviews, high-frequency words were taken as nodes and co-occurrence frequency as data, a $77 \times 77$ co-occurrence matrix is constructed in this study. Using the

![Figure 1. Location of study area](http://lwj.sanya.gov.cn/).
Table 1. Classification of Topical High-Frequency Words in Yalong Bay Tropical Paradise Forest Park.

| Classification      | High-frequency words                                                                 |
|---------------------|--------------------------------------------------------------------------------------|
| Attraction image (42) | Figurative elements (13) Guojianglong Cable bridge 659; Glass path 538; Battery car 436; Yalong Bay Tropical Paradise Forest Park 376; If You Are The One 286; Orchid Valley 247; Bird’s Nest 127; Canghai building 94; Hilltop Park 91; Trial Marriage Room 85; Shu Qi 79; Zipline 77; Magic Theater 70 |
| Public space element (29) | Scenic spot 487; Landscape 422; Attractions 406; Yalong Bay 396; Sanya 307; Mountaintop 221; the film 220; Forest Park 205; Rain Forest 151; Mountain Road 135; Viewfinder 132; Hainan 125; Forest 100; Tropical Rainforest 94; Park 93; Beauty 90; Altitude 88; Air 87; Landscape 52; Plant 51; Tropical 82; Seafood 80; Orchid 78; Sea View 78; Sea 66; Weather 66; Full Sea View 65; Panorama 63; roller coaster 56 |
| Emotional image (11) | Worth it 213; Exciting 186; Convenience 94; Feature 96; Net Red 66; Fun 65; Natural 62; Beautiful 59; Cost-effective 58; Romantic 55; Thrilling 53 |
| Service facility image (6) | Tickets 223; Package 153; Hotel 88; Service 65; Charge 63; Ticket 54 |
| Crowd image (7) | Child 184; Driver 112; Staff 75; Old man 66; Friends 84; Tourist 81; Guide 52 |
| Activity image (11) | Experience 241; Sightseeing 235; Take a picture 143; Queuing 128; Project 158; By car 144; Overlook 106; Marking 103; Travel 83; mountain climbing 55; framing 53 |

UCINET software, the multi-valued co-occurrence matrix is converted into a binary matrix for analysis of social network indicators. In this paper, K=3 is selected as the breakpoint value, which leads to 48 marginal nodes being isolated. But these marginal nodes are useless and do not play any role in the network. Some indicators of UCINET software are more meaningful for the measurement of the all-pass network (Zhang et al., 2014), so after the 48 isolated nodes are removed, the remaining 29 nodes are reconstructed into the all-pass network. In order to identify and extract core elements from the perspective of network relations, the structure of the reconstructed all-pass network is analyzed. On the basis of the network structure, a network structure diagram of the tourists’ perceived image of Yalong Bay Tropical Paradise Forest Park is constructed through NET Draw software (Figure 2). In the network, the line thickness is used to characterize the strength of the relations. Thicker the line is, stronger the relations is. It can be noticed that the core points of the network structure are Guojianglong cable bridge, glass path, battery car, scenic spot, and Yalong Bay.

Results

Overall Network Analysis

Network density and centrality analysis. Network scale refers to the number of actors in the network. If there are k nodes in any networks, there will be k × (k−1) ordered pairs of actors, that is, the number of all possible relations in the directed network is k × (K−1). Density refers to the overall compact degree of connections between nodes in the network. It is expressed by the ratio of the number of relationships actually existing in the network to the number of all relationships that may exist in theory. The result shows that the network density is only 0.1436, so the network effect is very poor, indicating that the core elements of Yalong Bay Tropical Paradise Forest Park are not closely connected. It also indicates that the overall network of keywords is loose, a high degree of correlation only existing between a few nodes.

Centrality is a key point of social network analysis, which is a quantitative expression of the relevance, influence, and power of actors (nodes). It is divided into two levels: centrality and centralization. Centrality refers to the relative importance of individual actors, reflecting the central position of a node in the network structure, its influence and dominance in interacting with other nodes (this indicator is reported in “individual network analysis”). Centralization refers to overall centrality of the network, reflecting the overall integration and consistency, representing the overall balance of the network (John, 2018b). The result shows that degree centralization of core elements in network is 63.01%, indicating that the network form shows a centralized trend to some element nodes. These nodes together shape the power center of the network. Betweenness centrality of the network is 32.87%, which means that there is no direct co-occurrence connection between many core elements, but it can be achieved by the bridge function of some core nodes.

