Identifying Opinion Leaders in Virtual Travel Community Based on Social Network Analysis

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Abstract. With the thriving development of internet industry and continuous increase of consumer demand in outbound tourism in China, opinion leaders in virtual community have significant effects on consumers' decision making process. Hence, identifying the opinion leader in virtual travel community (VTC) is significantly important for virtual community of outbound tourism. This study proposes the opinion leader recognition model based on social network analysis (SNA), and identifies leader value presented by construal influence, content influence, and activity to measure and evaluate the effect of opinion leader on consumers' cognition. Based on the empirical data, this study examines the soundness of SNA in VTC dimensionally and comprehensively, and establishes the opinion leader recognition, which can be used in future research to explore the assessment mechanism of opinion leader' effect on consumers.

Keywords: Opinion leaders · Virtual travel community ·
Social network analysis · Leader value

1 Introduction

The outbound tourism market is experiencing a thriving development globally. In 2016, the number of Chinese outbound tourists reached 122 million, increased by 4.3% compared with the number of 2015 [1]. The new movement of Chinese outbound tourism is deemed as a second wave of tourism by Arlt [2], therein more and more resorts outside of Asia become priorities for independent travelers. Travel is an informative-intensive activity. Since outbound tourism often happens in an environment of entirely different cultural and language background, which increases the difficulty for planning and traveling. However, since the mid-1990s, ever-emerging virtual travel communities (VTCs) provide travelers and tourism providers with an accessibility for exchanging information and maintaining relationships [3]. The development of supporting travel network products began from the original BBS to the user generating content (UGC) platform, from the professional generated contents (PGC) content to the vertical growth of the Raiders, accompanied by refined content. In China, tourists are more inclined to VTCs, because the cultural norms encourage people to live in a community-minded way [4].

VTCs allow people to share their suggestions or stories based on their knowledge and tourism experience [5]. Other tourists are able to refer to other's experience or word-of-mouth to design their own journey or communicate for fun [6]. In this process, opinion leader in tourism exert a great impact on VTCs' users community involvement [7]. Opinion leader has also been proved the best marketing object in terms of diffusion speed and maximum cumulative number of adopters [8]. In consideration of the demand for outbound tourism, a number of opinion leaders are active in the outbound tourism virtual community, in addition to many potential opinion leaders. In e-commerce, opinion leaders are excellent channels for information dissemination. They have special marketing advantages as word-of-mouth communicators in the outbound tourism market. With their unique structural position and social assets, they can achieve excellent marketing results. For virtual communities, opinion leaders also play an important role - opinion leaders are the foundation of the community and the most important members of the virtual community, which can activate the community atmosphere and enhance the popularity of the virtual community.

Given the popularity of outbound tourism and growing importance of VTCs utilization in outbound tourism, it is vital for us to identify opinion leaders rather than merely understand their characteristics. This study empirically to use social network analysis (SNA) combined with some feathers (Title Certificate, User Level) of outbound UGC virtual travel community (VTC) to identify opinion leaders in Qyer.com, an outbound VTC in China. The experiment study on real dataset reveal that our identification method is effective to identify opinion leader in outbound tourism virtual community. This study seeks to establish an outbound VTC opinion leader identification model and test this model with social networking analysis combined with outbound TVC's features using the data extracted from a Chinese outbound VTC called Qyer.com.

2   Literature Review

2.1   Opinion Leader in Virtual Travel Community

Virtual Travel Community relies mainly on information sharing by its users. Such information is a kind of online word-of-month (WOM), which is informal, person-to-person communication between a perceived noncommerical communicator and a receiver about a product, service or organization [9]. The research indicated that although the number of "travel opinion leaders" or "central travelers" is relatively lower, they play a key role in supplying information to others [10], they are those influential, respected, WOM-spreading individuals [11].

The connotation of opinion leaders was gradually discovered, and its influence mechanism was also concerned by researchers. Zhu [12] defines the concept of "network opinion leader" and discusses its influence on online speech and its social influence; defines the concept of "network opinion leader post" and considers its progressive significance. On the basis of distinguishing the two, think about the ambiguity, fusion and transformation between the two concepts.

In tourism virtual community behavior, Liu [13] studies the influence and mechanism of opinion leaders in the process of college students' participation, based on social capital theory, social influence theory and herd behavior theory and tests the influence of opinion leaders on college students' participation in tourism virtual community behavior. In addition, Zhu [14] believes that with the "snowball"-style communication structure, the Internet circle confirms the role of the opinion leader of the information initiator in the virtual community, that is, the power center of the communication network; at the same time, because the Internet circle is infiltrated by the blood of different social relationships, its authorization is formed. The opinion leader is unbalanced in practical role.

