

Article

Symmetry Analysis in Analyzing Cognitive and Emotional Attitudes for Tourism Consumers by Applying Artificial Intelligence Python Technology

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Abstract: Symmetries play very important roles in the analysis of cognitive and emotional attitudes. The analysis with Python technology, including optimized artificial intelligence technology, is designed on the basis of symmetry principles. Destination image perception as a branch of destination image research is of great significance to tourists' decision-making and destination image building. Ice-snow tourism is a hot topic nowadays, and research on perceptions of images of ice-snow tourism has become a focus. In this paper, python programming was used to crawl online travel journals and reviews about Jilin province's ice-snow tourism on the Internet to analyze the frequency of frequently used words, their classification, word cloud and co-occurrence network, and other aspects of image perception, and proceed to the emotional perception of and emotional attitude to the emotional images and an overall image analysis. The study found that: (1) Perceptions of images of ice-snow tourism can be divided into five categories: tourism attractions, tourism activities, tourism facilities, tourism features and the tourism service environment. The frequency of tourism attractions is the highest, followed by tourism facilities and the tourism service environment. "Changbai Mountain" and "rime" are the core words, that is, tourists are most impressed by the scenic spot and landscape of "Changbai Mountain and rime." (2) Positive emotional expressions accounted for 67.23% of perceptions of images of ice-snow tourism. Tourists gave a positive evaluation for Changbai Mountain, the snow landscape of Tianchi and skiing facilities. Meanwhile, passive emotional expressions accounted for 21.07% and tourists gave passive evaluations for travel, transportation, accommodation and catering. (3) Tourists spoke highly of overall images of ice-snow tourism in Jilin Province but few were willing to revisit. In the conclusion, strategies are put forward to improve image perceptions of ice-snow tourism and promote the sustainable development of ice and snow tourism.

Keywords: artificial intelligence; ice-snow tourism; sustainable development; Python; text mining

1. Introduction

In 1992, the China National Tourism Administration (CNTA) listed "ice-snow scenery tours" as one of the 14 special tourism products in China for the first time. Since then, ice-snow tourism has become highly popular in China. In recent years, relevant ministries and commissions have jointly issued a series of industrial policies to support the development of ice-snow tourism, in response to General Secretary Xi's important instructions that "snow and ice are also invaluable assets" and to "encourage 300 million people to participate in the ice-snow sport". Ice-snow tourism is becoming a new pillar of national strategic convergence and local economic and social development. From the perspective of policy, China's ice-snow tourism has ushered in a golden period of leapfrog development. According

to a report on the development of China's ice-snow tourism for 2020 released by the China Tourism Academy, participation in ice-snow tourism in China during the 2018–2019 ice and snow season totaled 224 million, achieving a revenue of about 386 billion yuan. Ice-snow tourism continues to grow rapidly. From the perspective of the market, China has become an important country in the field of ice-snow tourism economy. Jilin province, by virtue of its abundant snow and ice resources and unique geographical advantages, occupies an important position in China's ice-snow tourism market and has become the main battlefield in China's ice-snow tourism market. Studying the perception of images of Jilin province's ice-snow tourism will greatly help to improve the overall image of China's ice-snow tourism. As the 2022 winter Olympic Games is around the corner, tourists from all over the world will come to experience China and Jilin province's ice and snow tourism. Jilin province will take this opportunity to build itself into a province with booming ice and snow tourism and a world-class tourist destination. However, the outbreak of NCP (novel coronavirus pneumonia) at the end of 2019 has seriously affected snow tourism in the province during the snow season. Jilin province should seize the opportunity, face up to the crisis, avoid the risk, study the demands of ice and snow tourists, and utilize modern artificial intelligence Python technology to obtain big data from online texts. The experience and perception of snow and ice tourists should be analyzed based on the data, so as to provide products and services that meet the needs of tourists, and to conduct precise marketing.

The term "destination image" was first used in a doctoral dissertation titled "Image: A Factor in Tourism" by J.D. Hunt of Colorado State University (CSU) in 1971. Hunt believed that destination image is people's impression of a place they do not live in, and discussed the significance of development of destination image [1]. Since then, destination image has been widely studied and applied by scholars at home and abroad. Destination image perception research is a branch of destination image research, which is the overall impression on tourists of relevant resources and features of tourist destinations. Destination image perception is by nature a psychological behavior, as it is tourists' experience, perception and emotional evaluation of various elements of a tourist destination, as well as a kind of social perception of tourists' understanding of a tourist destination. Destination image perception is of great guiding significance for tourists to make tourism decisions, and for image construction, dissemination and promotion of tourism destinations.

1.1. Study of Tourism Image Perception

The study of tourism image perception at home and abroad is reflected in research content, research cases and research methods.

1.1.1. Research contents

Domestic and foreign research focuses on the constituent elements of and factors influencing tourism image perception.

Elements of Tourism Image Perception

Foreign scholars believe that the constituent elements of tourism image perception are from the perspective of tourists, and that tourism destination image perception is composed of pre- and post-tour images. Gunn Clare proposed that the formation of tourist destination image includes two levels, i.e., original image and induced image. The original image refers to the information accumulated by the tourist before the trip, and the induced image is formed after the field trip [2]. Kotler and Barich (1991) divided the perception of destination image into emissive image and receptive image. Emissive image refers to the fact that tourism destinations actively integrate their own resources to selectively deliver to tourists. Received image refers to the comprehensive impression of the tourist destination obtained by tourists on the spot or by external information [3]. On this basis, Fakeye and Crompton summarized the tourist perception image formed by tourists (including potential tourists) as the original image, induced image and mixed image (the comprehensive impression of tourist destinations after travel) [4]. Gartner continued to refine this on the basis of his predecessors. According to the

formation process of tourism perception image, tourism perception image has been divided into 8 types: obvious induction, hidden induction, and autonomous native [5]. Martin Selby and others proposed the concepts of native image and re-evaluation image from the perspective of tourists' cognitive time. Additionally, they distinguish the constituent elements of the tourist image from the perspective of the information source of the tourists. They believe that the original image of the tourist is formed by the mechanism image of the media, education and other channels that are not directly related to tourism and the induced image of tourism business channels such as advertising [6]. In addition, Seyhmus Baloglu and others agreed to divide the perceived image of tourists into cognitive image and emotional image and proposed a "cognitive-emotion" model of tourist destination image, and they considered that the two images together constitute a comprehensive image of the destination. This view has also been recognized by many scholars [7]. Tapachai and Waryszak (2000) used consumption value theory to introduce research, and introduced the tourist destination image's perceived goals covering the five major modules: attraction function, social characteristics (safety, residents friendly), conditions (comfort, hygiene), emotion and awareness [8]. Beerli & Martin (2004) summarize relevant literature and propose that tourists' perceptions of tourist destination images should be analyzed in four aspects: tourist attractions (natural and cultural attractions); reception facilities and services; emotions; and social environment and atmosphere [9]. Wang and Hsu (2010) explore the relationship between tourist destination image, satisfaction, and behavioral intent, showing that the overall state is reflected in both cognitive and emotional aspects [10]. Perceived image is a conceptual model reflection from the perspective of tourism image psychology.