Cohesive Subgroup Analysis

Cohesive subgroup refers to a subset of actors in a network, and actors in this set have a relatively strong, direct, close, frequent, or positive relationship with each other (Liu, 2009). The purpose of analyzing cohesive subgroup is to reveal the substructure inside the network (Felicity et al., 2018), and provide a deeper perspective on tourists’ selection of perceived image. In this study, by comparing the actual connections of each core element, we find a set of core elements with high cohesion. By analyzing the density between each
node group, we understand the degree of correlation between node groups, divide node groups with core elements according to compact levels, and sort out core elements that are more often combined. In this paper, with the CONCOR method, four cohesive subgroups and related density data are obtained (Table 2).

As shown in Table 2, there are four sub-structures with close internal relations in the tourists’ perceived image network of Yalong Bay Tropical Paradise Forest Park, which has characteristics of certain internal cohesion. It can be found that the connection density within node groups is generally low, indicating that the core elements in node groups are not often mentioned together in tourists’ reviews. However, there are sub-groups with higher density between node groups, in which the highest connection density between node group 3 and node group 4 is 0.450, indicating that the core elements of node group 4 are often mentioned when referring to the core elements of node group 3 in tourists’ reviews. In addition, it can be observed that the density between node group 4 and node group 1 or node group 2 is larger than that between other node groups, showing that node group 4 has a very strong driving effect. Combined with the online review texts of tourists, the core elements in node group 4 are the elements with the strongest sense of experience in the whole travel process. In tourists’ reviews, they described four feelings when riding a battery car up the hill. The first is to feel the ruggedness of the bended road. The second is to admire the driver’s superb driving skills, which enables them to experience a sense of excitement under the premise of safety. The third is the unique

Figure 2. Core element network structure diagram.

Table 2. Density Matrix of Each Cohesive Subgroup.

|     | 1     | 2     | 3     | 4     |
|-----|-------|-------|-------|-------|
| 1   | 0.056 | 0.153 | 0.313 | 0.235 |
| 2   | 0.055 | 0.109 | 0.098 | 0.200 |
| 3   | 0.051 | 0.196 | 0.085 | 0.450 |
| 4   | 0.052 | 0.101 | 0.053 | 0.000 |

Note. $R^2 = .375$. 1. Guojianglong Cable bridge/Glass path/Scenic spot/ Landscape; 2. Experience/Attractions/Mountaintop/Yalong Bay Tropical Paradise Forest Park/Orchid Valley/If You Are The One/Overlook/Forest Park; 3. Sanya/Bird’s Nest/Yalong Bay/Battery car/Take a picture/Package/Viewfinder/ Child/Project; 4. Tickets/Driver/By car/Worth it/Mountain Road/Exciting/the film/Sightseeing).
experience element of the scenic spot, that is, when two cars up and down the hill meet, the driver will lead the passengers on his or her car to greet the passengers in the other car in a very excited way. Tourists are very impressed by this experience. The fourth is that after the unique experience, tourists believe that the ticket is worthwhile. This experience mainly shows the emotional interaction between tourists and drivers, tourists and tourists, giving tourists a sense of integration and participation. At the same time, tourists feel the enthusiasm of the driver who is a representative of locals and have emotional resonance with tourists in the opposite car. This enlightens us to develop the experience element and give full play to its driving effect.

Core-Periphery Analysis

A Core-Periphery Analysis based on CORR in UCINET combined with real data can indicate the network location of the core element, and also provide a quantified information of the location (Core/Periphery) of the core element. In the core element network, the Core/Periphery location is not only determined by the attraction of the node, but rather by the correlation and the interaction of the core elements. A Core-Periphery Analysis of the core element network was performed, showing a fit index of .878, which supported the “Core-Periphery Hypothesis.” Twelve nodes in the core zone were concluded (Table 3).

When the overall average density of the network is 0.1436, the connection density between the core elements in the core zone reaches up to 0.833 (Table 4); while in the periphery zone, the connection density between the periphery elements is 0.000. And that indicates a sharp layering in the keywords, which demonstrates apparent power disparity. As where the co-occurrence frequently appears, the core zone dominates the network. However, due to a lack of correlation between the core elements, the periphery zone is often ignored in the network. Though there is a correlation between the elements of core zone and periphery zone when the density is .225, the co-occurrence effect is not prominent. The co-occurrence relation tends to appear between the core elements in the core zone, resulting in gathering phenomena like “winner takes all” and “rich-club.” A stable network power center was established in the complex connections. In this light, due attention should be paid to the driving effect of the core zone elements in the future implement and ejection of the core elements. The potential niche market of the periphery zone should also be taken into careful consideration to enhance their radiating capacity.