Opinion leader could affect people's knowledge and attitude [15]. Much research has been conducted to explore opinion leader in context of VTC. Vasiliki and Kostas [16] pointed that travel opinion leaders are more willing to provide information, and they were more accessible by others through abundant incoming links. Further, Yoo et al. [17] concluded that travel opinion leaders relied on their rich travel experience and official statues to be trusted by others. According to the study of Jeong and Jang [18], opinion leaders were more active in exploratory behavior and dispersed more eWOM that non-leaders. Gabriela et al. [19] found that group leaders in VTC seemed to be active participants, and they had more experience with products related to group's interests or have more refined tastes.

2.2 Opinion Leader Value Measurement Model

Opinion leaders are important in improving communication and encourage team members to achieve a higher level of information exchange [20]. Many studies have proposed innovative opinion leader recognition and value measurement models to identify and evaluate them across different platforms or groups. With regard to how to identify opinion leaders, Li and Du [21] proposed an ontology-based BARR framework to analyze Weibo content, user characteristics and user relationships in popular Weibo to identify opinion leaders in Weibo.

Besides, in terms of structural influence, the Analytic Hierarchy Process (AHP) was used to implement the opinion leadership impact assessment, and an evaluation system consisting of four first-level indicators and 13 second-level indicators was constructed [22]. Moreover, Zhang [23] constructed a directed right network that characterizes the interpersonal influence of the community from the perspective of social network, and constructed a user influence model, exploring the rules of interpersonal communication, communication and influence within the community, and provided a theoretical basis for community word-of-mouth marketing practical guidance. Further, Aghdam et al. [24] proposed a framework using trust relationship between the users and evaluates the total trust value (TTV) of primary opinion leaders between other users to select the highest of them. Top in-degree method, top out-degree method, top centrality method and hybrid IO-degree method were proved have better results in social network marketing campaigning.

From the perspective of content impact and activity, Cao and Zhang [25] explained the characteristics and trends of social network structure changes, and pointed out that opinion leaders will still play a central role in social media. Ding and Wang [26] took

"Douban Net" as the research object, and established four levels of indicators including neutral, active, cohesive and infectious, and whether it is administrator, number of friends, number of followers, number of followers SNS virtual community opinion leader identification index system with 12 secondary indicators such as posting number, posting frequency, posting type, and number of posts. Considering the activity indicator, Yu et al. [27] improved HITS algorithm based on micro-blog user's influence and liveness analysis. Micro-blog user's hierarchy ad their comments were used to build an interactive network based on their weight.

3   Data Source

Founded in 2004, "Qyer.com" has developed into a leading outbound service platform in China. The Travel Quiz section of the "Qyer.com" is a typical outbound travel virtual community with a registered number of 80 million. The members of the section can be divided into three categories: questioners, respondents and bystanders. All the research samples in the article were collected by the web crawler from the poor quiz section. The selected samples only included the questioner and the respondent, excluding the bystanders (users who did not communicate with other users). Because only the number of times the question has been viewed and the number of likes, and the fact that the bystander does not speak cannot be the opinion leader, the opinion leader can be identified by using only the sample of the questioner and the respondent. The daily posting volume of the Travel Quiz section of the "Qyer.com" is less volatile. This article randomly selects posts posted from March 12th to March 14th, using web crawlers to crawl posts, questions, responses, likes, page views, questioners, and respondents. A total of 298 posts were grabbed, 52 unreported posts were removed, a total of 246 posts were collected, and a total of 288 users were sorted out.

4   Study 1

4.1   Method

Participants. This study randomly selects posts posted from March 12 to March 14, 3 days, using web crawlers to crawl the posts, questions, responses, likes, page views, questioners, and respondents. A total of 298 posts were grabbed, removing 52 unreported posts, and then a total of 246 posts were collected. A total of 288 users were sorted out among 246 posts.

Procedure. This paper uses data mining technology to obtain research data, and uses social network analysis to measure the centrality, structural holes and core/edge of outbound tourism virtual community represented by "poor travel network" to analyze the structural influence of leaders. Firstly, the article uses integrated network data analysis to establish an interactive contact between questioners and responders. The interaction between the questioner and the respondent is marked as number 1, and if

there is no interaction, it is marked as number "0". Since some answers may be questioned multiple times, this case is also marked as "1". The above data are explained in detail by density analysis, correlation analysis and factional analysis. Next, social network analysis mainly measures the position of members in the network by degree centrality, intermediate centrality and proximity centrality. By intercepting the first 20 users and using Ucinet software, the calculation results of degree centrality, intermediate centrality and proximity centrality are obtained. Then the measurement of structural holes often focuses on four indicators: effective scale, efficiency, limitation and extreme. Run the Ucinet software and click on network → ego network → Structural Holes to calculate the structural holes in the network. Finally, through core/edge analysis, all members are divided into two parts according to the degree of affinity with other members and the density of the network: core members and edge members. Core members are more closely linked with other members and have greater advantages in the process of information exchange. The core and edge members of the network can be directly output through the Ucinet software.