Domestic scholars have also actively explored the constituent elements of tourism image perception, but due to different research objects, the constituent elements of tourism perception image are different. Xie Chaowu and Huang Yuanshui believe that five parts: tourism resources, tourist destination facilities, tourist destination services, industry management, and community participation together form the perception of tourist destination image [11]. Qi Huangxiong and others believe that social environment, folk culture, landscapes, urban planning, and economic construction jointly produce a tourism perception image system in Linhai City [12]. Li Xi, Ye Sheng, and Wang Dong analyzed the perception characteristics of business tourists visiting Australia, and put forward the perception of tourist destination image including tourism experiences such as room and board, transportation, shopping and overall perceptions of politics, economy, culture and history [13]. Wu Jinfeng (2014) believes that tourism image perception can be divided into five dimensions: tourism attraction; infrastructure; leisure and entertainment; environment; and local atmosphere. Each dimension contains different attributes [14]. Bai Dan, Ma Yaofeng, and Liu Junsheng believe that travel expectations, travel parades, tourist attraction experience, supporting facilities, service experience, and post-tour evaluation jointly form tourists' perception of the Terracotta Warriors and Horses of Qin Shihuang [15]. Li Ping [16], Feng Qing [17], Lu Lijun [18], and Tu Wenhui [19] discussed the perception of urban tourism community image and the perception of tourist destination image in Shaanxi considering three aspects: cognitive image, emotional image and overall image and Nanyue Hengshan tourist destination image perception and Beijing Fangshan District tourist image perception.

Factors influencing tourism image perception

Foreign scholars have carried out research on cognitive image, emotional image and overall image, which basically comprise three factors that affect the tourist destination, tourists and tourism media. In terms of cognitive image, Mayo believes that scenery, climate, traffic and other factors will affect the perceived image of tourism [20]. Stabler believes that demand factors such as tourists' motivation, cognition, and personal attributes, together with supply factors such as the tourism market and intermediary media, act on the perceived image of tourism [21]. Seyhmus and David point out that the perceptual influence factors include stimulus conditions and self-factors [22]. Hanlan and Kelly reported that tourism experience is an important factor affecting the perceived image of tourism, and tourism marketing organizations should use multiple methods to convey brand information [23].

In terms of emotional image, Beerli and Martín verified that the factors affecting tourists' perception evaluation include tourism, information sources, stimuli, and various demographic characteristics [9]. In the overall dimension, Olivia believes that the image of the tourist destination is the result of the tourists' internal and external conditions [24]. Dimitrios and Amir (2017) studied the perceived image of residents and tourists in the resort city of Eilat based on three levels of cognition, emotion and overall image, and verified the applicability of the behavioral intention model. Moreover, they found that the emotional component influences the overall tourist destination image to a greater extent than the cognitive evaluation [25].

Domestic scholars have carried out research on objective factors, subjective factors, destinations, time and space, transportation and information. Studies highlighting the combined effect of all influencing factors include those by Cheng Jinlong and Wang Fa, who built models of influencing factors for tourism image perception. These include tourist factors (individual and group factors), tourist destination factors (tourist destinations themselves, between tourist destinations, and tourist sources and destinations), information factors (personal, interpersonal, and business factors) and external forces factors [26]. Other scholars have emphasized one or two of these factors. Cheng Wei and Sui Lina believe that stimulus factors such as first-hand and second-hand sources, and individual factors such as tourism motivation and socio-demographic characteristics, are the main factors affecting the perception of tourism in Korea in the Yangtze River Delta [27]. Gan Lu and Lu Tianling concluded that tourists with different motivations had different evaluations of their tourist destination image [28]. Zheng Peng empirically pointed out that the urban environment has the greatest effect on the recognition of tourism image [29], Zhang Hongmei et al. [30] and Tang Yufeng et al. [31] pointed out that distance is an important factor affecting tourism image perception.

1.1.2. Research Case

As far as foreign research is concerned, many studies have selected a certain country as the research area. Jeong studied the image of Korean tourism perceived by Russian tourists [32], Steven studied the image perception of Brazilian, Argentina, and Chile in the hearts of Australian tourists [33], and Eran studied the restoration and reconstruction of perception of tourist images after the earthquake in Nepal [34].

Domestic tourism image perception cases are generally concentrated in tourist destinations and tourist attractions.

Most of the literature on tourism destination image perception research focuses on strategies for improving tourism destination perception image. Relevant studies include empirical research by Shan Linyao and others on image perception of Qingdao's tourism image [35], Yang Jie and others' study of Chongqing citizens' perception of Shanghai's tourism image [36], Zhu Cuilan and others' study of Xiamen's tourist destination image [37], Shi Kunbo et al.'s study of mainland university students' travel motivations and tourism image in Taiwan [38], and Yang Min et al.'s study of Xi'an tourism image perception [39].

Concerning tourist attractions, there are tourism image perception studies of Huashan Scenic Area by Zhang Gaojun et al. [40], studies on tourism cognition, emotion, and overall image of Shaolin Temple by Pi Rui et al. [41], tourism image perception studies of Yongding Tulou, Fujian Province by Zhang Wenting, et al., [42] and Xu Yayuan et al.'s study on tourism image perception of the Huangshan Scenic Area [43].

1.1.3. Research Method

The foreign research methods on tourism perception image mainly include factor analysis and structural equation models, network text mining, and content analysis methods. Hao Zhang and Taeyoung Cho and others used factor analysis and structural equation models to analyze the risk perception of tourism destinations, which negatively affected the tourism image, cultural image and stability image of the destinations [44]. Stella Kladou and Eleni Mavragani evaluated the image

of tourist destinations on TripAdvisor [45]. Hunter and William Cannon used network information and traditional print media to study the image of Seoul's tourist destinations [46]. Jinah Park and Alastair M. Morrison and others used content analysis to analyze the different perception characteristics of Chinese golf courses and their relation to Korean society [47].

Domestic research methods mainly include regression analysis, comparison of questionnaire surveys and web text analysis, and a combination of web text analysis and IPA models. Peng Huijun and others used the regression analysis method to analyze tourists' perception of the multiple tourism image positioning of mountain-type scenic spots, using Hengshan in Nanyue as an example [48]. Li Yan and others used the network text analysis method to compare the tourism image perception of desert-type scenic spots with Shapotou and Shahu scenic spots in Ningxia as examples [49]. Zhang Zhenzhen and others used questionnaire surveys and web text methods to analyze tourism image perception using Xi'an as an example [50]. Zhang Rui et al. analyzed the perception of tourism image of Shanghai Chenshan Botanical Garden by using web text and IPA models [51].

1.2. Research on Ice and Snow Tourism at Home and Abroad

Foreign ice and snow tourism research has basically focused on spatial differences in the application of ice and snow tourism resources, the demand for ice and snow tourism markets, and the suitability of ice and snow tourism. Arvid explores the value of sustainable tourism development in winter [52]; Yu Zhang predicts Harbin ice and snow tourism market demand with a time series univariate linear regression model [53]; Jun Yang and Ruimeng Yang used the Delphi analytic hierarchy process and the spatial analysis method to study spatial differences in the suitability of snow and ice tourism in China [54].

