Analysis and research on the evolution of public opinion emotion based on the theory of social combustion

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Abstract. In the new media era, the emotions of netizens have an important impact on the trend of online public opinion. Therefore, taking "China Eastern Airlines MU5735 crash incident" as an example, keywords in each stage of public opinion life cycle were extracted, keyword co-occurrence network was constructed, and theme communities were detected. Then, the similarity between topics is calculated, and the threshold is set to judge whether there is a theme evolution relationship. Finally, for the topic community with theme evolution relationship, we explore the process of emotion evolution of Internet users from the perspective of social combustion theory. Through the analysis, we dug out the emotional evolution trend of Internet users' attention content and themes with evolutionary relationship at each stage of the life cycle. By analyzing the reasons for the emotional evolution of Internet users during the evolution of online public opinion events, we proposed relevant emotional guidance measures, which are of great significance to prevent the emotional polarization of Internet users.

Keywords: Social combustion theory; Network public opinion; Theme evolution; Emotional evolution

1 Introduction

In recent years, the "roundtable effect of public opinion"[1] has brought about an information flow space with the basic characteristics of decentralization[2]. "We media" has brought about the universal society of information resources, and netizens' enthusiasm for discourse has been unprecedentedly stimulated. Their emotional attitudes will also affect the trend of online public opinions. If not properly guided, negative emotions are easy to spread on the network platform, absorb "oxygen", produce "combustion effect", and even cause "group polarization" phenomenon.

The "social burning theory" is a theory[3] that makes a reasonable analogy between the disorder, instability and unrest of society and the burning phenomenon in nature[8]. At present, some scholars have applied the social burning theory to online public opinions. Peng Guo-chao et[4] al. used csqca to explore the heat generation path of online public opinion reversal events. An Lu et[5] al. compared five machine learning methods to find out the optimal prediction model of reverse events. Li Chengcheng[6]For the

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reversal of public opinion events, He Jiesjun et[7] al. analyzed the emotions of Internet users at different time slices, and summarized the evolution rules of Internet users' emotions before and after the reversal of events.

However, there are still shortcomings in the current research: (1) Domestic and foreign scholars mainly focus on analyzing the emotional state of Internet users by combining different attributes such as spatial location information[9], and few studies introduce new theoretical perspectives for analysis; (2) There is usually a continuous transition between different emotional states of netizens, rather than jumping from one state to another. Most studies focus on using life cycle theory to analyze emotional states under different time periods or different themes, while few studies analyze emotional evolution process. Therefore, this paper combines theme and emotion, and analyzes the evolution characteristics of different emotional states from the perspective of social combustion theory for the theme with temporal evolution.

2 Research Design

The research idea of this paper mainly includes three parts: first, the post information of "China Eastern MU5735 Crash Incident" from March 21, 2022 to May 1, 2022 was crawled on Weibo, and the data was preprocessed; Secondly, time slices are divided, keywords of each stage are extracted, theme communities are divided, and the evolution of theme communities is visualized by Sankey diagram. Finally, based on the theory of social combustion, emotional tendency of the subject with evolutionary relationship is judged, its emotional evolution characteristics are analyzed, and emotional guidance measures are put forward. See Figure 1 for the specific process.