4.2   Results

Based on the analysis of the overall network data, a 288 * 288 matrix is obtained. Numbering 288 users from 1 to 288, a new 288 * 288 matrix is created, which is input into the social network analysis software Ucinet, and the network diagram as shown in Fig. 1 can be obtained.

The social network diagram shown in Fig. 1 shows the network relationships among 288 users, with a blue block representing each user and a number next to it representing each user's number. Because the relationship between all users in the matrix is bidirectional, the arrows between each two users in the graph are bidirectional. The network diagram above intuitively shows the relative position of each user in this virtual community. The most peripheral hanging point represents the user's relationship with other users alienated, only one user contact, and the center user contact is closer. This directly shows the position of each user in this group. Central users are also relatively central in the group, while marginal users are relatively marginal in the group.

By Inputting the finished matrix into Ucinet software, we can get the network density shown in Table 1. According to the results of Table 3, it can be found that the density of the outbound tourism virtual community network is 0.0176, and the standard deviation $\delta = 0.1316$. From the sociological point of view, the density of this network group is small, which is mainly due to the objective reasons of community structure. But in the long run, the density of the group will remain stable. Because most of the questions in the Travel Questions and Answers section are time-sensitive, the answer peak is concentrated on the question within three days. As time goes on, most of the questions will be brushed to the back pages and no one will answer them. Only onlookers will rely on tags to search for relevant questions and answers for browsing. The correlation degree of outbound tourism virtual community network studied in this paper is 0.0176. This is a relatively low degree of association, a low degree of
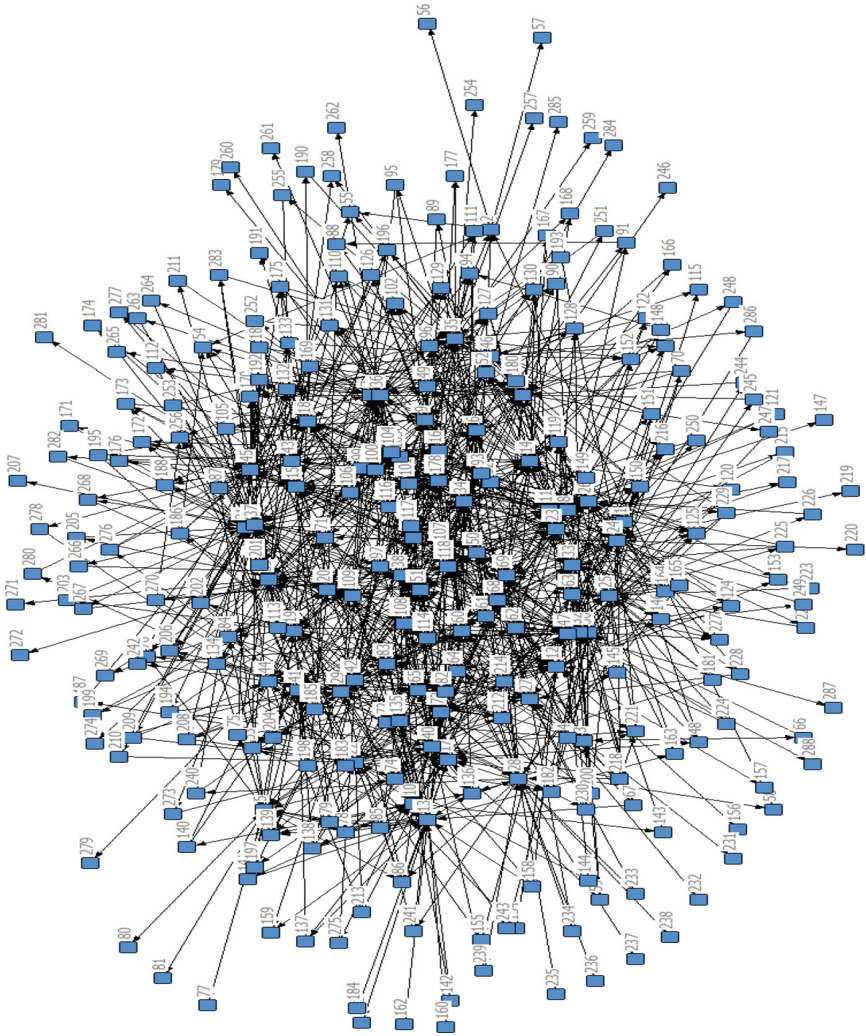
Fig. 1. Social network map of outbound tourism virtual community members

association network with the following characteristics: a. network information and power is more centralized; b. the status of network members is unequal; c. the network is vulnerable to individual users; d. network is a distribution structure. Because the network is a distribution structure, there are many small groups in the network. Ucinet software can be used to calculate the network in this study, including 108 factions, so there are a large number of small groups in the network.

