Research on Evolution Mechanism and Sentiment Analysis of Emergency Network Public Opinion

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Abstract: To study the forms and causes of the evolution of network public opinion for emergency events, this paper uses the public opinion of 8.12 accident of Tianjin Port explosion in 2015 as the sample to evaluation the correlations between chacteristics of weibos about 8.12 accident and analyze sentiments of all periods of public opinion using SVM during the life cycle of public opinion. This paper discusses influence factors which influence the evolution of the public opinion and how to interact with each other from four dimensions (government, media, opinion leaders, Internet users). At last this paper proposes corresponding advices.

Key words: Network public opinion, SVM, public opinion evolution, sentiment analysis.

1. Introduction

With the rapid development of Internet, Internet itself has been a vital approach of communications and disseminations of information between people. More and more people not only obtain information from network, they eager to involve into information release especially when Web2.0 has been developing. Internet users hope to express their thoughts, opinions and the truth they learn through Internet, hence there emerging a large number of online writings. Network public opinion is formed when social people express mass emotions, attitude, opinions and requests through network.

The burst of network public opinion always aims to special events which involve public interest and generate numerous information in a short period of time. Multiplication effect may push network public opinion into a larger scale and stronger social reflection. If it lacks of accurate responses to event in time, public opinion crisis may evolve into a mass emergencies consisting of confliction of ideas and actions in a very short period of time.

Disseminations of network public opinion are sensitive to media disseminations, government responses, opinion leaders' promotion and Internet users' reactions. The fore factors' interaction can affect sentiment of public opinion and finally affect the evolution of network public opinion. Based to this assumption, avoidance of outbreak period, directly transforming growing period to recession period are possible which suppress the mass emergency event and eliminate network public opinion crisis. While network public opinion has been the most powerful approach to express public opinions and comments, it is signature to analyze and discuss the evolution and internal causes of evolution of network public opinion in multi-dimensions concluding media, government, opinion leader and Internet users for finding out the strategy avoiding network public crisis.

2. Literature Review of Network Public Opinion Evolution

Network public opinions draw more attention from departments as the application of new technologize, extension of network influence, larger and more multivariate of networking groups. Many scholars have done research on network public opinion. Some research on the propagation of network public opinion suggest a process model which divide the propagation into incubation period, growing period, spreading period, outbreak period, recession period and extinction period[1]. Some research on the formation and factors of network public opinion on an emergency event suggest a differential equation model of its evolution rule which find out three feature time point of its propagation and four stages of evolution. Study on responses of government on different time period provides reference about how government response to network public opinion for emergency event [2].

Besides the research on the propagation of network public opinion, some other scholars start study on other factors of evolution of public opinion. Wang Guohua, etc. [3] have done research on opinion leaders in network public opinion. The research analyzes opinion leaders form three dimensions' knowledge background, social status, usage of medias and then analyze intervention time, behavior of opinion leaders based on the lifecycle of public opinion. Finally, it analyzes the affection on the aspects of events, Medias, audiences. Besides, Fang Fujian, etc. [4] have done research on formation mechanism of unilateral presentation of network public opinion for emergency event.

Available research analyzes from different aspects on network public opinion, providing a good entry point. But it has not explored the formation and factors deeply with only involving public opinion' affection for government, opinion leaders, Internet users, lacking how all this three factors plus media affecting network public opinion' evolution and how sentiment affecting its evolution and its mechanism.

Firstly, a research framework about network public opinion' evolution based on sentiment analyzing will be presented. Secondly, according to the data of 8.12 accident of Tianjin Port explosion in 2015, analyzing data of each time period of its evolution, the factors will be discussed. Finally, combined with SVM sentiment analysis, discussing how factors affect network public opinion, a countermeasure strategy will be proposed.

3. Process Model of Public Opinion Evolution

According to features of network public opinion in Web2.0, its propagation can be divided into six stages incubation, growing, spreading, outbreak, recession, and death. As shown in Fig. 1.

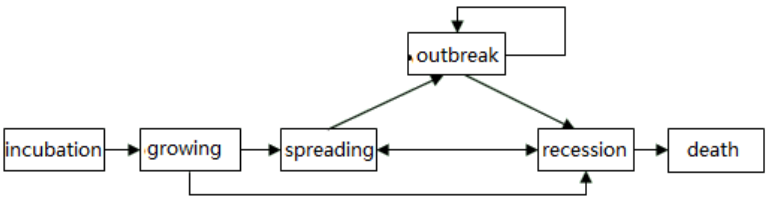

Fig. 1. Process model of network public opinion.

