

Exploring Cyber Opinion Leaders Based on Social Network Analysis: Sampling College Student Employment Public Opinion

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Abstract. Combining application research using social network analysis, the opinion leadership could be identified through the analysis of online public opinion structure. The case study of public opinion about college student employment is based on the measurement of the degree centrality, core-periphery and influence coefficient. The online opinion leadership that explored by the combination of social network analysis and content analysis should be the focus of monitoring public opinion.

Keywords: social network analysis, cyber opinion, opinion leader, college student employment

1. Introduction

As the mirror of reality, cyber opinion is a truthfully reflection of the state of mind among the people; it delivers state and trend of public opinion of each and every aspects of the society directly and timely. Cyber opinion platform—internet—is a network of complexity forged with multiple social relation networks in which one or several core members, also known as cyber opinion leaders, can always be found. Through their comments, opinion leaders post information, communicate information, bring people into consensus relatively quickly, brew emotion, and even induce action, alter the opinions of other netizens', and lead cyber opinion orientation. Discovering cyber opinion leaders and strengthening the supervision and management on them is a critical mean of improving cyber opinion management capability. With respect to the traditional cyber opinion control which identifies, analyzes, and tracks every pieces of information, the idea of cyber opinion leader discovery is less time-consuming and more efficient. Discovering cyber opinion leaders in their virtual community using social network analysis, evaluating their influence, and emphasizing on the analysis and supervision on their comments, can not only control the trend of public opinion on mass event, but also monitor the spreading of cyber opinion from the source, and even eliminate negative public opinion information from its source.

2. The Application of Social Network Analysis in the Study Of Cyber Opinion Leader

2.1. Comments on Methods of Cyber Opinion Study

Currently, the common method used in analyzing the content of cyber opinion is content analysis. Content analysis is able to describe the certain characterized communicative content objectively, systematically, and quantitatively. During the research of methodology, Yi Liu [1] discussed mining internet content, network structure, and internet log using content analysis enables describing the public opinion information on the internet, inferring the intention, attitude, and emotion leaning of the cyber

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opinion information communication subject, so as to describe and infer the inception and development of cyber opinion. The application of method mainly concentrated on research of the attitudes and emotions the public opinions articulate, e.g. Yukiko Kawai and others [2] conducted emotion differential analysis on the comments of netizens using content analysis on the credibility of on-Column news. Xiaoyun Huang and others [3] took one step farther to discuss the application of text data mining in content analysis on cyber opinion, and established cyber opinion information text mining model. Using internet text mining, cyber opinion text information can be expressed; its characteristic can be extracted, content summarized, categorized, clustered, relevance and semantics analyzed, and the tendency can be estimated using internet text, so as to discover focal and controversial topics, and to provide technical support and resolution for further analysis.

Analysis on cyber opinion can be based not only on the information content of public opinion, but also on analyzing the cyber structure and the pattern related to public opinion development discovery. Social network analysis is a method that combines visualization and scalability; it attempts to quantitatively measure various relationships so as to reveal the structure of group relations and study the effect such a structure have on the group functionality and individuals in the group. In recent years, social network analysis is used in the study of cyber opinion. It is especially widely applied in analyzing the relation structure and group characteristics in virtual community members. Researchers such as Jingmin Chen [4] introduced social network analysis into the studies on cyber opinion, dissected an internet political group using internet density, cohesive subgroups, and structural holes three rubrics. They estimated the transmission pathway of public opinion information according to the degree of structural density of virtual community, and discovered small groups that dominate the development of public opinion based on the interrelations between members. These researchers further proposed that a strengthened supervision of the intentions of the subgroup is needed, in order to help related departments understand cyber opinion, and consequently make the right decisions.

Concisely, social network analysis concentrates more on the relations between events and participants compared to other methods. When studying the transmission and relocation of cyber public information, more emphasis on the pattern of behavioral alternations of netizens that are caused by different cyber relation structures reveals better the essence of the transmission and relocation of cyber public information for it puts more emphasis the factor of human.