Table 1. Density of outbound tourism virtual communities

Input dataset:	matrix (C:\Users\ThinkPad\Desktop\matrix)
Relation: 1	
Density (matrix average) = 0.0176	
Standard deviation = 0.1316	
Use MATRIX>TRANSFORM>DICHOTOMIZE procedure to get binary image matrix.	
Density table(s) saved as dataset Density	
Standard deviations saved as dataset Density SD	
Actor-by-actor pre-image matrix saved as dataset Density Model	

When a social network member is in the central position of the network, there will be more social connections with other network members, but also has a higher status and importance, so these users are often the core users of the social network. Measuring the degree centrality of a network, we also pay attention to the central potential of a network. The central potential of a network is the central trend of a network. The formula is:

$$Q = \frac{\sum_{i=1}^{n}(C_{max} - C)}{Max[\sum_{i=1}^{n}(C_{max} - C)]} \tag{1}$$

Q represents the central potential of the whole, and C represents the degree centrality of the member.

Ucinet software is used to calculate the results of degree center. The calculation results consist of two parts. The first part is the result of individual analysis, including the original data number, the specified number, the absolute centrality of the members, the normalized degree centrality, and the proportion of the degree centrality of the members in the network. The second part is a statistical description of the overall results. It can be seen that the average degree of centrality of the network is 8.299, the standard deviation $\delta = 8.837$, the maximum degree of centrality is 37, the minimum is 1, and the centrality of the whole network is 10.07%. The centrality of the network is small because the links between members are mainly mediated by questions. Most of the respondents do not have direct links, but point directly to the questioner, so the network is less centrality.

Contrary to degree centrality, users with high degree of centrality are those who occupy a central position between two users in a social network and act as valves and intermediaries in the flow of information in the social network. The calculation formula of center centrality is:

$$C_j = \sum_{h}^{n}\sum_{i}^{n} b_{hi}, h \neq i \neq j, h < i \tag{2}$$

Where b_{hi} is the number of shortcuts between point h and point i of point j more than the number of shortcuts between point h and point i, and the centrality C_j of point j is obtained by summing up the centrality of all points of point j in the graph.

By using the middle centrality of Ucinet, the results of intermediate center could be obtained. Similar to the degree centrality, the analysis results of the center centrality are also divided into two parts. The first is the original data number, the second is the user ID, the third is the user center, and the fourth is the standardized center. Like point-centricity, the most centralized user in the network is still No. 51, which is nearly 2.5 times more centralized than the second-place user. This shows that No. 51 plays a mediating role in many user interactions and a large amount of information flows can be transmitted through it. Therefore, number 51 user has great power and resources in the network. In this network, there are also a large number of users with zero inter-mediate centrality. They are only associated with a certain member. They appear in the form of hanging points in the network diagram, so their intermediate centrality is 0. The second part is about the statistical description of the whole network. It can be seen that the average intermediate center degree of the network is 716.222, the standard devi-ation $\delta = 1443.040$, the minimum intermediate center degree is 0, and the maximum is 15594.157. The central degree of the network is 18.19%, which is also a relatively small value. It is also caused by the objective reality of the data.

The proximity centrality is used to determine the location of a point in the network by measuring the sum of the distances between the point and other points. The approximate centrality C_i formula of point i is:

$$C_i = \sum_{j=1}^{n} b_{ij} \tag{3}$$

b_{ij} is the shortcut distance from point i to point j.

Using the Ucinet software, we can get the results of the near-center calculation. The proximity center includes two indicators: the internal proximity to the center (in-closeness) and the external Proximity Center (outcloseness). The greater the internal proximity and the smoother the node passes information to the other nodes, yet the greater the external proximity to the center, the smoother the node gets the information from the other nodes. The results generated by the ucinet contain six columns, of which the first two columns are the same as the center of the midpoint and the middle center, the third column is indegrees away from the degree, the fourth column is a outdegree away from the degree, the five is the indegree of proximity, and the six is the outdegree of proximity. The second part is the statistical description of the network and can be seen in the proximity of the measurement, the number 51st ID is not awake users regardless of the indegree of proximity or outdegree of proximity are ranked first. It is visible that the user interacts frequently with other users in the network, not only answering questions from the questioner, but also making comments and supplemen-tary answers to other answers.