Individual Network Analysis

The overall network analysis only provides crude partition of the elements on a macro scope. The precise definition of the role individual element plays in the network is insufficient. While the node network analysis focus on the evaluation of the network power of the individual element as a way to examine the specific difference of the core element and the periphery element. A calculation of the network centrality (degree centrality and betweenness centrality) of the core elements and structural holes indicator related based on UCINET was performed. Results summarize as Table 5.

Degree Centrality Analysis

As is shown from Table 5 and Figure 3, in the 29-element network, each element co-occur with seven elements in average, indicating a relatively poor network connectivity. The standard deviation is 6.387, and that means the co-occurrence relationship is not evenly distributed. Chances are that some elements may occupy the key resource of the network.

There are seven emotional elements with a degree centrality higher than 10: Guojianglong cable bridge, glass path, scenic spot, experience, landscape, Yalong Bay, Yalong Bay Tropical Paradise Forest Par. The value of their degree of centrality varies between 10 and 24, in which Guojianglong cable bridge (24), glass path (21), and battery car (19) land in the top of the pyramid of the core zone with absolute advantage.

There are four intentional elements with a degree centrality between 7 and 9: Attractions, Sanya, If You Are The One, Experience. Although these elements co-occur externally frequently, they do not have absolute advantages and as a
result can only serve as secondary power center, but their influence cannot be ignored. Comparing the seven elements in the core zone, it is found that although the above four emotional elements are all located in the core zone of the overall network, they play different roles and the network power differs comparatively large between levels.

There are 18 elements whose degree centrality are lower than average. Orchid Valley lies in the core zone, and apart from that, all the rest elements find themselves in the periphery zone. Among which, the degree centrality of Child, Bird’s Nest, Driver, and Overlook are all 1, accounting for only one sixth of the average. These elements represent the peripheral nodes in the network with a weak co-occurrence relationship. In addition, there are seven elements whose degree centrality distribute between 5 and 6: Orchid Valley, sightseeing, the film, worth it, and forest park. These elements are located in the periphery zone. However, as the degree centrality of these elements is close to the mean value, it constitutes a transitional path element from the core zone to the periphery zone to a certain extent. Although these elements are not widely perceived by the majority tourists, they may be the core elements that attracted some minority tourists.

### Table 5. The Centrality and Structure Holes Indicators of Core Element in Network.

| Components                        | Degree centrality | Betweenness centrality | Structure holes |
|-----------------------------------|-------------------|------------------------|-----------------|
|                                   |                   |                        | EffSize | Constra |
| Guojianglong Cable bridge         | 24                | 131.657                | 21.999  | 0.128   |
| Glass path                        | 21                | 59.990                 | 17.856  | 0.188   |
| Scenic spot                       | 15                | 11.124                 | 10.056  | 0.238   |
| Battery car                       | 19                | 76.445                 | 16.580  | 0.155   |
| Landscape                         | 15                | 0                      | 3.324   | 0.238   |
| Attractions                       | 8                 | 0.429                  | 10.703  | 0.428   |
| Yalong Bay                        | 14                | 35.840                 | 5.649   | 0.223   |
| Yalong Bay Tropical               | 11                | 2.640                  | 6.046   | 0.317   |
| Sanya                             | 7                 | 0                      | 3.418   | 0.472   |
| If You Are The One                | 9                 | 6.300                  | 3.323   | 0.362   |
| Orchid Valley                     | 6                 | 0                      | 3.145   | 0.495   |
| Experience                        | 7                 | 0                      | 2.963   | 0.459   |
| Sightseeing                       | 5                 | 0                      | 3.246   | 0.547   |
| Tickets                           | 4                 | 0                      | 3.038   | 0.570   |
| Mountaintop                       | 2                 | 0                      | 3.270   | 0.537   |
| The film                          | 5                 | 0                      | 2.373   | 0.559   |
| Worth it                          | 5                 | 0                      | 2.963   | 0.535   |
| Forest Park                       | 3                 | 0                      | 1.000   | 0.640   |
| Exciting                          | 4                 | 0                      | 2.963   | 0.570   |
| Child                             | 1                 | 0                      | 1.000   | 1.000   |
| Project                           | 2                 | 0                      | 1.836   | 0.651   |
| Package                           | 2                 | 0                      | 1.836   | 0.651   |
| By car                            | 1                 | 0                      | 1.000   | 1.000   |
| Take a picture                    | 2                 | 0                      | 1.836   | 0.651   |
| Mountain Road                     | 2                 | 0                      | 1.828   | 0.658   |
| Viewfinder                        | 2                 | 0                      | 1.733   | 0.733   |
| Bird’s Nest                       | 1                 | 0                      | 1.000   | 1.000   |
| Driver                            | 1                 | 0                      | 1.000   | 1.000   |
| Overlook                          | 1                 | 0                      | 1.000   | 1.000   |
| Mean                              | 6.862             | 11.187                 | 4.758   | 0.552   |
| Std Dev                           | 6.387             | 29.055                 | 5.457   | 0.394   |

**Betweenness Centrality Analysis**

As can be seen from Table 5 and Figure 4, in the 29-element network, each element plays 11 times the intermediary role in average, but the variance is 29.055. The large variance means that only a few elements work as a bridge for network connections.