In incubation period, the causes of public opinion crisis are always because of dissatisfaction about certain event or department; in growing period, disseminators uses of dissatisfaction and spread information on online social sits for obtain more attention from more Internet users; in spreading period, related information soon attract large number of Internet users and start discussion due to the newsworthy or disseminators' hype; in outbreak period, media and opinion leaders enlarge the affection of event; if departments can control the public opinion and release the public emotion in this period, public opinion will lead to recession period; when the enthusiasm of Internet users, media on this event is lower, attention

will be faded and public opinion will lead to death period.

3.1. Correlation Analysis of Weibo Characteristics

Correlation Analysis is a simple, practical analysis techniques which is used to found centralized association or correlation in large amounts of data. It describes the laws and patterns of attributes occurred in the same time of a thing. There are many typical correlation analysis method, concluding Apriori and FP-growth in data mining [5]. These methods are able to find frequent item sets from large amounts of data, and to find the relationship between the variables through frequent item sets [6].

Correlation analysis in this paper has been divided into three steps:

Step1: analyze the characteristics of a micro-blog. These characteristics are divided into content features and user features. Each feature of micro-blog is a variable which is used in correlation analysis.

Step2: analyze the variable correlation. Correlation analysis and regression analysis of variables are closely related in practical application. Correlation analysis is focused on variety of relevant characteristics of random variables which the relationship between variables and significant are more important.

Step3: do regression analysis. We first select a feature variable as the dependent variable and the remaining variables ad independent variables. Regression analysis can help interpret the affection of the characteristic variables to the only one characteristic as the dependent variable.

3.2. Sentiment Analysis Based on SVM

Sentiment analysis also is called opinion mining, view analysis, subjective and objective analysis, etc. [7]. The aim of sentiment analysis is to mine opinions of user and its sentiment polarity from text. It is signature to mine users view as its view can attract potential users and help other users make a decision [8], meanwhile, its view contain valuable feedback [9]. Sentiment polarity contains positive, negative and neutral polarity [10].

In Fig. 2, it shows the algorithm design flow of sentiment analysis designed by this article. It works as this: firstly, put data based on key words gathered by crawler into database; secondly, preprocess the data (feature selection, Chinese word segmentation etc.); finally, training SVM classifier to classify sentiment polarity of data and put out sentiment tags.

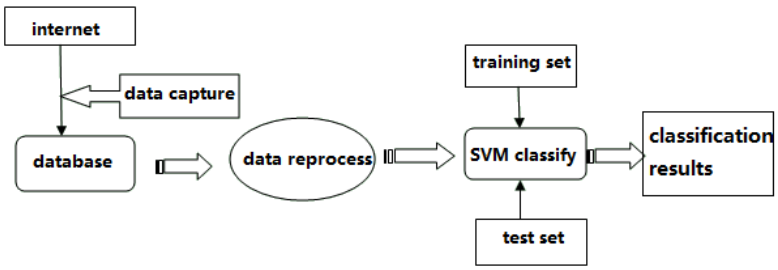

Fig. 2. Sentiment analysis flow based on SVM.

The main idea and character of SVM is to separate tuples with a straight line for linearly separable data. SVM reflects training data to a higher dimension with nonlinear mapping for nonlinearly data. Therefore, it is possible to linear analyze nonlinear features with linear algorithm in high-dimensional feature space. In new high-dimensional space, SVM will search for linear optimal separating hyperplane based on structural risk minimization theory which means to separate one class tuple to other tuples with decision boundary. SVM employ support vector (basic training tuples) and edge (support vector definition) to discover this hyperplane.

We need to build a classification to classify network public opinion. It is: $f(x) = < w \cdot x > + b$, $< w \cdot x >$

means dot product between w and x, b is bias. Specific research follows:

(1) eigenvalues selection

Approach to obtain eigenvalues is square test (CHI). Square test statistics is employed to describe association degree between features and category, larger statistics means lower independence between them and more significant for classification. The equation of CHI follows:

$$x(t,c)=\frac{AD-BC}{(A+B)(C+D)} \tag{1}$$

A is the number of documents which contain feature items in class c; C is the number of documents which doesn't contain feature items in class c; B is the number of documents which contain feature items in other classes except class c; D is the number of documents which doesn't contain feature items in other classes except class c.

