Modelling the public opinion transmission on social networks under opinion leaders

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Abstract. In this paper, based on Social Network Analysis (SNA), the social network model of opinion leaders influencing the public opinion transmission is explored. The hot event, A Female Driver Was Beaten Due To Lane Change, has characteristics of individual short-term and non-government intervention, which is used to data extraction, and formed of the network structure on opinion leaders influencing the public opinion transmission. And the evolution mechanism are analyzed in the three evolutionary situations. Opinion leaders influence micro-blogging public opinion on social network evolution model shows that this type of network public opinion transmission is largely constrained by opinion leaders, so the opinion leaders behavior supervising on the spread of this public opinion is pivotal, and which has a guiding significance.

1 Introduction

Studying network public opinion is gradual attention, the study further focused on the concept of network public opinion, transmission characteristics, evolutionary law, network public opinion monitoring analysis and tracking. With the development of complex network theory and its application, using social network analysis (SNA) to quantify the process of public opinion transmission has become one of the hotspots of many scholars.

Rousseau [1] divided the definition of public opinion into three dimensions: general will, common will and private, and then elaborated on how to form a general will on the basis of common will and private. Wong [2] compared the concepts of public opinion, and explored the interaction and connection between public opinion, policy and media. In particular, it analyzes how policy and media influence the development of public opinion, Noelle-Neumann [3] argues that in the process of public opinion transmission, people's opinions tend to grow slowly because they do not sound, and through the strengthening to achieve consistent public opinion, which evolved into the network public opinion with group tendency. Sociologist Lazarsfeld [4] argues that there is a public opinion leader between the mass media and the public and is the main source of public access to information and acceptance, and that opinion leaders spread the mass media's message to the public as well as published subjective judgment.

In this paper, we use the social network analysis method, select a kind of network hot event as the research sampling, construct the relationship matrix of public opinion transmission network, explore the network model of opinion leaders influences public opinion transmission and analyzes its evolution characteristic.

2 Network public opinion case

Network public opinion can be divided into political opinion, economic opinion, cultural opinion, social opinion and composite opinion according to the content. From the perspective of transmission object, the social include the individual and multi-subject, government and civil, and OL (online)

media -OO (online offline) media, seen the spread span, including short cycle, long cycle, and chaos state. In this paper, the event, *A Female Driver Was Beaten Due To Lane Change*, from sina micro-blogging attributed to a short cycle, and small influence individual behavior. Since May 3, the event video on the network began to exposure, Internet users give a high attention, causing public outcry. With the development of the incident and the media reports, the mood and attitude of the Internet users have great changes, constantly changing the accusations or sympathy object, public opinion has appeared many times reversal. From Fig.1 on the event of the public opinion trend shows that after May 12, public opinion tends to be smooth, less attention, so the construction of social network data from the time period from May 3, 2015 to May 12, 2015
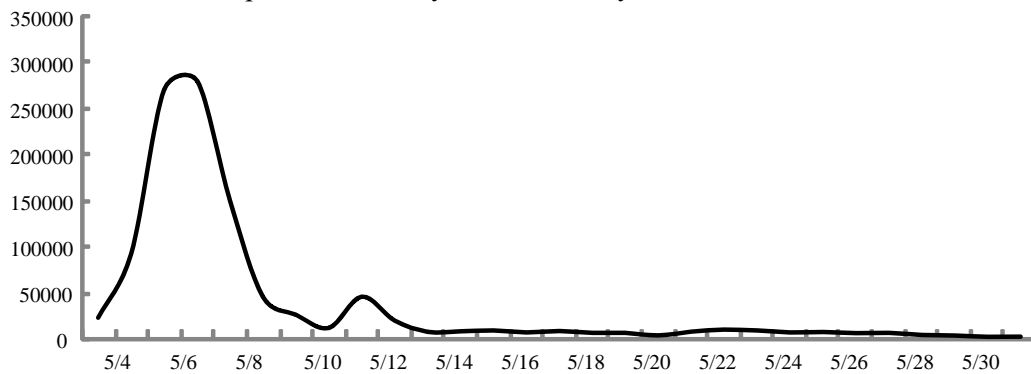

Fig.1 Sina micro-blogging hot words trend (micro index)

3 Characteristic and evolution mechanism under opinion leaders

From the point of view of graph theory, an actual network can be described by the binary G = (V, E), where V = $\{v_1, v_2, \cdots v_n\}$ is called the set of nodes and E = $\{e_1, e_2, \cdots e_m\}$ is the set of edges of graph G. Based on the social network analysis method, the network density, the average shortest path and the average degree three indicators are used to analyze the characteristics of the public opinion network structure. In this paper, the public opinion dissemination process is divided into three periods, each period of public opinion has its special form and evolution, using the opinion leaders to guide the changing of propagation network structure to analyze the complex social network evolution mechanism of impacting micro-blogging public opinion propagation [5].
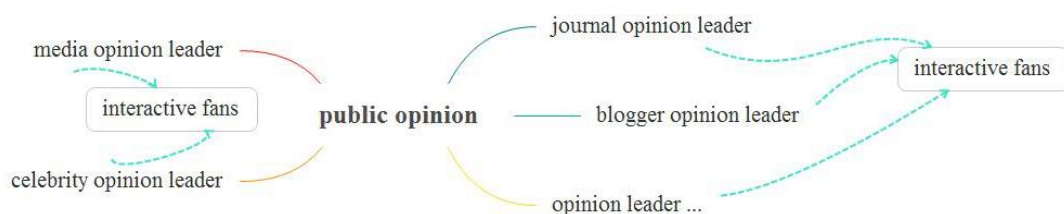