Domestic snow and ice tourism research is basically focused on research in the Northeast region. The research content mainly focuses on the analysis and forecast of ice and snow tourism status, ice and snow tourism marketing, snow and ice tourism resource development, and sustainable development. Dong Xia mainly uses the logistic model to predict the passenger flow of ice and snow tourism in Jilin Province, and makes suggestions for the development of ice and snow tourism in Jilin Province [55]. Song Hongjuan analyzed the potential source market of Yabuli Ski Resort and proposed a strategy for tapping the potential source market; [56] Xu Yijun and others analyzed the development status of the Harbin ice and snow tourism market and divided the ice and snow tourism source market into four levels, and proposed corresponding development strategies for each level [57].

In the study of ice and snow tourism image, there is Wang Hairong's image of ice and snow tourism in Heilongjiang Province [58]. Han Zhenkun and others have promoted Harbin's ice and snow tourism image in two aspects: ice and snow landscape and ice and snow culture [59]. There is also Liang Shuang's research on the influence factors of Harbin's ice and snow tourism season tourism image [60].

1.3. Deficiencies of Existing Researches

From the research literature summarized above, it is found that the research content of domestic and foreign scholars in tourism image perception mainly includes tourism perception components and influencing factors. The research area focuses on countries, destinations, and tourist attractions; in the research methods, factor analysis and structural equation models, network text mining, content analysis, regression analysis, and network text analysis and IPA models are combined. Domestic and foreign scholars' research on ice and snow tourism has basically focused on the development of ice and snow tourism resources, the application of ice and snow tourism resources, the analysis and prediction of the status of ice and snow tourism, the marketing of ice and snow tourism, and spatial differences in the suitability of ice and snow tourism.

From the perspective of tourism image perception, domestic and foreign scholars' research on tourism image perception of a certain destination or a certain scenic spot has gradually matured, but little attention has been paid to image perception of certain types of tourism products. In the future,

the scope of application of tourism image perception research should be expanded, and it can be applied to coastal tourism image, rural tourism image and so on. This study selects snow and ice tourism as the research object. It will theoretically open up new research fields and broaden the scope of tourism image perception, which will help scholars to think about differentiating and establishing different types of tourism image perception theories and models.

From the perspective of ice and snow tourism research, existing research focuses on ice and snow tourism resources, ice and snow tourism markets, and the suitability of ice and snow tourism. Based on image perception, this study opens up a new research direction for ice and snow tourism, which is helpful for scholars to study ice and snow tourism from the perspective of the experience economy.

Concerning research method, there are existing studies using traditional methods and tools. This research uses the most modern Python technology for big data text mining and analysis. This can make up for the shortcomings of other text data mining methods in fine cleaning and deep mining, and can extract some hidden information, thereby improving the accuracy and scientificity of tourism image perception research.

From the perspective of interdisciplinary studies, there have been many studies focusing on tourism geography or management. This study combines management science, economics, and psychology perfectly, and applies it to the new ice and snow tourism industry. This is conducive to the intersection and fusion of disciplines to create new research directions and fields.

In summary, based on existing research, in the era of big data where travel and reviews are king, text mining methods and the Python language will be used to study emerging tourism formats around the three aspects of cognitive image, emotional image and overall image of snow and ice tourism image perception. In addition, this paper accurately grasps and judges the factors that influence the image of ice and snow tourism, and proposes strategies for improving the image perception of ice and snow tourism, with a view to providing a reference for image perception research on ice and snow tourism and other emerging tourism formats in Jilin Province.

2. Research Design

2.1. Research Object

2.1.1. Current Status of Ice and Snow Tourism Resources in Jilin Province

Jilin Province is located in the core area of Northeast Asia in the world's golden ice and snow tourism belt. Ice and snow tourism resources have the characteristics of resources and climate, of globalization (all types), high taste, good combination, little wind, and relatively warm winters. The characteristics of their spatial distribution are outstanding. Jilin Province's ice and snow tourism resources are led by Changbai Mountain, Songhua River, and Chagan Lake, showing the spatial distribution characteristics of "ice in the west, town in the middle, and snow in the east". The excellent snow and ice tourism resources include Changbai Mountain, Tianchi, Jilin rime, Changbai Mountain Hot Spring, Moon Lake, Chagan Lake (winter catch), Songhua Lake, Lianhua Mountain in Changchun, etc. There are four types of ice and snow leisure and vacation resources: ice and snow hot spring health resources, ice and snow tourism cultural resources, and ice and snow folk experience resources. The most popular ice and snow leisure and vacation resources are skiing vacations, such as Wanda Changbai Mountain International Resort and Vanke Songhua Lake Resort, Town, Tianmu Hot Spring and other representatives; ice and snow sightseeing experience resources are represented by Changbai Mountain Scenic Area, Shidao Daogou Scenic Area, Devil World, Old Rick Lake, Liuding Mountain, etc. Among the snow and ice folk cultural resources, the historical and cultural categories include Goguryeo cultural sites, Jingyue Snow World, Changying Century City, and the Puppet Manchurian Palace. Abundant ice and snow resources have laid a very advantageous resource foundation for the development of global ice and snow tourism, key ice and snow tourism industry clusters, characteristic ice and snow tourism towns and famous villages, and the creation of characteristic boutique ice and snow tourism routes.

2.1.2. Current Development of Ice and Snow Tourism Market in Jilin Province

The development status of the ice and snow tourism market in Jilin Province adopts a questionnaire survey method. It is calculated that the longest period of time is 180 days (from 1 November to 1 April of the following year). A total of 4020 questionnaires were distributed this time, with 4000 questionnaires being retrieved and 4000 complete questionnaires. Foreign tourists who come to Jilin Province and local citizens in the province (travelers who travel more than 10 km and travel more than 6 h) are divided into two groups: overnight tourists and day tourists. The survey results are analyzed as follows: Jilin Province's ice and snow tourism source market is dominated by domestic tourists, with the largest number of tourists in the province, followed by Liaoning, Beijing, Heilongjiang, Shandong, Guangdong, Zhejiang, and Shanghai. The entry market is dominated by tourists from South Korea, Russia, Hong Kong, Macao and Taiwan, followed by Japan, Germany, Singapore, Australia, the United States, the United Kingdom, and France. In terms of gender and age, female tourists are fewer than men. The majority are people in their 80 s and 90 s, followed by those in their 40 s and 60 s, and finally students. In terms of occupational composition, private enterprises, foreign-funded enterprises, state-owned enterprises/institutions, and trade staff are the main forces; in terms of travel and stay time, the travel time is mainly concentrated on winter holidays, New Year's Day long holidays and the Golden Week of the Spring Festival. Around 1–2-day surrounding tours are more popular, and the needs of tourists from other provinces for 2–3-day medium and long-term itineraries are increasing year by year; the average stay time of tourists is 2 days, and the stay time in Changchun, Jilin and Yanbian is relatively long. In terms of consumption composition, transportation costs, accommodation costs and food and beverage expenses are concentrated; forms of travel mainly include agency teams and self-help tours, only a small number of tourists are organized by companies or units.