The measurement of structural holes often focuses on four indicators: effective scale, efficiency, limitation and extreme. Run the Ucinet software and click on network → ego network → Structural Holes to calculate the structure hole of the network (intercepting the top 20 members):

Table 2. Outbound tourism virtual community network structure hole analysis

Input dataset:	matrix (C:\Users\ThinkPad\Desktop\matrix)				
Method:	Whole Network				
Output datset	StructuralHoles (E:\ucinet\Ucinet 6\DataFiles\StructuralHoles)				
Display of dyadic redundancy matrix automatically suppressed due to large size.					
Display of dyadic constraint matrix automatically suppressed due to large size.					
Structural Hole Measures					
	EffSize	Efficie	Constra	Hierarc	Indirec
	-------	-------	-------	-------	-------
1	6.000	1.000	0.167	0.000	0.000
2	7.000	1.000	0.143	0.000	0.000
3	10.800	0.982	0.100	0.034	0.023
4	8.000	1.000	0.139	0.093	0.000
5	16.000	1.000	0.064	0.018	0.000
6	23.638	0.985	0.053	0.058	0.075
7	22.895	0.995	0.049	0.048	0.019
8	21.809	0.991	0.052	0.059	0.021
9	23.000	1.000	0.048	0.064	0.000
10	23.662	0.986	0.052	0.076	0.044
11	29.000	1.000	0.039	0.069	0.000
12	31.813	0.994	0.036	0.069	0.013
13	26.735	0.990	0.044	0.077	0.026
14	29.885	0.996	0.038	0.069	0.008
15	23.968	0.999	0.047	0.072	0.005
16	26.809	0.993	0.043	0.075	0.016
17	24.886	0.995	0.047	0.066	0.022
18	28.776	0.992	0.042	0.065	0.044
19	26.953	0.998	0.041	0.065	0.004
20	27.955	0.998	0.040	0.063	0.008
Structural hole measures saved as dataset StructuralHoles (E:\ucinet\Ucinet 6\Data-Files\StructuralHoles)					

Table 2 shows the results of the operation, the first column is the user ID, the second is valid scale, the third is limited to the system, the fourth list is Level. This is most important, as the extreme higher represents the higher limit on the user's concentration. Combined with the data can be found, such as Level maximum of 1, the lowest is 0, in 288 users, users with numbers 56, 57, 77, 80, 81, 147, 156, 157, 160, 161, 162, 179, 184, 207, and so on, are Level 1, it can be seen that they have a greater degree of restriction in the network.

Through the Ucinet software, the core and edge members of the network can be directly output. As shown in Table 3, all members are grouped into two categories, distinguished by 1 and 2, of which 1 is the core member with 54 members and 2 is the edge member with 234 members. 288 members can be sorted by core/edge values (intercepting the top 20 members). The sorting results are shown in Table 4.

Table 3. Core/edge analysis of outbound tourism virtual community network

Input dataset:	matrix (C:\Users\ThinkPad\Desktop\matrix)
Type of data:	Positive
Fitness measure:	CORR
Density of core-to-periphery ties:	
Number of iterations:	50
Population size:	288Core/Periphery Class Memberships:
1: 1 3 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 44 45 46 47 49 50 51 60 61 62 64 65 68 69 72 73 82 83 92 93 97 98 99 100 101 103 104 106 107 108 116 117 118 135 178	
2: 2 4 43 48 52 53 54 55 56 57 58 59 63 66 67 70 71 74 75 76 77 78 79 80 81 84 85 86 87 88 89 90 91 94 95 96 102 105 109 110 111 112 113 114 115 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288	
Output partition:	CorePartition (E:\ucinet\Ucinet 6\DataFiles\CorePartition)
Output clusters:	CoreClasses (E:\ucinet\Ucinet 6\DataFiles\CoreClasses)
Starting fitness: 0.280	
Final fitness: 0.280	

Table 4. Core/marginal analysis ranking

Number	ID	Corene
51	醒不来啊	0.366
60	Cotatu	0.21
6	Minituski	0.188
68	志留纪	0.185
116	唐古拉01	0.172
9	HickeyHsui	0.142
82	Alegria_1122	0.142
14	美好心情521	0.139
64	宇宙人001	0.136
100	自在兰卡	0.132
21	111da	0.131
29	我中迫	0.13
8	盼panda盼	0.126
12	西枣Qin	0.123
18	月123567	0.123
38	13906222081	0.12
98	bestow07	0.12
11	nicy	0.119
49	白隼翱翔	0.119
7	擦心而过	0.118

On the whole, the core value of users who can not wake up is the highest, and is located in the most central position of the network. IDs for Cotaku, Silurian and Tanggula 01 are also relatively high core members, they constitute several cores of the network.

Social network analysis is to study the network relationship among members, and to judge whether opinion leaders exist in a group from the perspective of structure. But this method only focuses on the relationship among members and ignores the content of communication among members. The following research combines social network analysis with index analysis, in consideration of the relationship structure, content influence and activity of network members. Therefore, Study 2 research is carried out.