Among which, there are only three elements showing a betweenness centrality larger than 50, which are: Guojianglong cable bridge (132), battery car (76), and glass path (60). Although only accounting for 10% of the network, they have the core control function in the attachment.
network and play a central role in the complex co-occurrence relationship. The betweenness centrality of Guojianglong cable bridge in particular, is high as 132, much higher than other elements. In addition to these three elements, there is only one core element whose centrality is larger than the mean value, which is Yalong Bay (36). Its betweenness centrality is relatively prominent, not enough to gain full control of the overall network element co-occurrence though, it may play an important broker role in the local network.

There are only four elements with a betweenness centrality between 0 and 11. These elements only serve as intermediaries occasionally. In the process of improving the
efficiency of network co-occurrence, their roles are not prominent. There are as much as 21 elements with a betweenness centrality of 0, which indicates that these elements barely perform as intermediary in the core element network and are often scattered on the margin of the network.

In general, the two indicators of centrality are apt to converge. The comparison of the degree centrality and betweenness centrality shows that four elements tend to be high in both terms, and they are: Guojianglong cable bridge, battery car, glass path, and Yalong Bay (Figure 5). Indicating that they have both strong co-occurrence and communication capabilities and absolute network control. The degree centrality of Scenic spot is greater than the mean value, and its betweenness centrality is close to the mean value, indicating that although the co-occurrence frequency of this element is high, it does not have absolute control over the network. This element has important accompanying properties, which earns it a unique position in the network. In addition, the remaining 24 elements tend to be low in both terms. In the network, these elements are not only insufficient in co-occurrence frequency with other elements, they barely mediate the co-occurrence between other elements, neither. Due to a weak network influence, they belong to absolute peripheral nodes.

**Structure Holes Analysis**

Structure holes refer to the important aspects pertaining to the advantages and disadvantages individuals hold in position occupying. In this paper, two indicators, “EffSize” (Effective size of the network) and “Constra” (Constraint), are used to describe the positional advantages and disadvantages of core elements.

The four-quadrant of the structural hole (Figure 6) shows that the Guojianglong cable bridge in the fourth quadrant topped the network power with its highest effective scope (21.99) and lowest limit (0.128). Battery car and Glass path occupy the second level of the dominators. Although their effective scales are not as inclusive as that of Guojianglong cable bridge, their limit is lower than other elements. Scenic Spot, attractions, Yalong Bay, and Yalong Bay Tropical Paradise Forest Park are the key adjuncts of the network structure. Their effective scale is greater than the average and the limit is less than 0.5. They serve as amplifier and complement of the dominating elements. These elements have a non-alternative competitive advantage in the network structure. But at the same time, people should be alert to the potential risks brought by the excessive structural hole advantage.
Five elements are located in the third quadrant, namely, Landscape, If You Are The One, Sanya, Experience, and Orchid Valley. They are characterized by below average effective scale and below average limit. The frequency of the binary co-occurrence of them in the core element network is insufficient, but the elements are free from the influence of other elements and have stronger independency due to lower limit. Meanwhile, these elements are scattered in core area (see Table 3), which means they are deprived of innate advantages of structural holes, but are in possession of potential competition advantages. They can take the lead to rise in the third quadrant by means of location advantages in the core area and independency advantages with lower limit.

The 17 elements in the second quadrant, whose effective scale is lower than the average and the limit higher than the average, have no competitive advantage in the core element network, and they are scattered in the periphery of the network structure. They are not representative but are important supplementary features of the core elements. For instance, tourists will talk about the driver and their feelings as they describe battery car, which is characterized by exciting, by car, and driver.

**Discussion and Conclusions**

The study increases the objectivity of data by mining unstructured data with the help of Python. Introducing SNA to niche tourism is innovative. It can be a reference for forest tourism research and practice by exploring the projection of core elements based on SNA. Based on the 77 high-frequency words of core elements extracted by ROST.CM, this study adopts SNA to identify and extract the core elements of Yalong Bay Tropical Paradise Forest Park from the overall network and the node network. As a result, a dynamic network of tourists’ perceived image of Yalong Bay Tropical Paradise Forest Park is constructed.