In view of the fact that the ice and snow tourism market in Jilin Province is mainly dominated by Chinese tourists, this paper studies the image perception of ice and snow tourism mainly by Chinese tourists who enter the Jilin Province.

2.2. Research Methodology and Tools

With the popularization of mobile Internet technology, more and more tourists choose to express their travel feelings by posting online travel journals and reviews. Therefore, it is of great significance to research destination image perception to mine these online texts [61]. Text mining is a process of extracting hidden, previously unknown and potentially meaningful patterns from text data in order to discover knowledge [62]. Commonly used text mining tools include the Rost Content Mining software developed by Professor Shenyang of Wuhan University and the Language Technology Platform (LTP) developed by the Social Computing and Information Retrieval Research Center of Harbin Institute of Technology. However, given the fact that there are many punctuation marks and irrelevant words in the content of travel journals and reviews, neither tool is capable of fine cleaning and analysis of text data. Therefore, this paper chooses the Python language, which is a flexible and easy-to-use programming language and has been widely used in data mining, machine learning and other fields in recent years. A large number of high-quality third-party Python modules are available for facilitating the analysis of this study.

2.3. Research Technology Route

The first step is to use Python programming to crawl travel journals and reviews related to the ice-snow tourism in Jilin province from the major travel websites. Secondly, regular expressions were used to extract Chinese content from the original travel journals' text data, and then the jieba module was used for Chinese word segmentation and part-of-speech tagging. After the deactivated words were removed, the statistical results for word-part-of-speech and word frequency were obtained, so as to obtain high-frequency words and their corresponding parts of speech. Then the word cloud module

was used to visualize the word frequency. Programs were written to segment the original travel journal data, to count all pairs of co-occurring words in each sentence and the word frequency matrix of co-occurring words was obtained. Then, the most frequent co-occurring words were extracted from them, and the *netwulf* module was used to conduct visual analysis of the text co-occurrence network and complete the cognitive image analysis. Thirdly, adjectives frequently used in online travel journals and reviews were used to describe emotional perception. According to the distribution of emotion score, the *snownlp* module was used to obtain the negative, neutral and positive emotional attitude comment analysis by using the natural break point method, and to do emotional image analysis. The last step was to analyze the perception of the image of ice-snow tourism in Jilin province and put forward conclusions and suggestions on improving the image of ice-snow tourism in Jilin province.

2.4. Data Source

In this paper, the keywords “Jilin” and “snow and ice” were used to search travel journals on the internet and 526 travel journals were selected, with 476 from Ctrip and 50 from mafengwo.cn. However, there are few text data of reviews of ice-snow tourism in Jilin Province. A search on tuniu.com based on the keywords “Jilin” and “snow and ice” found only 842 reviews about the two routes. Eventually, in view of the limited research period and actual review data, 203 travel journals and all 842 review texts from November 2017 to April 2018 and November 2018 to April 2019 were selected. At last, 219,426 words of travel journals and 28,441 words of reviews were obtained after deleting highly viewed repeated reviews of the same account on the same topic, text descriptions containing news, advertisements, business promotions etc., and invalid reviews consisting of photos only without text, and selecting travel journals emphasizing personal feelings, cleaning and removing stop words.

3. Result Analysis

In this paper, the Cognition-Emotion-Overall Image Model proposed by Baloflul is adopted to divide destination image perception into cognitive image, emotional image and overall image. Cognitive image refers to tourists’ understanding of the attributes of tourist destinations, while emotional image refers to tourists’ feelings and attitudes towards tourist destinations, and the overall image is a combination of the two.

3.1. Analysis of Destination Image Perception

3.1.1. Analysis of Frequency of Frequently Used Words

Python regular expressions were used to extract Chinese content from the online travel journals obtained through network crawling, and the *jieba* module was used for Chinese word segmentation and part-of-speech tagging. After the stop words were removed, the statistical results of word, part-of-speech and word use frequency were obtained, so as to obtain frequently used words and their corresponding part-of-speech. The *jieba* module was used for Chinese word segmentation and part-of-speech tagging. Single words were deleted, and 25,648 words were finally outputted. Due to the length of the paper, the top 120 high-frequency words (including only nouns, verbs and adjectives) were extracted. These words reflect tourists’ cognition of various elements of the image of ice-snow tourism in Jilin province, as shown in Table 1.

Table 1. Top 120 Most Commonly Used Terms in Network Travel Journals.

No.	Feature Words	Frequency	Part-of-Speech	No.	Feature Words	Frequency	Part-of-Speech	No.	Feature Words	Frequency	Part-of-Speech
1	Rime	2096	Noun	41	Baihe	262	Noun	81	Freedom	172	Adjective
2	Changbai Mountain	1623	Noun	42	Located in	257	Verb	82	Charter	170	Verb
3	Ice and snow	1141	Noun	43	Park	254	Noun	83	Life	170	Verb
4	Harbin	1106	Noun	44	Arrive	253	Verb	84	Yangcao	169	Noun
5	Hometown of snow	1097	Noun	45	Waterfall	251	Noun	85	Scenic spot	169	Noun
6	Northeast China	1021	Noun	46	Ticket	251	Noun	86	Beautiful	168	Noun
7	Skiing	938	Noun	47	Erdao	250	Noun	87	Snow sculpture	167	Noun
8	Hotel	872	Noun	48	Culture	248	Noun	88	Kids	166	Noun
9	Jilin	762	Noun	49	Photography	240	Noun	89	Mobile phone	166	Noun
10	Time	711	Noun	50	Activities	239	Verb	90	Check in	165	Verb
11	China	698	Noun	51	Suggestions	238	Noun	91	Songhua Lake	162	Noun
12	World	673	Noun	52	Manchu	231	Noun	92	North	161	Noun
13	Place	651	Noun	53	Architecture	227	Noun	93	Breakfast	159	Noun
14	Tianchi	627	Noun	54	Special	225	Noun	94	Keep warm	159	Verb
15	Tourism	564	Verb	55	Project	221	Noun	95	Art	159	Noun
16	Changchun	503	Noun	56	Hiking	215	Verb	96	Fun	158	Noun
17	Scenic spot	500	Noun	57	Mountaintop	212	Noun	97	Airplane	158	Noun
18	Snow valley	490	Noun	58	Take photo	209	Verb	98	Ice sculpture	158	Noun
19	Hour	472	Noun	59	Morning	204	Noun	99	More River	158	Noun
20	Hot spring	465	Noun	60	Good	200	Adjective	100	Camera	157	Noun
21	Songhua Lake	456	Noun	61	Subzero	198	Noun	101	Arrangement	156	Verb
22	Ski resort	416	Noun	62	Scenery	197	Noun	102	Photos	154	Noun
23	Depart	413	Verb	63	Price	197	Noun	103	Cold	152	Adjective
24	Feeling	408	Noun	64	Weather	197	Noun	104	Jilin province	151	Noun
25	Jilin City	381	Noun	65	Accumulated snow	196	Noun	105	Driver	150	Noun
26	Cross	379	Verb	66	Ula	195	Noun	106	Xipo	144	Noun
27	Season	367	Noun	67	International	195	Noun	107	Discover	144	Verb
28	Tourists	321	Noun	68	Feeling	194	Verb	108	Beijing	144	Noun
29	Schedule	321	Noun	69	City	192	Noun	109	Ride	144	Verb
30	Experience	311	Noun	70	Wanda	191	Noun	110	Temperature	143	Noun
31	Scenic spot	300	Noun	71	Beipo	187	Noun	111	Rest	142	Verb
32	Airport	299	Noun	72	Street	184	Noun	112	Jingyuetan	141	Noun
33	Accommodation	297	Noun	73	South	183	Noun	113	Train	141	Noun

Table 1. Cont.