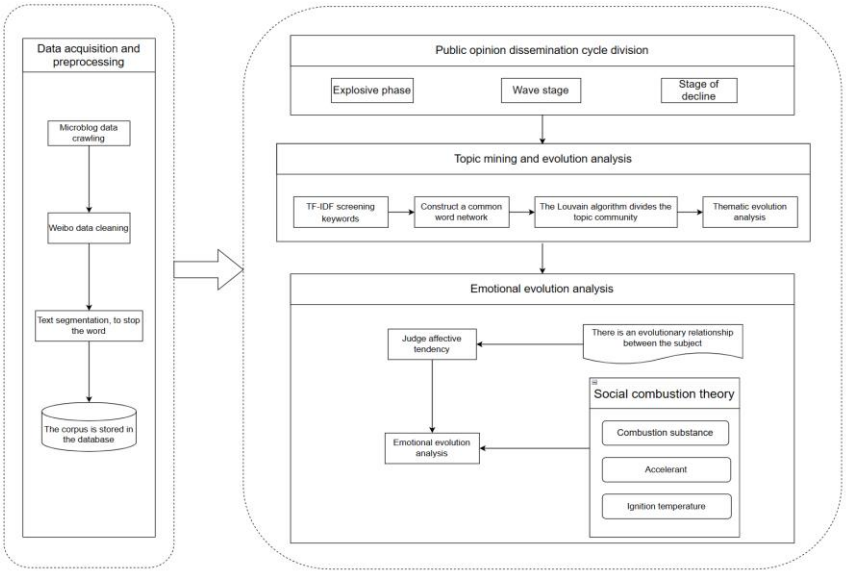

Fig. 1. The analysis process of netizens' emotional evolution

3 Empirical Study

3.1 Thematic Communities

The crash of China Eastern MU5735 aircraft on March 21, 2022 started as an incident. On March 26, the national emergency management headquarters confirmed that all aboard the flight had been killed. On April 6, the Civil Aviation Administration held a meeting to deeply reflect on the flight accident of "March 21" China Eastern MU5735 aircraft, and the heat of the incident gradually decreased. Combined with Baidu index, the life cycle of the incident was divided into: outbreak stage (March 21 - March 26), fluctuation stage (March 27 - April 6) and recession stage (April 7 - May 1).

This paper adopts TF-IDF method to extract keywords from microblog data. Extract TOP-100 words as nodes in the keyword co-occurrence network. The Gephi software was used to visualize the co-occurrence network of the three stages, as shown in Figure 2. In this study, the modularization function of Gephi was used to detect community, and a three-stage co-word network was obtained. Different colors in the figure represent different thematic communities; Node size represents the importance of keywords, which is sorted by PageRank algorithm. The line between nodes represents the co-occurrence relationship between keywords, and the thickness of the edge represents the co-occurrence frequency.

Fig. 2. Three stage keyword co-occurrence network

3.2 Topic Evolution Analysis

According to the keywords under each topic, this paper summarizes the content of each stage of the topic. In order to identify the evolution path of topic community, cosine similarity algorithm is used to judge the similarity of two topics. The topic similarity threshold φ is set as 0.3. When the topic similarity is greater than φ, it indicates that there is an evolutionary relationship between the two sub-communities. Each rectangle is a community. The connection between rectangles represents the flow of nodes between communities, namely the topic keywords. The height of rectangles represents the intensity of the topic community, as shown in Figure 3.

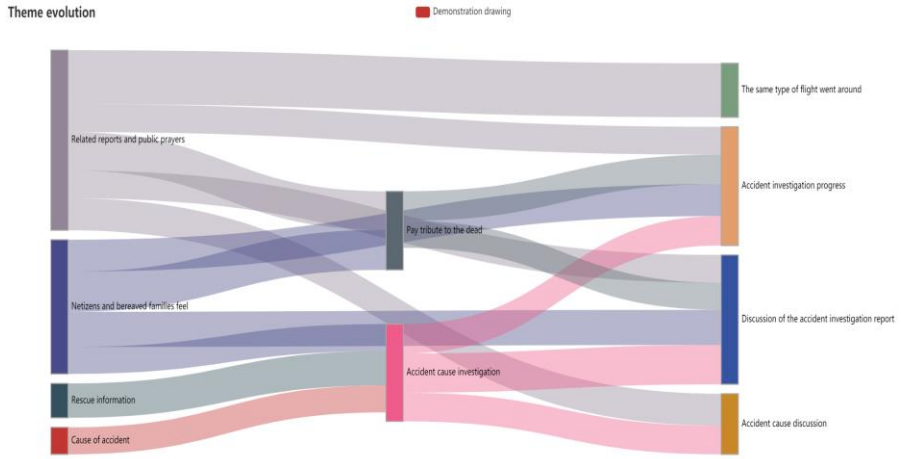

Fig. 3. Topic evolution path

3.3 Analysis of Emotional Evolution

For topics with evolutionary relationships, the SnowNLP library of Python was used to judge the emotional tendency of blog posts. In the results, microblog posts with an affective value greater than or equal to 0.6 were judged as positive emotion, microblog posts with an affective value between 0.3 and 0.6 were judged as neutral emotion, and microblog posts with an affective value less than or equal to 0.3 were judged as negative emotion. The analysis results of emotion evolution are shown in Figure 4.

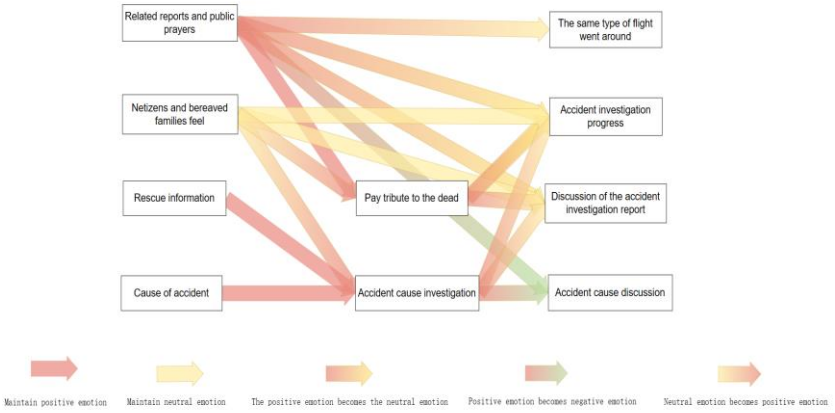

Fig. 4. Evolution process of theme emotion with evolutionary relationship

From the perspective of emotional evolution, for subjects with evolutionary relationship, the emotional values of most subjects decreased gradually[10]. For example, netizens' discussion on the topic of "accident cause" eventually turned negative.