(2) data set prerecession

According to the format in LIBSVM package [6], we prepare the test data and training data and normalize the data.

(3) kernel function selection

RBF kernel function is employed: $K(x,y)=\exp\{-r\|x-y\|^2\}$, it means dot product in SVM classification function which can calculate the value of w and b.

(4) Cross-validation

Cross-validation is employed to train whole training set for obtaining support vector product model.

(5) The model is employed to test and forecast.

There are several SVM classification strategies. Take sentence classification for example, there are two different methods. We employ non-clause strategy to address data because the data we deal with are posts containing much text. Based on non-clause, we further divide into three categories, positive, neutrality, negative.

3.3. Research Model of Public Opinion Based on Sentiment Analysis

We consider to the network public opinion process model and sentiment analysis methods and employ the data collected about 8.12 event to analyze the characters of government, opinion leaders, Internet users in network public opinion' propagation and its affection to public opinion evolution. The research model follows as Fig. 3:

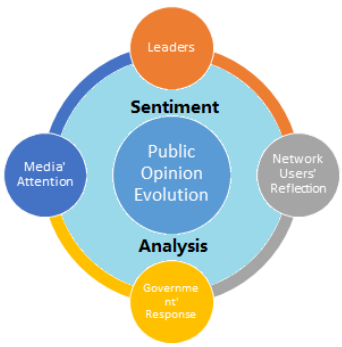

Fig. 3. Public opinion evolution research model.

We collected opinions expressed by public users about 8.12 Tianjin blasts event from Internet. Combining with sentiment analysis in each stages, we analyze the sentiment polar and observe affection to people feeling when medias, government, opinion leaders involving in it and how this affection affect public opinion evolution.

4. Factors Affection Analysis in Network Public Opinion Evolution

4.1. Data Preparation

In March 1, 2016, we employ LocoySpider to gather posts concerning about Tianjin blasts event from a topic page of "Tianjin Blasts" in Weibo.com. There are 10000 hot micro-blogs in the topic page of "Tianjin Blasts". After deduplication and removal of irrelevant, 825 hot micro-blog are gathered. We utilize the data between Augest 12 and Augest 29 for data accuracy and effectiveness. We analyze data of 8.12 Tianjin blasts event to obtain features of government, News Medias, Internet users in public opinion evolution. Fig. 4 follows:

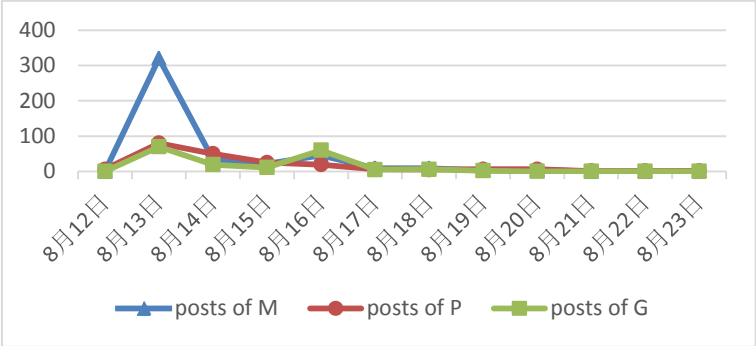

Fig. 4. Attention changing of internet users, medias, and government in public opinion evolution.

From the above chart, we can draw a conclusion that attention of Internet users to 8.12 Tianjin blasts event is P state distribution along the whole evolution. In Augest 13, the number of posts reached peak then became downward and after Augest 17, it raised again following subsidence.

The attention of media is also M state distribution in chart. But it reached peak in Augest 13 then fall back after Augest 15 following raising. In Augest 16, it reached another peak following subsidence after Augest 17.

The attention of government is similar to M state distribution in chart. It showed two peaks in Augest 13 and Augest 15 then subsidence in Augest 17.

4.2. Correlation Analysis

4.2.1. Variables that affect repost number

A micro-blog has a lot of characteristic variables which are divided into content and user variables. Both variables affect the amount of reposting [11], [12]. The following will describe the meaning of each characteristic varibles.

(1) Content variables:

① GetURL: wether the micro-blog has an URL or URL links.

② GetAT: wether the micro-blog has @ someone.

③GetQorE: wether the micro-blog has a question mark or exclamation mark.

④CommentNumber: the number of comments written by other users.

⑤ RepostedNumber: the number of reposted by other users.