No.	Feature Words	Frequency	Part-of-Speech	No.	Feature Words	Frequency	Part-of-Speech	No.	Feature Words	Frequency	Part-of-Speech
34	Museum	277	Noun	74	Vocation	183	Verb	114	Delicacies	140	Noun
35	Forest	276	Noun	75	Scenery	182	Noun	115	Snow	140	Noun
36	Friends	275	Noun	76	Recommendation	179	Verb	116	Days	140	Noun
37	Travel	273	Verb	77	Partners	174	Noun	117	Gloves	139	Noun
38	Inn	273	Noun	78	Beautiful scenery	174	Noun	118	Changbai	138	Noun
39	Devildom	263	Noun	79	History	173	Noun	119	Return	137	Verb
40	Resort area	262	Noun	80	Appreciation	172	Verb	120	Luggage	136	Noun

As can be seen from Table 1, “rime”, “Changbai Mountain”, “snow and ice”, “Harbin”, “hometown of snow” and “Northeast China” have the highest frequency, occurring between 2092 and 1021 times, and are things attractive to tourists. Terms including scenic spots, tourism resources, place names and locations are the most intense part of tourists’ image perception, leaving a deep impression on tourists. These attractions have become the first choice for tourists to visit Jilin province for snow and ice. The frequent use of such terms as “Harbin” and “hometown of snow” indicates that tourists often compare the ice-snow tourism in Jilin province with that in Heilongjiang province. Meanwhile, the frequency of terms on travel accommodation and travel transportation such as “hotel”, “time” and “hours” is between 872 and 472, which reflects that tourists pay close attention to the accommodation and transportation elements related to scenic spots. Frequency of terms on tourist activities such as “hot springs”, “ski resorts”, “museums”, “forests”, “resorts” and “waterfalls” is average, between 465 and 251. These tourist activities are very attractive to tourists and are an important part of perception of the image of ice-snow tourism. In addition, frequency of terms on travel services and features such as “tickets”, “culture”, “Manchu”, “architecture”, “features”, “prices”, “ula”, “international”, “history” and “art” is between 251 and 159, which is the most important part of tourist perceptions. Frequency of nouns related to tourism climate is between 152 and 138, which is the most direct perception of the image of the ice-snow tourism in Jilin province.

3.1.2. Analysis of Classification of Frequently Used Terms

Based on analysis of the frequency of the above frequently used terms, the perception of image of ice-snow tourism in Jilin province was classified into five main categories and 12 sub-categories based on the 120 extracted frequently used terms. The five main categories were tourism attractions, tourism activities, tourism facilities, tourism features and tourism service environment. The 12 sub-dimensions were: tourist sites, scenic spots, tourist resources, ice-snow themed activities, auxiliary themed activities, tourist accommodation, tourism transportation, tourism catering, ethnic, international, art and culture, tourism services, tourism climate conditions, etc. According to the classification system, frequently used terms unrelated to the primary and secondary categories were excluded, and the selected feature words were classified into the corresponding primary and secondary categories, forming a statistical table classifying frequently used terms (see Table 2).

As can be seen from Table 2, of the main categories, tourism attractions have the highest frequency, followed by tourism facilities and tourism services. Among the sub-categories, tourists pay the closest attention to scenic spots, followed by tourist destinations, tourism transportation, tourism resources, ice and snow themed activities, tourism accommodation, auxiliary themed activities, internationalization, tourism services, art and culture, and tourism catering. Seen in this light, scenic spots are the most important part of tourists’ perception of the destination image, and tourists pay close attention to tourist destinations, tourism transportation, tourism resources, and ice-snow themed activities.

Table 2. Classification of Frequently Used Terms in the Perception of Image of Ice–Snow Tourism in Jilin Province.

Main Categories (Frequency/Percentage)	Sub-Categories (Frequency/Percentage)	Frequently Used Terms
Tourism attractions (13027/53.19%)	Tourist sites (4136/31.75%)	Northeast China, Jilin, Changchun, Jilin City, Baihe, Erdao, South, Jilin Province, North, Beijing, Changbai
	Tourist attractions (6673/51.22%)	Rime, Changbai Mountain, Tianchi, Songhua River, museum, devildom, park, waterfall, Beipo, Wanda, Songhua Lake, Xipo, Jingyuetan
	Tourist resources (2218/17.03%)	Snow, hot spring, forest, accumulated snow, snow
Tourism activities (3117/12.73%)	Snow and ice themed activities (1679/53.87%)	Skiing, ski resorts, snow sculptures, ice sculptures
	Auxiliary themed activities (1438/46.13%)	Traversing, photography, hiking, mountaintop, photo taking, vacation
Tourism facilities (4160/16.99%)	Tourist accommodation (1607/38.63%)	Hotel, lodging, inn, check in
	Tourism transportation (2254/54.18%)	Time, hour, airport, chartered bus, plane, driver, ride, train
	Tourism catering (299/7.19%)	Breakfast, delicious food
Tourism features (2153/8.79%)	Ethnic (231/10.73%)	Manchu
	International (1063/49.37%)	World, ula, international
	Art and culture (859/39.80%)	Culture, characteristics, art, architecture
Tourism service environment. (2033/8.30%)	Tourism services (1045/51.40%)	Schedule, tickets, prices, days, luggage
	Tourism climate conditions (988/48.60%)	Subzero, weather, cold, temperature, warmth, gloves

tourists' perceptions, and the most important factor of winter ice-snow tourism in Jilin. These core words form a network of internal and external connections. Co-occurring words such as "Changbai Mountain—skiing", "Changbai Mountain—Tianchi", "Changbai Mountain—hotels", "Changbai Mountain—hot spring", "rime—enjoy" and "rime—Jilin city" have a high degree of connection. This is a further cognition of the evaluation subject, which is in the sub-core position, indicating that tourists are most impressed by the core resource elements of the scenic spot and the city where the scenic spot is located. These are the most prominent representatives of Jilin ice-snow tourism, with brand characteristics. Peripheral terms include "ski resort," "Wanda," "Changchun," "snow and ice tourism", and all other high-frequency words involving the specific tourism sites and range of reputation, and they provide further expansion and enrichment of the core words and sub-core words.