5   Study 2

As all sample data are taken from the travel question and answer section of "Qyer.com", the members who can be collected in this section are the questioner and the respondents. According to the definition and characteristics of the opinion leader, the questioner is not

able to become an opinion leader by merely asking questions in the network and not having a wider exchange with other members. On the contrary, respondents, whether in the form of high-quality answers or broad-based socializing, may have a unique social capital advantage, so they may become opinion leaders in the virtual community, so this article excludes 47 questioners from the remaining 241 respondents to identify the network's opinion leaders.

Social network analysis includes three research interests: dynamic grading, role evaluation, professional and Community discovery [28]. SNA can study the relationship between nodes and reveal the structure of group relationship, which will affect the function of the group [29]. But this approach only focuses on the relationships among members and ignores the content of communication among members. Therefore, this research combines the social network analysis with the index analysis, taking into account the relationship structure, content influence and activity of the network members, and using the analytic hierarchy process to calculate the weight of each index, thus calculating the value of each member leader, and then identifying the virtual community opinion leader under the theme of outbound tourism.

5.1 Development of Opinion Leader Recognition Model

Opinion leaders in different virtual communities show different behavioral characteristics, so the identification indicators of opinion leaders in different virtual communities are different, but can be used for reference in this study. Based on the existing research and social network analysis results, this paper establishes a virtual community member leader value measurement model including three first-level indicators and eight second-level indicators as shown in Fig. 2.

Structural Influence. Structural influence refers to the influence of members in a special position in the network, such as the administrator of the virtual community, member communication intermediary, etc. As they naturally have the position of information valve, they can control the flow of information and become the opinion leaders in the virtual community. The structural influence of virtual community members can be measured by the intermediate center degree, the near center degree, the core/edge degree value, and the structural hole efficiency index in the social network analysis. Here the value of the center degree is inBetweenness; the close to the center degree takes inCloseness. The metric of the structural hole selects the degree, but the smaller the limit, the easier the point i is in obtaining information and transmitting information, so it is inverted and recorded as $i_{s'}, i_{s'} = 1/i_s$; core/Edge analysis selects the Corene value, indicating where the user is in the network.

Content Influence. Opinion leaders in BBS often spread their images to other users by virtue of their large number and excellent quality of posts, so as to maintain high community influence. However, they are often not moderators and administrators. Therefore, it is necessary to calculate these users and measure the influence of their replies. In the "Qyer.com" travel question and answer board, users can be judged by the number of "like" answers and their own authentication.

The number of "like" directly affects the number of page views of users' answers, and the number of likes will be placed on top. In addition, the number of "like" reflects

the degree of recognition of users' answers. The more likes, the higher the degree of recognition, the greater the influence. There are four titles in "Qyer.com": destination players, question and answer pathfinders, elite authors, and experienced users of regions and interests. The four titles were ranked by how easy it was to get, and they were all tied directly to the quality and quantity of responses. For example, the criteria for selecting a pathfinder is: more than 100 high-quality answers in Qyer 2 months before applying for the title, without over-heated comments, and more than one third of the useful answers are clicked; Published a journey of essence 2 months before applying for the title. According to observations, users who answered questions in the Travel Q&A section mainly had the first three titles, of which the number of respondents was the most, and the number of users who received titles was significantly higher than that of users without titles. Quantify the four titles: 1 point, 2 points, 3 points and 4 points for the four titles, and 0 points for users without titles.

Activity. The activity degree is to measure the active degree of users in the virtual network in China. The more active the users who answer the questions, the more connections they have with other members, and the higher the degree of degree center, so the degree center is chosen to measure the active degree of users. In addition, the more active members answered questions and established connections with other members, the higher their community contribution and the corresponding community level would be. Therefore, this study also used the level of members to measure their activity.
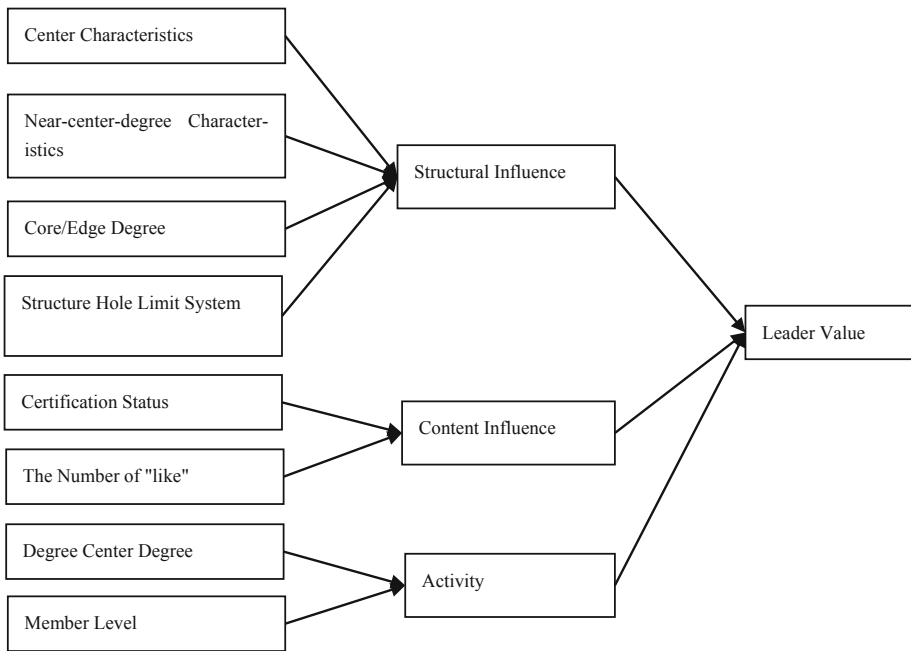