2.2. The Combination of Social Network Analysis and Cyber Opinion Leader Study

Social network analysis has developed a series of professional theories and models that are applied in structural analysis of on Column community up until this day. Among these is the famous structural holes theory often addressed as the classic theory determined to find public opinion leaders. According to Ronald S. Burt [5], the Author of structural holes theory, when there are only indirect or lack of relations between people in cyberspace, a hollow “hole” comes into being, which he named “structural hole”. Structural holes usually make up the “valves” for information reflection and resource liquidity in cyberspace. In cyberspace, the more “structural holes” one possesses, the more structurally advantageous this actor will be; subsequently, the higher possibility of return this actor will have through these advantages.

Centrality is another critical indicator in measuring an actor’s status superiority and social prestige. Alex Bavelas [6] is the first one that conducted researches on the formal characteristics of centrality. Hereafter, Juhani Nieminen gave this concept a systematic explanation. The so-called point-centrality in cyberspace is the measure of points; that is, the number of points directly connected to one points. If a point has a high measure of points, this point is said to be at the center, and the actor this point denotes is the central figure. This is the easiest and most direct approach to determine a public opinion leader. Besides this, the theory of “the strength of weak ties” and six degree of separation, both by Mark Granovetter, can also be applied in the analysis of the status and effect of every member in the cyber community that is under weak tie status, so as to enrich the cognition of cyber community public opinion leaders.

Some models and methods in social network analysis can be applied in the study on cyber opinion leaders. The rate of transmission and development of public opinion among the existing virtual circle of the

public opinion leaders can be reflected by computing the tightness of social network density. By measuring centrality and structural holes constraint factor, the public opinion leaders in the circle can be quickly identified; the position of the leader in the virtual circle can be understood, as well as the influence, so as to infer the intention and attitude leaning of the cyber opinion leader and seize the opinion trend of the entire network while track false messages to the origin and erase the negative effect they impose, reinforce the analysis and estimation of cyber opinion leaders with focuses.

3. The Design of Social Network Analysis Methods in Cyber Opinion Leader Discovery Study

3.1. Approach

In a virtual community, members connect with each other by replying posts of others'. To any given member, the sum of replies acquired from other members is denoted as point in degree; the sum of replies sent to other members is denoted as point out degree. If one member is able to attract the attention of a large number of members with one post, to be broadly and frequently discussed with a long thread; or one member is actively replying to posts from other members, this member becomes of the virtual community an active member. A cyber opinion leader is inevitably an active member of the virtual community. Active members of a given virtual community can be identified with level of activity explicitly observed by measuring the point in degree and point out degree. However, active members are not necessarily cyber opinion leaders. Only those active members who are widely supported and getting mass response are essentially cyber opinion leaders. For this, analyzing the influence of active members in a virtual community is the key to locating the cyber leaders in that community. Influence can be expressed using quantitative measure, determined by calculating the sums of supports and opposes a given member's opinion acquired in a given period. In other words, the higher the count of explicit supports this member's opinion acquires, the higher the influence; so as to determine the cyber opinion leaders in a virtual community.

3.2. Factors

The level of activity of members can be easily and directly measured applying centrality analysis and core-periphery model in social network analysis, so as to determine the position of the member and the tightness between active members. Denote "coefficient of influence" as category index to filter virtual community cyber opinion leaders from active members.

- **Centrality:** Centrality is the quantitative indicator in measuring the power of an actor, the purpose of which is to locate the core members in a network in the entire network structure. Point degree centrality is an important method in measure of centrality; it measures the capability of a give point develops connection with other points. Suppose one actor has direct connection with multiple other actors, this actor is at a central position, and thus holds relatively high power.
- **Core-periphery Model:** Core-periphery model is a quantitative of the actor' s position. This model identifies series of actors with higher density (core) and lower density (periphery) to determine the positions of actors in a network based on the degree of dispersion of the connection between members.
- **Coefficient of Influence:** Coefficient of influence refers to a given member' s degree of influence on other members in a virtual community. The higher the influence in the virtual community, the higher degree of approval this member has. To measure the influence of a given member, value of response and value of approval need to be measured. Value of response is the sums of both supports and opposes a member acquire in a given period. Value of approval is degree of approval this member acquired from other members, a. k. a. total support count. Coefficient of influence is the ratio of value of approval over value of response.