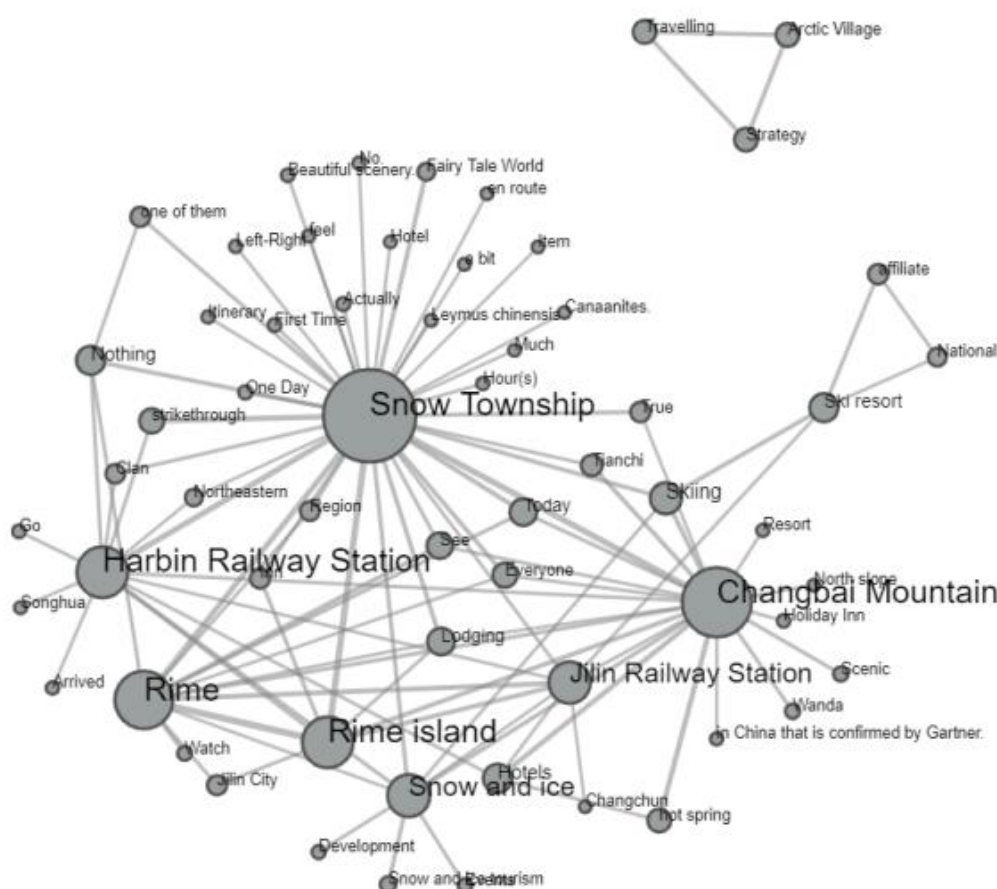


Figure 2. Diagram of Network of Frequently Co-occurring Words in Ice-Snow Tourism in Jilin Province.

3.2. Analysis of Emotional Image

Tourists' perception of emotional image is an important part of Jilin's ice and snow tourism image perception. Emotion image perception can be characterized from two dimensions: emotion perception and emotion attitude.

3.2.1. Emotional Perception

Emotional perception is described by the top 30 high-frequency adjectives screened in online travel notes and reviews, as shown in Table 3.

Table 3. Top 30 High-Frequency Adjectives in Samples of Web Travel and Reviews.

Sequence	Word	Frequency	No.	Word	Frequency	Sequence	Word	Frequency
1	Good	200	11	Beautiful	81	21	Mysterious	57
2	Free	172	12	Full	73	22	Exactly	56
3	Cold	152	13	Regret	73	23	Magical	53
4	Most Beautiful	136	14	Warm	72	24	Happy	53
5	Magnificent	120	15	Perfect	69	25	Crystal	51
6	Cheap	113	16	Simple	65	26	Fun	49
7	Unique	99	17	Freezing	65	27	Exquisite	47
8	Famous	98	18	Look-looking	62	28	Lively	44
9	Big	87	19	Warm	59	29	Comfortable	41
10	Gorgeous	86	20	Luck	58	30	Cozy	39

From Table 3 and crawled web texts, we can see that “nice, comfortable, and cozy” is the emotional perception of hotel accommodation and the overall itinerary; “free” is the emotional experience of the emerging travel style of “free journey” in Changbai Mountain; “cold and freezing” is an emotional perception of the tourist climate; “most beautiful”, “magnificent”, “unique”, “famous”, “big” and “gorgeous” are tourists’ emotional experience of Changbai Mountain, Tianchi, and misty scenery, emotional cognition in “Smart Choice” accommodation, package price and transportation. “Beautiful” is a compliment to moments of playing in snow, happy holidays and overall travel memories; “full” is an emotional interpretation of the oriental charm of Changbai Mountain, the mystery of snow, the childlike snow fun, and the joy of playing in snow; snow means the beautiful Tianchi, and the emotional perception evaluation caused by the lateness of the tourist traffic plane. “Perfect” is a fake “perfect” emotional experience that tourists expect from a richer breakfast and a guided tour throughout the Tianchi service; “simple” is a “simplified” emotional sigh for the convenience of free online ticket purchase, skiing, and experience. “Warm” is an emotional experience of hot springs, hotel service environment, and the rustic and hospitable folk customs of Northeast China; “pretty” is the praise of snow, scenery, blue sky, Baiyun and Changbai Mountain Tianchi, and the small town, and the emotional experience of seeing the Changbai Mountain Tianchi, wild animals and the misty mist of Jilin. “Mysterious” is the tourist’s emotional experience of Changbai Mountain, Tianchi, Wuluo Island, Beauty Songyuan Park, and Songhua Lake winter fishing and hunting culture and ancient techniques; “indeed” expresses the emotional experience of tourists choosing the right time to see the beauty. It is an emotional expression that is worth visiting after experiencing Changbai Mountain; “crystal” is the description of snow, fog, and ice sculpture; “fun” is the emotional expression of skiing, skating, winter fishing and adventure crossing.

3.2.2. Emotional Attitude

The snownlp module was used to analyze the emotion in the reviews, and according to the distribution of emotion score, the natural break point method was used to obtain the negative, neutral and positive review data, as shown in Table 4.

Table 4. Statistical Table of Emotional Attitude.