(2)User variables:

⑥VIPorNot: wether the micro-blog has been reposted by VIP.

⑦ UserPostNumber: the number of author has been posted.

⑧ UserFollowerNumber: the followers the author has been got.

⑨UserFollowedNumber: the munber the author followed.

4.2.2. Correlation between variables

First we involve all of the characteristic variables to do pearson correlation analysis and the result are showed in Table 1:

Table 1. Correlation Reuslt

	1	2	3	4	5	6	7	8	9
GetURL	1								
GetAT	-.017	1							
GetQorE	.051	-.097*	1						
VIPorNot	.021	.193**	-.090*	1					
UserPost#	-.025	.213**	-.226**	.300**	1				
UserFollower#	-.020	.216*	-.182*	.193**	.594**	1			
UserFollowed#	.049	.039	.037	.002	.369**	.104*	1		
Comment#	-.168*	-.060	-.093*	.139*	.023	.081*	-.124*	1	
RepostedNum#	-.155*	-.070	-.157**	.115*	.027	.074*	-.127	.833**	1

From the Table 1, we can obtain the conclusion that not all the characteristic variables are correlation with RepostedNumber, characteristic GetAT and UserPostNumber and UserFollowedNumber are not significant correlation. The UserFollowedNumber is the amount of users the author has been followed, it is reasonable that it is not significant correlation with RepostedNumber, the same as UserPostNumber.

Besides the RepostedNumber, we can see other correlation relationship: Characteristic GetAT, VIPorNot and UserPostNumber are very significant. It means the three variables are strong interdenpendent measurement. Characteristic VIPorNot, UserPostNumber and UserFollowerNumber are very significant which means three strong interdenpendent measurement.

4.2.3. Regression with variables

After doing correlation analysis with all 9 variables, it shows that most of these variables are significant, so it makes sense to do regression between RepostedNumber and other variables. The result shows in Table 2.

Table 2. Regression Result

Variables	Beta(Std.)	significant
GetURL	-.013	.034*
GetAT	-.029	.061
GetQorE	-.081	.003**
VIPorNot	.001	.042*
UserPost#	.007	.061
UserFollower#	.005	.036*
UserFollowed#	-.023	.053
Comment#	.819	<2e-16**

From Table 2, we can see GetQorE and CommentNmuber are very significant, GetURL, VIPorNot and UserFollowerNumber are significant. It means these five variables have affection with RepostedNumber. It is reasonble that the beta of CommentNumber, UserFollowerNumber and VIPorNot are greater than zero. But what is intersting that beta of GetURL and GetQorE are less than zero. GetURL and GetQorE are not significant, it means that these two variables are seperated affect RepostedNumber with negative effection.

5. Lifecycle of Public Opinion Division

According to the frequency of Internet users posting opinions, we divide the lifecycle of this event. Processing and analyzing the data we gathered combining the evolution pattern in Fig. 4, we divide the lifecycle as following in Table 3.

Table 3. 8.12 Tianjin Blasts Event Public Opinion' Lifecycle

stage	incubation	growing	spreading	outbreak	recession	death
Date	8.12	8.13	8.14	8.15-8.18	8.19-8.21	8.22-8.23
posts	6	470	102	222	22	3

8.12 event is an emergency, its incubation is not obvious but affection is widespread, so its recession and death propagation last longer.

5.1. Affection to Public Opinion of Media Attention

We obtain 819 concerning posts from Netease website during Aug. 12 and Aug. 23. Processing and analyzing the data we gathered combining the evolution pattern in Fig. 4, we divide the lifecycle as following in Table 4.

Table 4. Media Attention in Each Stage of Public Opinion

stage	incubation	growing	spreading	outbreak	recession	Death
Date	8.12	8.13	8.14	8.15-8.18	8.19-8.21	8.22-8.23
posts	0	320	33	85	7	1

Table 4 and Fig. 4 indicate that media attention' affection to public opinion is remarkable. In growing period, attention frequency obviously raised from 0 posts in August 13 to first peak. It attracts public to pay attention to 8.12 Tianjin Blasts event which push public opinion into spreading period with continued development. Furthermore, high posting frequent of 8.12 event push public opinion into outbreak period.

It also indicates that public attention affects media reported amount. August 13, public started to comment the Tianjin Blasts event, media' cloth attention on the event is following in August 13. Since August 19, public attention falls, reports amount also becoming less. Public and media are factors and information source of each other which accelerate public opinion evolution.