3.3. Executive Approach

To discover cyber opinion leaders, a virtual community should first be selected, related logs of discussion participants be extracted. We create an interaction matrix, assuming that a connection is generated by users replying posts of each other, that is, if user X replied user Y's post, X and Y has a connection, regardless of the reply one user has for another is one time or multiple times, denoted as "1"; otherwise, if there is no connection between X and Y, denoted as "0". By measuring the centrality of users, locate the users at the central position, a. k. a. active members. The position of active members can be

determined using the CORR algorithm in core-periphery model. Lastly, compute the coefficient of influence of active members individually, and the one with the largest coefficient of influence is determined as the opinion leader of this virtual community.

4. College Students Employment Public Opinion Case Analysis

College student employment is one of the topics netizens constantly follow. Using cyber opinion, the psychology and attitude of how the netizens treat the current state of College student employment can be understood, which is beneficial for the government and universities to give targeted guidance to college students looking for jobs. Extract logs of every post and reply before January 28, 2011 from Tianya forum college student employment module, and apply social network analysis method to discover the cyber opinion leader, whose influence will be inspected.

4.1. Social Network Interaction Matrix of Virtual Community and Charts

In this virtual community, connection between members is created by replying to each other's posts. After a period of collecting, the interactions between the 47 members of this virtual community are made into a matrix, denoting members alphabetically from "1" to "47". Column denotes replier, row denotes poster. A member replies another is denoted as "1"; otherwise, they have no connection, is denoted as "0". Thus, a 47 by 47 matrix is formed, which is able to explicitly depict the network relation in this virtual community.

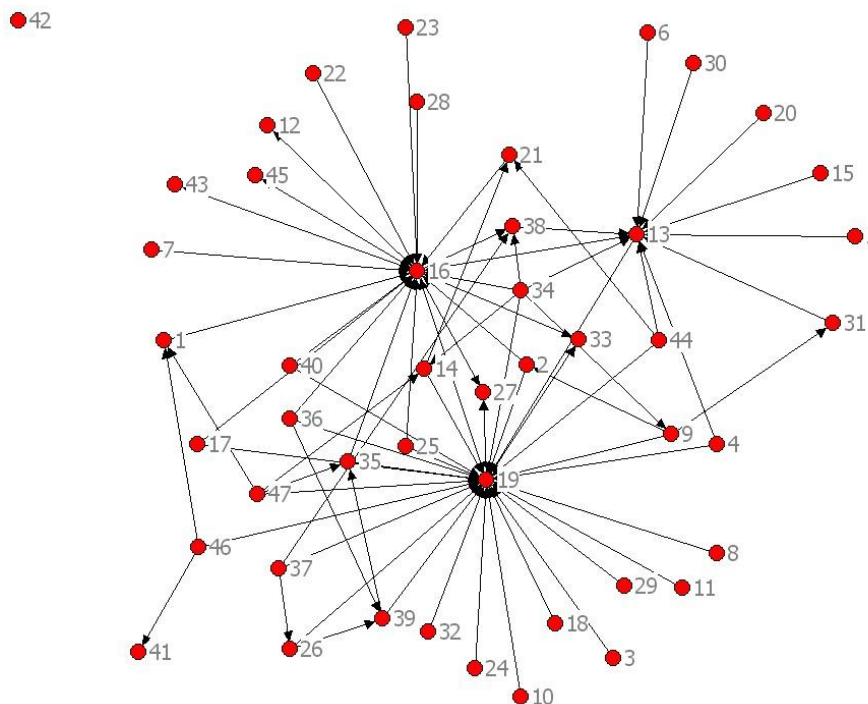


Fig. 1. The Network Relations between 47 Members in the Virtual Community

It's not difficult to see that 13, 16, and 19 are at the central position of the network, having many other points connected to these points. They are active members in the community, having a high count of followers in this virtual community. Members like 42 is at the peripheral position, having hardly any direct connections to other points, which indicates that they barely communicate with other members in the community, seldom express their opinions in the community and make little contribution.