Emotional Types	Frequency (Time/Percentage)	Segmented Statistical	Frequency (Time)	Percentage
Positive emotion	278/67.31%	Low (0.797–0.893)	29	7%
		Middle (0.893–0.97)	45	10.86%
		High (>0.97)	204	49.3%
Neutral emotion	48/11.62%		48	11.83%
Passive emotion	87/21.07%	High (0–0.058)	57	13.8%
		Middle (0.058–0.165)	12	2.9%
		Low (>0.165)	18	4.35%

As can be seen from the reviews in Tables 4 and 5, positive emotions account for a large proportion (67.13%), and high-degree positive emotional expressions accounted for 204 reviews (49.3%). These positive reviews use the adjectives “so beautiful”, “very beautiful”, “first-class,” and “best”, used by tourists when describing the scenic spot Changbai Mountain and Tianchi snow scenery, hotel accommodation and skiing facilities. Negative reviews only accounted for 21.07%, and the frequency of high-degree negative emotional expressions was 57 (13.8%). Negative evaluation refers to insufficient breakfast, hotel accommodation without sound insulation, geographical location, inconvenient transportation and high cost. However, it should be pointed out that the emotional attitude is affected by tourists’ degree of satisfaction in travel consumption needs, knowledge and experience, personality characteristics and group, and so on, and there are subjective differences in the experience evaluation of the same thing by different tourists. Therefore, in practice, it is necessary to specifically analyze the influencing factors of the formation of tourists’ emotional attitude and make targeted changes.

3.3. Overall Image

The overall image is tourists’ evaluation of the overall image perception after they separately evaluate the “eating, living, traveling, shopping and entertainment” of the ice-snow tourism in Jilin province. The words selected from frequently used words such as “spectacle,” “most beautiful,” “spectacular,” “magical,” “shocking,” “scenic spot,” and “not bad” are tourists’ overall evaluation of the ice-snow tourism in Jilin province. This shows that ice-snow tourism in Jilin province has formed its own characteristics and generated brand effect. Tourists use positive emotion words such as “recommend merit,” “worthwhile trip,” “satisfied,” and “valuable” to describe the overall image of ice-snow tourism in Jilin province. Only a small number of negative words were used by tourists to describe the image of ice-snow tourism in Jilin province such as “pity” and “bad” in relation to accommodation, catering, transportation and service management. Among the frequently used terms, “next time” indicates tourists’ willingness to visit again, but its frequency is relatively low, indicating that the structure of ice-snow tourism products in Jilin province is single and lacks a continuous attraction.

Table 5. Representative Positive and Negative Evaluation Texts.

Positive Evaluation	Negative Evaluation
Tianchi, skiing is worth visiting, beautiful and breathtaking.	The hotel is a little better than the express hotel, the sound insulation is poor, you can clearly hear the speech in the corridor when lying on the bed. There are few types of breakfast. The least favorite is the airline of Juneyao Airlines. It also has to stop in Tianjin, wasting time and energy! Of course, if you just go for skiing, the price/performance ratio of the Smart Choice Hotel is still okay. The hotel is only 5 minutes' walk from the ski resort, and the snow card process is now very convenient.
The Changbai Mountain is so beautiful. It's a great time to go to the cold snow while enjoying the snow while enjoying the cold snow. Unfortunately, we did not see Tianchi in heavy snow, so we will go there next time. The ski slopes are good, but you must be able to get hit or you won't master it.	During the Chinese New Year, take children to travel, the overall itinerary is mainly skiing, the hotel with a good snow slope is slightly bad for breakfast.
Very nice, the snow is beautiful and skiing is even cooler. Convenient transportation, prices in the scenic area are naturally higher than normal, but almost the same as in Nanjing. Great! The only drawback is: I set off from Nanjing at noon to Changbai Mountain Hotel (Nanjing has no direct flight to Baishan)	The plane arrives at 9 pm and the return trip is 11 noon. This arrangement is almost a waste of the whole day, and the schedule is not very satisfactory. Hyatt's restaurant is good, the resort has KFC McDonald's Pizza Hut, so you can also eat anything if you are tired. The traffic is not very good. The location of the resort should be relatively biased; it is not convenient to go anywhere. We reported a group to Changbai Mountain locally; the overall feeling is OK; the feeling of skiing is great.
The flight time is good. The Park Hyatt Hotel is first-rate in the Wanda Resort. The rooms are very large, the facilities are very advanced, and they are very comfortable and worth a stay. The ski resort facilities are also the best in the country. The ski tracks and hardware facilities are all excellent. Although it is a beginner, please hire a coach, but you can get started soon.	Changbai Mountain is free of charge in winter, but you need to take a scenic bus + ascent to the off-road vehicle, and you have to spend a lot. It is found that the trip to the Northeast is a big traffic, and accommodation and meals are not expensive.

4. Conclusions and Discussions

4.1. Conclusions

In this paper, python technology was used to crawl, analyze and mine travel journals and reviews on famous travel portals like the OTA (Online Travel Agent) and UGC (User Generated Content) platforms related to ice-snow tourism in Jilin province to explore the perception of the image of ice-snow tourism in Jilin province. The following conclusions are drawn:

4.1.1. Cognitive Image

The perception of the image of ice-snow tourism in Jilin province can be classified into five main categories and 12 sub-categories according to the 120 extracted frequently used terms. The five main categories were tourism attractions, tourism activities, tourism facilities, tourism features and tourism service environment. The 12 sub-dimensions were: tourist sites, scenic spots, tourist resources, snow and ice themed activities, auxiliary themed activities, tourist accommodation, tourism transportation, tourism catering, ethnic, international, art and culture, tourism services, tourism climate conditions, etc. Among the five main categories, tourism attractions have the highest frequency, followed by tourism facilities and tourism service environment. According to the word

cloud and text co-occurrence visualization network, “Changbai Mountain” and “rime” are core words, indicating that tourists are most impressed by “Changbai Mountain” and “rime”.

4.1.2. Emotional Image

As for the emotional image of ice-snow tourism in Jilin province, positive emotional expressions account for 67.31%, neutral emotional expressions 11.62%, and negative emotional expressions 21.07%. These positive evaluations include the positive adjectives “so beautiful”, “very beautiful”, “first-class”, and “best” used by tourists when describing the scenic spot Changbai Mountain and Tianchi snow scenery and skiing facilities. Negative evaluations refer to inconvenient transportation and unsatisfying accommodation and catering.

4.1.3. General Image

Tourists tend to speak highly of the image of ice-snow tourism in Jilin province but few intend to revisit. Tourists used words such as “spectacle,” “most beautiful,” “spectacular,” and “not bad” in evaluating ice-snow tourism in Jilin province. Tourists use positive emotion words such as “recommend” and “worthwhile trip” to describe the overall image of ice-snow tourism in Jilin province. Tourists used negative terms such as “pity” and “bad” in relation to accommodation, catering, transportation and service management. In addition, the low frequency of the term “next time” indicates tourists’ willingness to revisit is low.

4.2. Suggestions

The following suggestions are proposed based on the above conclusions to improve the image of ice-snow tourism in Jilin province.

4.2.1. Develop Special Ice-Snow Tourism Products and Embark on a Road of “Transformation and Upgrading”

In view of the classification of perception of the image of ice-snow tourism in Jilin province, the four product systems of ice-snow leisure vacation, ice-snow hot spring health care, ice-snow sightseeing culture and ice-snow folk experience should be further improved, with attention paid to tourist sites, scenic spots, tourist resources, snow and ice themed activities, auxiliary themed activities, tourist accommodation, tourism transportation, tourism catering, ethnic, international, art and culture, tourism services and tourism climate conditions. The core Jilin ice-snow tourism product portfolio features long-term and short-term “in-depth ice playing,” “thick snow entertainment,” “warm hot springs,” “heat” and “folk customs” to meet diverse demands, extend the industrial chain and improve supporting services. These measures aim to create a richer, more comfortable and more concentrated ice-snow tourism experience through transformation and upgrading, meet the increasingly diversified travel needs of tourists, and improve the willingness of tourists to visit again.