5.2. Role of Opinion Leaders in Network Public Opinion Evolution

Virtual opinion leaders are the individuals who are keen to spread news and express opinions in virtual network. They may somehow have more information source or contact to media more frequently or are experts in some fields whose opinions always affect others around.

5.2.1. Opinion leaders' affection on network public opinion

In the perspective of event' development, opinion leaders push every development of network hot events. Their opinions controls public attitude and disseminated, enlarger by public.

From the perspective of dissemination of information, the opinion leaders have constructed a control layer. Opinion leaders are the active people who offer information in interpersonal communication network and affect others. They are the filter and intermediary of public dissemination procession7.

From the perspective of audiences, network opinion leaders will not only influent the topic of network public opinion, they will also affect the trend of public opinion. They have a significant impact on discussion focus and ways of emergency events.

5.2.2. Behavior analysis of opinion leaders in public opinion evolution

Network opinion leaders play a significant role in public opinion evolution. Research on the structural features of opinion leaders in emergency event public opinion evolution can help to perform larger amount and more accuracy prediction.

Take 8.12 Tianjin Blasts event as an instance, we classify the 200 micro-blogs gathered from Weibo according to public opinion lifecycle and analyze the behavior features of opinion leaders in each stages based on this classification. It is following as Table 5.

Table 5. Behavior Features of Opinion Leaders

Incubation	Inform the Tianjin Blasts event	2015.8.12	Statement of facts without sentiment polarity
Growing	Questioning the reasons why it happens	2015.8.13	Single focus, emotional catharsis
Spreading	Analysis of reasons, responses and attitude of accident	2015.8.14	More focus, compete for the right to speak
Outbreak	Dissection reasons of Event	2015.8.14-8.15	Concentrate focus, firm standpoint
Recession	Post-processing work after accident (Compensation for the families of the victims etc.)	2015.8.16-8.18	Focus become differentiated
death	Recall of emergency event	2015.8.19	Elimination of focus, experience summary

In the incubation period of emergency event network public opinion, media and litigant are the opinion leaders who inform the public of events which are always facts statement without comments.

In the growing period, mundane opinion leaders take the main role in dissemination and development of network public opinion. Moderators and Internet VIP users post and forward information to further propagate the event and enlarge the audience. In the period of propagation, opinion leaders describe event and add their own feelings to produce more network public opinion.

In the spreading period, the emergency event attracts some degree of attention and its new advance offer new discussion topic. In this period, besides mundane opinion leaders, some experts, celebrities, scholars also transfer to opinion leaders and they dissect the causes, properties, development of event from different concept based on expertise.

In the outbreak period, the level of concern and people concerning raise rapidly which push the network public opinion concentrate into one or few focus that makes public opinion centralization and clarified. (Take 8.12 event as instance, public focus on the causes of this event on the last few stages.)

In the recession period, new emergency event and new hot topic plus the settlement and control of event decentralize the attention of public and lower the level of attention.

In the death period, with the solution and the result represented by concerned department, the level of attention and public opinion lower in a further degree. Emergency event fades from public vision. In this period, Internet users always focus on the influence and experience summary, but many emergency event will not truly disappear from public discussion, such as 8.12 Tianjin Blasts event. If such event suffers some changes, it may become public focus again.

5.3. Government Attention's Affection on Public Opinion Evolution

Based on the dynamic on Fig. 4 combining with period of public opinion lifecycle, we classify the data about government responses according to lifecycle stage of public opinion. Table 6 is following:

Table 6. Government Response in Each Stage of Public Opinion Lifecycle

stage	incubation	Growing	spreading	outbreak	recession	Death
Date	8.12	8.13	8.14	8.15-8.18	8.19-8.21	8.22-8.23
Report amount	0	70	19	82	2	0

From the Table 6 and Fig. 4 we can observe the affection of government in public opinion evolution. In the

growing and spreading period, government reports are rare but in outbreak period, government begin to response actively and reports amount is double which controls the public opinion and push it into recession period even death period.

The involving frequency directly affects the degree of government responses. When public involving become into a large scale group event, government must respond which directly affect the next stage of public opinion evolution. If government responds improperly, it will stimulate the public opinion.