Therefore, the subsequent analysis mainly discusses the reasons for the decline of netizens' emotional value during the evolution of the theme.

According to the social combustion theory, combustion phenomenon needs three elements: combustion substance, accelerant and ignition temperature[11]. The unstable factors in the society as "burning materials" constantly stimulate the public's social mentality, and transform it into unstable negative social emotions. Under the instigation of wrong public opinion guidance, "burning material" has been amplified and heated up, affecting the emotions of netizens. In addition, in order to occur combustion chemical reaction, but also need a certain ignition temperature, namely ignition point. "Ignition temperature" can be understood as the "psychological threshold" of individuals or groups in network public opinions. When the "psychological endurance threshold" is less than the "ignition temperature", the burning material will continue to accumulate, and on the contrary, the emotion of netizens has a high probability to change. The evolution process is shown in Figure 5. This paper explores the "combustion substance", "accelerant" and "ignition temperature" in the "China Eastern MU5735 Crash", and analyzes the logical relationship among the three, in order to provide reference for the emotional guidance of the public.

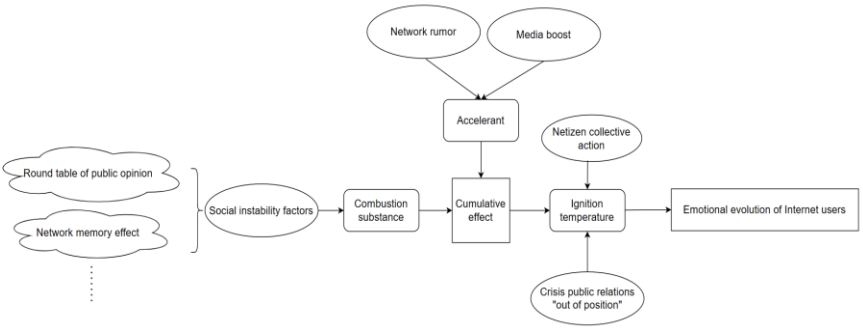

Fig. 5. Evolution process of Internet users' emotions based on social combustion theory

(1) Burning Material.

In the open information platform of "we media", the influence of ordinary netizens on hot issues of public opinion is constantly increasing. After the "China Eastern MU5735 crash" happened, people expressed their opinions on the microblog platform. Due to the powerful information aggregation function of We media, the originally dispersed individual power evolved into a huge influence on public opinion, forming a "round table of public opinion"[1]. Different opinions and views of users contain different emotions. The collision of different ideas and value propositions of these diverse social subjects also increases the unstable factors in the society. At the same time, aircraft is one of the most important means of transportation in modern times. This disaster incident involves the safety of public travel, and the handling of this incident always affects people's nervous nerves. Moreover, according to network memory Effect [12], netizens maintain a high sensitivity to aircraft safety events. After the accident happened, many netizens connected it with other accidents of this type of flight and expressed concerns

about travel safety. Various rational and irrational voices collided in the field of public opinion, and negative emotions continuously accumulated, which accumulated rich burning materials for the evolution of emotions of Internet users.

(2) Accelerant

News media is a professional mass information media, and the public has the right to obtain public information through the media. After the accident, some media in order to seek sensationalism, in the character of the story with the tragic narrative way to exchange flow, these improper operations to the victims' families brought secondary damage[12]"oxygen" for the burning effect. Secondly, the breeding and spreading of Internet rumors also affect the public mood. High-frequency words such as "lock the co-pilot" are related to the rumors. Rumors can spread quickly in a short period of time. Such information will bury the truth and stimulate irrational emotions of the audience. Meanwhile, the delay of the government and the media in reporting the incident will also aggravate this phenomenon. For example, after the crash, a video claiming to be "the last seconds before the crash of Flight MU5735" circulated on the Internet, showing an inverted camera shot at the tilting wing and the plane hurtling towards the mountain amid the terrified cries of passengers. The video later turned out to be a video grab from a video game, not the real thing. What's more, before the press conference held by the Civil Aviation Administration, several versions of the "conspiracy theory" were fabricated to disturb the public eye and become the "accelerant" of the emotional evolution of netizens, making the "burning substance" constantly amplified and heated up, intensifying the cumulative effect and forming a negative effect with great inciting effect.