4.2.2. Improve the Brand Effect of Ice-Snow Tourism and Embark on a Road of “Multi-Elemental Creative Marketing”

The marketing strategy of the ice-snow brand should be implemented, with a focus on cultivating four ice-snow tourism brands: ice-snow Changbai Mountain, fishing and hunting Chagan Lake and fairy tale rime island. It is suggested to make use of the advantageous resources of ice-snow tourism in Jilin province, to carefully plan the products of the ice-snow tourism festival, improve and enhance the Jingyue Wasa International Cross-country Skiing Festival, expand its influence, and make it an international ice-snow tourism event. In addition, the “national ice-snow season” should be continued to cultivate the ice-snow market. The destination image of Jilin shall be established, and the brand influence of “Jilin ice-snow tourism” developed in collaboration with major media and network resources for extensive publicity and influential mass media. Propaganda utilizing CCTV’s golden advertising time, airports, railways and other must-bypass traffic scenes should be

continued. It is necessary to guide and encourage tourism enterprises to utilize the mainstream network platforms to establish the Internet platform marketing system of ice-snow tourism marketing.

4.2.3. Build a Brand-New Ice-Snow Tourism Environment and Optimize Services

For an optimized and attentive service, it is necessary to design a whole set of travel experiences that take into consideration tourists' diversified needs for food, accommodation, travel, shopping and entertainment. An ice-snow theme hotel should be built, so that tourists in the ice and snow can enjoy a variety of unexpected and novel accommodation. There should be enrichment of food types, characteristic catering, accommodation and travel products for different periods. The business district, accommodation area and entertainment area should be properly planned around the snow field to integrate the commercial street, food street and entertainment area facilities. A special ice and snow food bar or food stall should be set up to sell special food or snacks of northeast China and enjoyable gourmet dinners. Tourist souvenirs with northeast characteristics should be developed to integrate local customs, historical culture and folk customs into tourist souvenirs. The indoor temperature of the ski resort should be raised, sufficient rest facilities should be provided, panoramic pictures of the ski resort should be improved, ski guide signs should be perfected, and the parking lots, tourist centers, hot springs and facilities for swimming should be updated. Infrastructure such as transportation and entertainment should be constantly improved. Transportation and entertainment infrastructures should be constantly improved and regulatory platforms should be established to achieve full-coverage supervision.

4.2.4. Improve the Safety Mechanism for Ice-Snow Tourism to Ensure Safety

"Exciting and thrilling" refers to the emotional experience of snow and ice tourists in terms of tourism safety. Safe ice-snow tourism is the focus of continuing attention and the construction of ice-snow tourism in Jilin province. Therefore, tourists' safety awareness should be enhanced, and business operators should attach great importance to the safety warning of tourists, so as to strengthen tourists' attention to the safety of themselves and others. It is necessary to improve the guarantee level of ice and snow sports and ice and snow tourism facilities and improve the preventive mechanisms of facility maintenance, management and investigation. Measures should be taken to actively guide related industries such as medical care, insurance, education, science and technology, and equipment to participate in promoting the snow and ice industry and establish a snow and ice safety system. We should improve the safety and development of the market, continue to maintain the order of the ice and snow tourism market, crack down on violations in accordance with the law, and promote the establishment of a comprehensive regulatory system for the modern ice and snow tourism market. The level of market security and development should be improved to continuously maintain the order of the ice and snow tourism market, and more efforts should be made to crack down on illegal behaviors in accordance with the law, so as to promote the establishment of a comprehensive regulatory system for the modern ice and snow tourism market.

4.3. Discussion

The perception of tourism image is of great significance to the image formation of tourism destinations and the sustainable development of tourism. Research on the perception of ice and snow tourism image, especially the specific promotion strategy of tourism image perception, is of great significance for the formation of ice and snow tourism image and the high-quality development of ice and snow tourism in Jilin Province, and even further for improving the overall tourism ice and snow image and high-quality development of tourism in China.

This research has theoretically opened up a new field of tourism image perception, which has played a role in attracting scholars to study different types of tourism image perception issues. It opens up a new perspective on ice and snow tourism, and introduces image perception into the field of ice and snow tourism instead of traditional ice and snow resources and snow sports. It realizes the

perfect combination of new liberal arts and new engineering, uses the artificial intelligence big data mining technology of engineering, studies cognitive image and emotional image in psychology from the perspective of consumer behavior, and uses product management and marketing of management science. Additionally, management theories such as brand philosophy and safety management have put forward specific solutions. Ultimately, it has promoted the development of the industrial economy in the region of ice and snow tourism and ice and snow economy in Jilin Province, realized the cross fusion of disciplines such as engineering, psychology, management, and economics, and created new research directions and fields.

However, this study has certain limitations. First, there are deviations in the network text data analysis. According to the report of iUserTracker, among the users who book travel products online, users aged 19–35 account for up to 79%, and users with college degrees or above account for up to 84%. However, OTA online travel review users are not representative of the overall travel audience. Some social groups make less use of online travel services. The second issue is in the segmentation and comparison of image perception multidimensional data. This paper does not subdivide the ice and snow tourism image perception from the perspective of users. In addition, this study considers the impact of external environmental factors on the perception of snow and the snow tourism image in the future. Also, the image-aware text analysis method is not detailed enough. With the combination of the Python language and text mining method, although it is possible to accurately find high-frequency words and visualize word clouds and co-occurrence networks, there is still a problem that classification studies are not performed by topic and type, and the corpus data is not accurate enough in sentiment analysis.

In the future, research will continue to be based on Python technology. With the multi-dimensionalization of network text data, it will further subdivide research users. This paper conducts targeted image perception research around users of different genders, ages, nationalities, and regions, so as to more accurately propose strategies for improving the image perception of snow and ice tourism in different market segments, and to realize the comprehensive and high-quality development of ice and snow tourism. At the same time, with the approach of the 2022 Winter Olympics, tourists from all over the world will come to China to experience China's ice and snow. At that time, it will be possible to study the perception of ice and snow tourism from the perspective of inbound tourists. The status of tourism power has important practical significance. In addition, whether external environmental factors such as global warming, haze and the new coronavirus, and the full passenger flow on holidays, will have a significant negative impact on the perception of ice and snow tourism image is also a question for further discussion. Finally, regarding the research method, in future research, methods like LDA, BTM and other topic models can be used to extract different topics in text data, and draw word cloud diagrams to study the frequency of words more specifically. In terms of sentiment analysis, corpus data that better fits the travel scene can be used in the future. In addition, more advanced deep learning methods such as Bi-LSTM will be used to improve the model, to obtain real-time text data from the Internet, to improve research on the image perception of snow and ice tourism in real time, and to promote the sustainable development of snow and ice tourism.

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