6. Sentiment Analysis in Public Opinion Evolution

6.1. Sentiment Analysis Based on SVM in Public Opinion Evolution

We train and classify the content of gathered posts employing SVM supported vector product based on the thinking and workflow in former three parts to obtain sentiment polarity of public opinion. We employ the 8.12 event data as training set and after some preprocessing (deduplication, theme irrelevant removal, Chinese word segmentation, text feature[8]), we perform classification training using SVM. Former 200 data are utilized as training set and 13 features are selected. Classification program in matlab is following:

```
load motional
data=motion
label=motionresult        %Import data, assign it to variable data, assign results to variable label.
ind = 200
traindata = data(1:ind,:)
trainlabel = label(1:ind,:)      %Employ former 200 data as training set.
testdata = data(ind+1:end,:)
testlabel = label(ind+1:end,:)        %Employ remaining data as testing set.
model = svmtrain(trainlabel,traindata,'-s 0 -t 2 -c 1.2 -g 2.8');    %Set up SVM training model.
Parameters = model.Parameters    % Setting the parameters of the model
……
[ptrain,acctrain] = svmpredict(trainlabel,traindata,model)    %Forecast of training set and export
accuracy.
[ptest,acctest] = svmpredict(testlabel,testdata,model)    %Forecast of testing set and export accuracy.
```

The results show in Table 7. The accuracy of training set is 81.5%, testing set is 57.6%. The accuracy of 57.6% is adopted because that Internet language is complicate and diverse and difficult to forecast its sentiment polarity.

Table 7. Public Sentiment Polarity in Each Period of Public Opinion Evolution

Incubation	Positive	1	0	Internet users inform Tianjin Blasts event in microblog
	Neutrality	6	100.00%	
	Negative	0	0	
Growing	Positive	1	3.03%	Media report the Tianjin Blasts event
	Neutrality	15	18.18%	
	Negative	17	78.79%	
Spreading	Positive	6	11.84%	Event of burying Tianjin Blasts front is reported
	Neutrality	14	23.53%	
	Negative	31	68.63%	
Outbreak	Positive	14	15.22%	First step investigation report are represented, survival girl is called life miracle.
	Neutrality	28	19.56%	
	Negative	50	65.22%	
Recession	Positive	9	21.05%	Condolences to the families of casualties by department, accident follow-up arrangements
	Neutrality	10	10.53%	
	Negative	19	68.42%	
Death	Positive	1	9.52%	Government committee to give a truth of this event
	Neutrality	8	23.81%	
	Negative	12	66.27%	

6.2. Factors' Affection on Sentiment Polarity of Public Opinion

8.12 Tianjin Blasts event is a disaster so the general sentiment polarity of public opinion is negative. In form 7, we choose the amount of different polarity posts in each stage to analyze the public sentiment polarity. For showing the changing of public sentiment polarity, we draw Fig. 5.

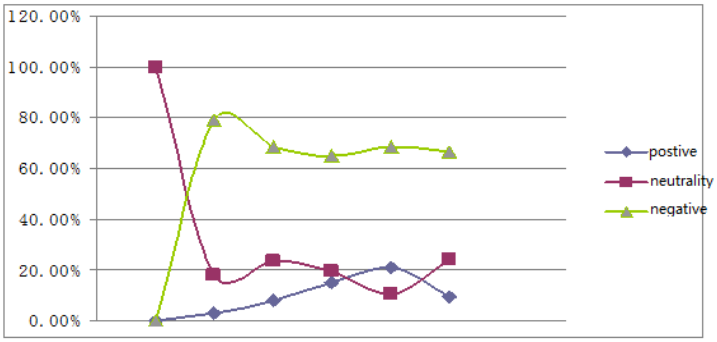

Fig. 5. Changes of public sentiment polarity in each stage.

Comparing Fig. 4 with Fig. 5, we can observe that in the whole lifecycle of public opinion negative is dominate. In incubation and growing period, with the increasing of media reports and opinion leaders involving, neutrality mood rate falls following the raising of positive and negative mood. In these periods, sentiment polarity begins to appear. In growing and spreading period, the negative mood reaches the peak, but when government' attention increases (in Fig. 5), negative mood falls and step in the trough after outbreak period. Meanwhile, positive mood reaches the peak in recession period which indicate that government responses suppress the development of negative mood of public opinion. In the end of public opinion, government's enthusiasm to respond is lower the negative mood raises again. But with the public opinion stepping into death period, the development of negative mood stopped. The data shows that the attention of Internet users, media, government interact push the evolution of public opinion in some degree.