Fig.2 Influencing logic of opinion leaders on public opinion transmission

The article uses more than 7,000 micro-blogging users as the research sampling, and constructs the social network matrix which is based on the micro-blogging user as the node and the forwarding relation as the connection side. Software Ucinet6 is used to calculate the data of the network of the forwarding relationship, opinion leaders affect the spread of public opinion process Fig. 3. At the same time, the each period eigenvalues of the event network structure and each period opinion leaders network family are calculated.
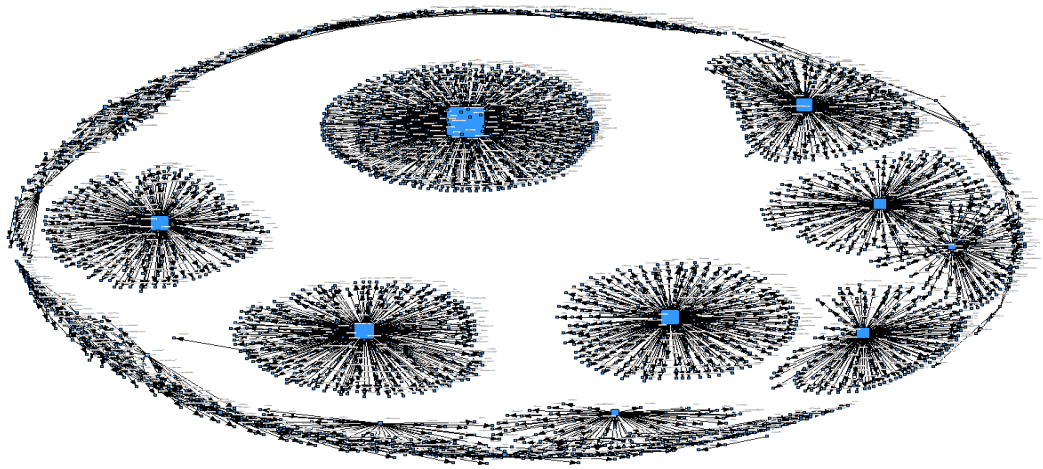
Fig.3 Opinion leaders influence the spread of public opinion

In the composition of micro-blogging user groups, most users are celebrities fans, resulting in most of the information flow from the opinion leaders to public [5]. Opinion leaders guide the public to inform the event and participate in public opinion through the topic [6]. In the Table1, the number of opinion leaders cluster in the whole period of public opinion is 8, the number is less, indicating that this kind of event belongs to the a short cycle, and small influence non-government behavior. The data of whole period shows that the density of the network is small, the distance is short and the network average degree is small in this kind of public opinion event, therefore, the spread of network information is mainly caused by several influential and appealing users, they are opinion leaders who spread the public opinion. In Fig.3, the size of a blue node indicates the influence of the node, the larger the node is, the larger the center degree of the node is, this indicates that the information of this node flows to other nodes is more, it is the key nodes (Opinion leaders cluster) in the public opinion transmission process.

Table1 Various period network public opinion eigenvalues

Public opinion period	D	$\bar{L}$	$\bar{k}$	Max node k	Opinion leaders
5.3—5.12（whole	0.0001	1.00	1.05	514	8
5.3—5.4（first period）	0.0003	1.91	0.58	225	2
5.4—5.6（second	0.0001	1.00	0.83	381	5
5.6—5.12（third	0.0002	1.93	0.50	57	8

Observation of each period data of Table1, finding that the first period of public opinion transmission has a larger network density and network average degree, but the shortest distance of the network at this period is large, so the user contact is close, but because of the long distance to spread, the spread of public opinion more difficult. The first period of the maximum node degree is large, but the number of opinion leaders clusters is small, indicating that the period belongs to the formation and development of public opinion. However, in the second period, the average shortest distance of the network is much smaller than the other two period, the average degree of the network is relatively large, and the largest node degree of the largest number of opinion leaders cluster, indicating that the period belongs to the outbreak of public opinion, and the period of the leaders have the largest number of fans, most of the public opinion discussions are initiated by the opinion leaders , so the information transmission is the fastest, the communication between users is also more frequent. In the third period, the average shortest distance is large, while the value of the network average degree is relatively small, resulting in the speed of public opinion information transmission is slow, and less contact between users, the number of opinion leader cluster in the third period is the same as the whole period, indicating that the spread of public opinion has reached a steady state, but since the maximum node

degree is the smallest, this period has entered the state of public opinion subsided.

4 Conclusion

In this paper, "*A Female Driver Was Beaten Due To Lane Change.*" is picked up to conduct data extraction, furthermore, based on the social network analysis, a complex network of public opinion is generated, and quantitative analysis of the complex network structure characteristics from the three indicators of network density, average shortest distance, Node degree. While using the opinion leaders guide the changing of transmission network structure to analyze the public opinion network evolution mechanism. Research on public opinion by social network analysis finds that the type of micro-blogging forwarding relationship has a small network density and a short distance. Therefore, the dissemination of network information is mainly influenced by several influential and appealing users, known as opinion leaders, which shows that this type of network public opinion transmission is largely constrained by opinion leaders. So the opinion leaders behavior supervising on the spread of this public opinion is pivotal, and which has a guiding significance.

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