(3) Ignition Temperature

After the "China Eastern MU5735 crash" happened, due to the accidental occurrence of public opinion events, the government extended the identification and judgment time of the event increased the ambiguity of the event, and netizens could not get timely feedback, and would make inappropriate comments under the negative psychological effect. At the same time, netizens create momentum on the network through strong emotional expression, prompting "smoldering users", "unburned users" and "burning users"[6]to continuously gather in thinking and action and become "collective actors" [13], raising the "ignition temperature" of combustion effect. When the number of members with common or similar behaviors increases enough, individuals will think that their choice is the correct choice of the whole society because their choice is the same as that of the vast majority of others, and then identify the new behavior as normative, even if it develops in the direction of aggravating the situation [14]. A preliminary investigation report released by the aviation administration on April 20 focused more on aggregating existing information, but many netizens were not aware of this "common practice," and emotional sentiment led to widespread criticism of the report. In the first two stages, netizens' discussion on the cause of the accident reached a climax, the accumulation of negative emotions was not dealt with in time, the release of the preliminary

investigation report broke the safety threshold, and the temperature reached the ignition point, which became the "fuse" for the decline of netizens' emotional value.

3.4 Guidance of Public Emotion

(1) Reduce "burning matter"

Internet platforms have brought freedom of speech to the public, but should not become a cathartic place for public emotions. Therefore, public opinion managers should not only respect the right of expression and participation of every ordinary individual, but also regulate the expression of public opinion in the we-media space, and strive to create a harmonious and stable cyberspace. At the same time, for such disaster events, online public opinion should be well responded in the first time. The appearance of sensitive information is random and unpredictable, but it can disturb the audience's sight and become an incentive to stimulate public emotions. We should take appropriate control over inflammatory online trolls, screen out some sensitive words and expressions with ulterior motives, and try to reduce the spread of negative false information and the accumulation of combustible materials from the source without affecting the freedom of speech.

(2) Curb "accelerants"

In the case of the China Eastern Airlines crash, rumors provided an opportunity for the spread of negative emotions among netizens and became the "fuel" for the spread of negative emotions among the public. In order to suppress them, firstly, it is necessary to strengthen the management of media platforms, make use of the credibility of official media to disclose the truth in time and seize the initiative. The second is to strengthen the management of Internet users, once found wantonly fabricated news, to trace their corresponding responsibilities, to restrict the network environment. Secondly, as a bridge for the public to understand the event, the media should confirm the information before the event is reported. They should return to the news event itself and dig out the positive emotions of things. In the news report, they should avoid the tragic description of the disaster event and prevent the rhythmical flow from bringing secondary damage to the victims' families.

(3) Control the "ignition temperature"

Emotional infection means that an individual's emotions are affected by others' emotions, intentionally or unintentionally, and then trigger the same or similar emotional experience with others [15]. When the crash incident of China Eastern Airlines broke out, all kinds of emotions spread throughout the public opinion field, and netizens with similar views quickly converged to form a consistent public sentiment. Thus, while the majority of people express an attitude, some individuals will often follow suit and express similar emotional tendencies to the group. When the accident investigation report is released, it touches the sensitive point of the audience's psychology, and the emotions of the group are detonated. Therefore, when negative information begins to spread, public opinion managers should give play to the emotional guidance role of the media

and conduct timely emotional guidance for negative public opinion information to "cool down" negative emotions. In addition, the government, as a social manager, strengthens information disclosure, gives feedback to netizens in the first time, strengthens the direction of mainstream public opinion, and instill "stabilizer" into the public mood.

4 Conclusions

In the era of new media, netizens express their opinions through the Internet, and their emotional expression will largely affect the progress of public opinion events, which has laid a great hidden danger to social harmony and stability. Taking "China Eastern MU5735 Crash" as an example, this paper combined time and content dimensions to study and analyze the emotional evolution of Internet users on the basis of theme evolution. It analyzed the emotional evolution process of Internet users from three aspects of burning substance, accelerant and ignition temperature, and proposed relevant emotional guidance strategies, which provided a new perspective for the analysis of the emotional evolution of online public opinions. It is helpful for emergency management departments and organizations to understand the emotional evolution process of netizens, so as to take timely measures to prevent the emotional polarization of netizens. However, there are still some areas to be improved in the research. The research is limited to a single case and the data coverage is limited. More representative topics will be selected in the subsequent research so as to conduct more in-depth research on such issues.

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