Fig. 2. Measurement model of member leader value of outbound tourism virtual community

5.2   Index Weight Calculation

According to the established virtual community opinion leader value calculation model, the analytic hierarchy process (AHP method) is used to calculate the weight value of each indicator. Yaahp software can be used to obtain each measurement index and its corresponding weight (Table 5):

Table 5. Weight of opinion leader value of outbound tourism virtual community

Indicators	The weight
Intermediate centrality	0.017
Near centrality	0.052
Core/margin	0.069
Structure hole limit system	0.062
Certification	0.080
The great number	0.320
Degree of center	0.333
Members of the class	0.067

5.3   Identification of Opinion Leaders in Outbound Tourism

The leader value of each member can be calculated by using the above weight and the 8 indicators of each member's leader value. However, the 8 indicators of each member are different in form and size. Therefore, the above 8 indicators data are first processed in a consistent manner, and all data are converted into Numbers between 0 and 100. Taking $i_{c'}$ close to centrality as an example, the consistent formula is as follows:

$$i_{c'} = \frac{i_c}{i_{cmax}} \times 100 \tag{4}$$

$i_{c'}$ represents the nearly centroid value of consistent, i_c represents the close centroid value of point I, and i_{cmax} represents the maximum value of the nearly centroid value of point I. After conversion, the consistent result of the 8 index values of each member can be obtained. Then the leader value of each user can be calculated.

5.4   Results

After comparison and verification, all the opinion leaders identified by the social network analysis indicators were included in the above results, that is, both the pure social network analysis and the index system method that introduced content and activity were considered to have high leader values in the virtual communities under the theme of outbound tourism. Therefore, the opinion leaders in the "Qyer" travel quiz section include the following users: Cotaku, can't wake up, sean3076, silurian, tangula 01, meow on the journey, rockylee, white falcon soaring, wcm360, bestow07,

shanghai1973, free lanca, kate9660, bennypsr, cosmic 001, Shadowk, oldbay, fswindy, hui1952, Charlemagn, forty flowers, alegria_1122, Nicolesyo, vasily hussain, mahler, wu Teacher, lin86109, masterio, I travel, SHCHM.

6 Discussion and Contributions

6.1 Discussion

This article uses the social network analysis and the AHP method to identify the opinion leader, and adopts the statistical method to carry on the characteristic analysis to the opinion leader and the non-opinion leader, obtains the following conclusion:

1. From the sociological point of view, the density of the network group is relatively small, which is mainly caused by the objective reasons of the community structure. Through correlation analysis and factional analysis, it can be found that because the network is an allocation structure, there are many small groups in the network. Through the structure hole and core/edge analysis to identify the structure of the 288 outbound tourism virtual community members, while using the AHP method to the center, structure hole and core/edge degree and certification, points like number and membership level together, in 288 members identified 30 opinion leaders. A group that demonstrates the presence of opinion leaders in the virtual community of outbound travel affects the outbound travel decisions and experiences of other users.
2. According to the results of the study, the virtual community of administrators and members of the exchange intermediary can control the flow of information as the opinion leader, because they have the status of natural information valve. It can be used to measure the structure influence of the virtual community members by using the middle Center degree, the Close Center degree, the core/edge degree value and the structure hole efficiency index in the social network analysis.
3. Based on the "social impact model" and "technology acceptance model" and the actual situation of the outbound tourism virtual community, the article puts forward the model of the participation of the virtual community of outbound tourism, and designs the questionnaire to investigate the characteristics of opinion leaders and non-opinion leaders respectively. Through comparison and verification, the opinion leaders identified by the social network analysis are all included in the results of the study, that is, whether it is purely social network analysis, or the introduction of content and activity of the index system method is considered that these members in the outbound tourism theme of the virtual community has a higher leader value. The study found that opinion leaders were significantly higher than non-opinion leaders in their involvement, functional, recreational, social, community identity, interaction, emotional connection, perceived usability, and perceived ease of use. However, there is no significant difference between opinion leaders and non-opinion leaders in the behavior of Internet use.