4.2. Measuring Centrality

The discovery of the cyber opinion leaders in a virtual community can be achieved by measuring the point degree centrality of that community. Input the interaction matrix into Ucinet to compute the centrality of the matrix, shown as table 1:

Table 1. Centrality measure result (partial)

	OutDegree	InDegree	NrmOutDeg	NrmInDeg
16	8.000	19.000	8.696	20.652
35	6.000	2.000	6.522	2.174
37	4.000	0.000	4.348	0.000
26	3.000	1.000	3.261	1.087
39	3.000	2.000	3.261	2.174
19	3.000	26.000	3.261	28.261
38	3.000	3.000	3.261	3.261
31	3.000	2.000	3.261	2.174
9	3.000	1.000	3.261	1.087
46	3.000	0.000	3.261	0.000
42	2.000	0.000	2.174	0.000
2	2.000	1.000	2.174	1.087
45	2.000	2.000	2.174	2.174
14	2.000	2.000	2.174	2.174
13	2.000	11.000	2.174	11.957

From the analysis, each member is represented by different point in degree and point out degree. According to the difference in point degree centrality, the power and statue of the members in the community vary. The analysis shows that member 16 and member 19 are ranked top in both point in degree and point out degree compared to the residual members, which indicates that they are relatively active in the virtual community. Not only do their posts attract a large number of other members, they also positively engaged in the discussion of others, making high contribution to the virtual community. They are the active members in the community. The points in degrees are larger than points out degrees, indicating that their comments are much more followed by the residual members. Member 35 has a point out degree far larger than the point in degree, indicating active following on other members, yet was less followed by others. Member 13 has a point in degree far larger than point out degree, indicating certain influence the comments this member have, followed by many members, but seldom does this member follow comments of others.

4.3. Positions of Core Members in Core-Periphery Model

Identify the position of each member based on the computation from the CORR algorithm in core-periphery model using the software Ucinet. Arrange the result into table 2. The members who have a core index of larger than 0.15 form the core population; the ones have between 0.08 and 0.15 form semi-peripheral population, and the residual form peripheral population.

Table 2. Centrality and position of 47 members

Position	Member	Centrality	Member	Centrality	Position
core	35	0.471	28	0.116	Semi-periphery
	16	0.345	47	0.116	
	37	0.309	22	0.116	
	38	0.227	4	0.099	
core	19	0.209	14	0.083	Periphery
	39	0.172	6	0.054	
	42	0.163	30	0.054	
	13	0.163	32	0.054	
	2	0.163	20	0.054	
	25	0.163	5	0.054	

	17	0.163	40	0.054
	31	0.156	15	0.054
	9	0.153	18	0.044
Semi-periphery	26	0.142	8	0.044
	46	0.139	33	0.044
	41	0.132	43	0.044
	21	0.116	11	0.044
	1	0.116	3	0.044
	45	0.116	10	0.044
	36	0.116	24	0.044
	23	0.116	29	0.044
	7	0.116	44	0
	34	0.116	27	0
	12	0.116		

In table 2, member 13, 16, and 19 appear in the core population again, while the residual members falls into the peripheral position. This further verified the central position of the three members'. Meanwhile, this result also indicated these active members capture the crucial position in the information pathway in the virtual community.