7. Conclusion

From the research on network public opinion of emergency event, we can draw a conclusion that government consider public opinion as a serious issue and with the evolution of network public opinion, it affects government external reputation. Therefore, government should take public opinion serious and try their best to handle the event similar by public opinion.

Based on the evolution rule of public opinion, we suggest government absorb following as strategies:

(1) Timely response. Once the public opinion occurring, government should take the right to speak and avoid rumors to suppress the negative mood taking the main role in public opinion.

(2) Be honest. The key to lead the trend of public opinion is telling the truth for what the government can win the public trust and avoid rumors stabilizing society. Government didn't achieve this which push the public opinion to a peak and lose the credibility of government.

(3) Correct mistakes. If government can be responsibility without any avoiding of problems and negative reports, government will obtain credibility and reputation again.

(4) Guide actively. Network public opinion is always based on individuals' view and belief and expressing in emotional ways. It needs actively guidance to lead it developing in a trend beneficial on social harmony.

(5) Swap positions. In the procession of network public opinion, government should consider and solve the most urgent issues in the perspective of public people. Only in this way, government can eliminate

negative the large scale group issue as soon as possible.

(6) Control opinion leaders. Internet opinion leaders play the critical role in disseminating information and affecting the evolution of network public opinion. Government may guide or control the views and opinions of opinion leaders to control the evolution trend of public opinion.

Based on the previous research, we take 8.12 Tianjin Blasts event as an instance to illustrate the evolution of public opinion is influencing by four aspects, public, media, government and opinion leader. Then we employ the sentiment analysis in each period of lifecycle of network public opinion to judge the sentiment favor of public and research emergency event network public opinion more comprehensive. After obtaining the affection of each aspect on evolution of public opinion, we suggest some guidance and controlling strategies in different point of view. But 8.12 event is a typical emergency event which it may not cover the whole features of different kinds of public opinion. Moreover, language itself is changeable and complicate and difficult to classify the sentiment of public and show the sentiment polarity of audience. The conclusion may be constantly replenished and amended at a later research stage.

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References

[1] Liu, Y. (2007). *Introduction of Network Public Opinion Research*. Tianjin: Tianjin People's Publishing House.

[2] Ding, J., Le, Z., & Wang, G. (2010). Research on early warning of network public opinion crisis in China. *Information Journal, 29(10)*, 5-6.

[3] Wang, G., Zhang, J. & Bi, S. (2011). Researcn on opinion leaders in the evolution of network public opinion in of unexpected events. *Information Journal, 30(12)*, 1-4.

[4] Fang, F., Wang, G., & Xu, X. (2010). The formation mechanism of 'one-sided presentation' for network public opinions of emergency event based on the netizens view. *Information Journal, 4(2)*, 6-13.

[5] Li, G., & Dong, Q. (2011). Research and empirical analysis for transmission process of enterprise network public opinion under the Web2.0 environment. *Information Science, 29(12)*, 1180-1184.

[6] Bianco, William, T., David, T., & Canon. (2013). *Public Opinion in American Politics Today* (3rd ed.). New York: W.W. Norton.

[7] Zhu, Y., Min, J., & Zhou, Y. (2006). Semantic orientation computing based on Hownet. *Journal of Chinese Information, 20(1)*, 14-20.

[8] Xu, X., & Zhang, C. (2008). Analysis and application of the Internet public opinion. *Information Science, 26(8)*, 1194-1200.

[9] Hu, M. Q., & Liu, B. (2004). Mining and summarizing customer reviews. *Proceedings of ACM SIGKDD 2004: Knowledge Discovery and Data Mining* (pp. 168-171).

[10] Pang, B., & Lee, L. (2008). Opinion mining and sentiment analysis. *Foundations and Trends in Information Retrieval, 2(1-2)*, 1-135.

[11] Huang, C., Wang, P., & Qu, Y. (2012). Diffusion of IT innovations via social media: Studying a Chinese micro-blog community. *Proceedings of the Academy of Management Annual Meeting*. Boston, MA.

[12] Jin, X., Xie, B., & Zhu, J. (2012). Research on micro-blog information transmission mechanism based on complex network analysis. *Journal of Jilin University, 1*, 271-275.

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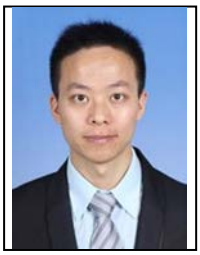

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