6.2 Contributions

Theoretical Contributions

1. At present, the research on virtual community Opinion leaders focuses on two levels: first, the opinion leader recognition level, this level discusses the establishment and optimization of the recognition algorithm more. Second, the public opinion control, this level is mainly concerned about emergencies and government micro-blog, discussion is how to define and use the relevant opinion leaders to guide the opinion. However, there are few research on outbound tourism opinion leaders in virtual community at present. On the one hand, outbound travel is often used as a section of virtual community of tourism, overlapping with other sections, difficult to collect data, on the other hand, this kind of post has a long time span of large data and inconvenient handling. However, with the improvement and development of virtual community of tourism and the upgrading of data mining and processing technology, objective obstruction has been solved. The paper analyzes the social network of the outbound tourism opinion leaders in the virtual community, which is a further subdivision of the opinion leaders of the tourism virtual community, which can fill the gap in this area, and facilitate the management of the tourism virtual community, broaden the tourist information sources and help the tourism enterprises to find the marketing objects.
2. This paper mainly has two ideas: the first, the social network analysis of the members of the virtual community of outbound tourism and the combination of analytic hierarchy process to find out which members belong to the opinion leaders, which members are not the opinion leaders, and the second is the characteristics of community participation in the identified opinion leaders through the questionnaire survey, Attempts to clarify the differences between opinion leaders and non-opinion leaders in outbound travel topics, and to supplement existing research.
3. This study combines social network analysis with index analysis, taking into account the relationship structure, content influence and activity of network members, using analytic hierarchy process to calculate the weights of each index, thus calculating the value of each member leader, and then identifying the virtual community opinion leaders under the outbound tourism theme.

Practical Contributions

1. For tourism enterprises, we should pay attention to the special status of opinion leaders and make reasonable use of their social assets value.
   In e-commerce, word-of-mouth marketing has become a very efficient marketing means, opinion leaders in the outbound tourism market as a word-of-mouth communication has a special marketing advantage, with its unique structure and social assets can achieve excellent marketing results. Similar to Weibo's online red economy, more and more tourism companies are now opting to collaborate with opinion leaders in the tourism community, such as full-time and "poor" Japanese

version of the Essence of Shenyangoxygen co-author, Gore-Tex outdoor equipment to the user's sponsorship and so on. Therefore, tourism enterprises should use the opinion leader to accumulate the popularity, reputation and other social assets advantages, with opinion leaders as intermediaries to open up the market, in-depth market, and then the company's products or services marketing to vigorously promote.

2. For the relevant departments, the opinion leader is a very good channel of information dissemination.

   For the tourism Bureau, especially the Overseas Tourism Bureau, the information Communication intermediary role of opinion leaders can help the tourist bureau to promote tourism, and can achieve good results. However, in the process of information dissemination, the amplification of opinion leaders will also cause negative information or the expansion of false information, therefore, the relevant departments for opinion leaders should focus on monitoring, maintain good cooperation, so as to use their influence to spread practical information, issued security alerts, to protect the interests of outbound travelers.

3. For virtual communities, use opinion leaders to enhance social linkages in virtual communities.

   Opinion leaders can enliven the community atmosphere and increase the heat of virtual communities, especially in question-and-answer communities, where opinion leaders are the foundation of Community existence, and therefore they are the most important members of a virtual community. To this end, the virtual community can take a combination of online and offline activities to promote the interaction between opinion leaders and other members, the use of virtual community social, mutual influence and other characteristics to create a sense of community for members. So as to enhance the participation of members and promote the generation of opinion leaders.

6.3   Limitations

This paper uses the social network analysis and analytic hierarchy process to identify the opinion leaders of the outbound tourism theme virtual community. There are some limitations as belows.

1. Due to the website structure limitation of "Qyer.com", only 288 members of the information is crawled. The sample size is relatively small. We can improve the network crawler technology, Grab more samples and increase the depth and breadth in future study.

2. The article does not further subdivide the opinion leaders. In outbound tourism, there are different opinion leaders under different issues. For example, trip questions of "Qyer.com" include visas, transportation, accommodation and other issues. In the future study, we could increase the sample size and classify the opinion leaders in each field according to the different fields of outbound tourism.

3. Due to the objective condition of collecting data, the current study just chooses the travel question and answer section of "Qyer.com" to excavate the user relationship. But the "Qyer.com" also has a more popular plate for the travel forum allowing

users to publish their travels, where the number of posts is large, and the relationship between users is more active and complex. Therefore, the data mining and cleaning technology should be optimized in the future research, and the big data in the plate can be analyzed to obtain more accurate results.

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