4.4. Measuring the Influence of Cyber Opinion Leaders

From the above analysis, member 13, 16, and 19 three people can be explicitly seen as the core members of the virtual community. Their posted opinions are responded by the super majority of the members, have a high degree of attraction. However, the responses are mixed. Whether their opinions are approved by the majority of the members, causing resonances, imposing influence on other members, are significantly important in judging the trend of cyber opinion. To speculate whether active members are able to influence the acts of other members, every opinion in the virtual community that involves cyber opinion leaders and the residual members needs to be sampled, and computed by coefficient of Influence, to ultimately discover the real cyber opinion leaders. The statistics is shown in table 3.

Table 3. Coefficient of influence of active members in virtual community

Member	Value of Response	Value of Approval	Coefficient of Influence
13	74	27	0.36
16	102	84	0.82
19	118	86	0.73

In table 3, coefficient of Influence reflex on the degree of influence active members have on the virtual community. Empirical evidence suggests despite the fact that all of the three members are able to gather huge popularities, their recognitions acquired from others come in significant differences. Obviously, member 16 and 19 both has high values of response and values of approval, as well as a relatively high coefficient of Influence, which reflect that these two members are the real cyber opinion leaders of this virtual community. They enjoy relative high prestige in the virtual community, and their comments resonate with netizens, even causing mass response, and guide the developmental trend of cyber opinion. The other member, 13, is otherwise: the value of oppose is far higher than value of approval, which is to say that the comments by member 13 are less often approved by the population, are unable to impose influence on

others' opinions, and even at times objected by others, having a lesser effect on the accumulation of cyber public opinion.

We randomly withdraw a log containing a cyber opinion leader's thread. In it, the cyber opinion leader 16 in Jan 18, 2011 expressed contempt against the behavior posted in a news alleging college students "would rather stay in metropolis as an ant, than go back to town as a noble", saying: "the cost of living and competition are low in towns. It's better to be a head of a dog than to be a tail of a lion. A person has to live with dignity". This comment received 20 replies in total, with 13 supports. Meanwhile, based on observation, member 16 receives replies for every post from certain members, forming a subgroup with steady relations. Not only do they respond to the opinion, they also actively resonate. Therefore, a group tightly unified around the cyber opinion leader as its center is formed.

5. Conclusion

The application of social network analysis has helped discover the notable variance in terms of influence each users in a virtual community has according to the difference of their characters and network positions. The measuring of centrality depicts that the ones who score high centrality and are at central positions are active members in the given social network. Comments from these members are broadly followed by the majority of the residual members, while inflecting great promotional effect on the propagation of public opinion. Yet to identify whether they are opinion leader or not also requires taking the influence of the members in the given community into account. The comments from active members stand out from the extensive and heterogeneous flow of cyber information, in certain levels guide the trend of cyber opinion and even catalyze the development of events only when they are broadly supported by other members. In most cases, cyber opinion leaders will process the pieces of information they acquired before they spread and communicate them to a broader audience in form of messages. These messages which contain the objective opinions from the cyber opinion leaders are able to tweak or dominate the attitudes and behaviors of the followers and the influenced. The research has revealed that the social network analysis discovers active members in a community simply using the interaction between actors in a network; however, to become public opinion leaders requires not only the initiatives in interaction, but also relatively high prestige among members. Therefore, when discovering cyber opinion leaders, assistance from corresponding content analysis is much needed, calculating also the emotion, proposal, and attitude in the explicit opinions to ensure the accuracy of cyber opinion leader discovery.

Easily drawing conclusion based on the above analysis, comments from cyber opinion leaders shall become focal subjects under cyber opinion supervision and management compared to ones from the residual members. Against sensitive and special topics the society is concerned about, identify the cyber opinion leaders, specially supervise, control and timely handle their inflammatory comments to avoid negative emotions to continually affect the residual members. Based on that, perfect the early warning and crisis responding mechanisms against cyber opinion leaders. In the daily internet management, cyber opinion leaders can be purposely fostered. The prestige they have in the virtual community can be used to guide public opinion positively, and guide people to fight back false and reactionary speeches actively.

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