The results show that lower density of the overall network of core elements and a trend of centralization centered on
few core elements. The tourists’ perceived image network of Yalong Bay Tropical Paradise Forest Park has four closely related sub-structures, which characterizes certain internal cohesion. The connection density is generally low, but density-larger sub-groups appear between parts of different node groups. For example, the connection density of the fourth node group with other node groups is higher, particularly, with the third node group, 0.450. It can be found that combined with the texts, the core-periphery structure triggered a “Matthew Effect” of the network. Elements with higher experience such as battery cars and drivers attract more tourists, apart from scenic signature elements.

In addition, different influences of elements for distinct positions and roles in the network structure are observed. The four elements, Guojianglong cable bridge, battery car, glass path, and Yalong Bay, are characterized by high degrees of both degree centrality and intermediary centrality. They are often located in the center of the network and have higher network power, while most other elements are weakly centralized and scattered on the edge of the network. Furthermore, the four elements above are at the top of the core area due to their significant advantage of structural holes.

This study generates a number of academic contributions and practical implications. SNA shows that image is not a stable element, but a dynamic social network. In the future, Yalong Bay Tropical Paradise Forest Park parks should establish a dynamic image network thinking, on the one hand to create super attractive core image elements, on the other hand, pay attention to image elements with double high trend both degree centrality and betweenness centrality. And continue to look for emerging elements to enhance the tension of the tourism image network. The elements, such as Guojianglong cable bridge, battery car, and glass path, should bring driving effect on peripheral elements. On the other hand, it is necessary to strengthen the links between scenic spots and other spatial elements in the regional tourism network. In Hainan Province, Yalong Bay is a region that mingled spatial elements from cities and counties. It is indispensable to strengthen the correlation of both structural hole and regional competition in the whole network.

With the angle of element mining and projection, it is suggested to retain dominant elements and dig deep into local elements. The elements with experience have more power and influence in the current network. We found that the elements, Guojianglong cable bridge, battery car, and glass path, are always associated with the movie If You Are the One. The scenic spot has attracted everyone’s attention, to a large extent, due to the popularity of the film. In addition, the valuable local elements of the spot have not been effectively developed, such as tropical vegetation, forest recreation, and nature education.

In terms of element category, it is recommended to employ different elements to trigger tourists’ different sensory experiences and release the embodied experience effects of elements. In terms of attractiveness, it is necessary to strengthen figurative elements and optimize public spatial elements. Sufficient attention must be paid to both static background elements and dynamic experiential elements. For emotional care, what tourists most concern is cost performance, followed by experience, such as convenience, stimulation. Therefore, different product combinations in terms of maximizing the value for tourists should be designed in the future. In terms of service facilities, three out of six elements involve “tickets,” which means tickets of the spots can be further optimized. In terms of the crowd, the highest-frequent word is “children,” which represents the romantic elements movies projected failed to activate couple market, but parent-child market. It is clear that element projection does not echo market. In the future, we can combine the tropical forest resources with natural education environment to create a consumer demand suitable for parent-child tourism. In terms of activity, what tourists mentioned most was experience, which verified the theory of tourism experience (Xie, 2019). Elements like “photographing” and “framing,” indicate that tourists are concerned about the landscape elements, looking forward to beautiful scenery or the elements projected by movies and TVs. Future scenic spots should promote the symbolization of landscape and develop more landscapes to frame.

This study has its limitations. Tourists’ reviews are limited because of the restrictions of online travel platform. Ctrip, for instance, is allowed to show up to 3,000 reviews, and only 2,990 are crawled. Due to the limitation, all reviews we obtained were from 2019, which means the evolution of the dynamic network of core elements cannot be presented. Moreover, despite of data preprocessing, it is inevitable to omit, merge or delete some element words due to large amount of data. The same limitations widely exist in other studies of web text analysis (Kim & Lee, 2019).

Future research can explore the dynamic evolution of the element network structure based on diachronic data, and expand the static analysis of the network to dynamic one. Besides, it is possible to adopt multiple data source analysis, which means that data can be obtained from social media, such Twitter, Facebook, and WeChat.

Acknowledgments
Xueli Li and Songtao Geng are grateful to friends from Zhejiang Forest Research Institute for their data mining help. Unless otherwise stated, the views expressed in this article are those of the authors and do not represent any official position of the authors’ affiliations.
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