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Comparative Analysis and Strategy Research of Enterprises Dealing with Network Public Opinion Based on Text Mining

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Abstract

Enterprises need to pay attention to and track changes in online public opinion, and create a good public opinion environment for enterprise development. This study analyzes the successful experiences and deficiencies of enterprises in dealing with network public opinion, which is helpful to provide decision support for enterprises to respond to network public opinion. Two public opinion incidents of "Pinduoduo Employee's Sudden Death" and "Huolala Girl Jumps from the Car" are taken as the research objects. Based on text mining methods, the evolution of network public opinion, semantic network and sentiment trends are compared and analyzed. Through comparative analysis, it is found that Pinduoduo's comments focus on the corporate institutions and labor law, and revolve around multiple important nodes. The Huolala's comments focus on the truth and rectification of the event, and only revolve around two important nodes. The proportion of negative emotions in the early stage of the "Huolala girl jumping from the car" is much higher than that of the "Pinduoduo employee sudden death". However, Huolala did better than Pinduoduo in terms of coping strategies, which makes the proportion of negative emotions in the later stage lower and comments tend to be more rational. This study put forward corresponding strategies and suggestions for enterprises to effectively respond to the crisis of online public opinion. Firstly, network public opinion early warning mechanism need to be established to control from the source. Secondly, companies have to understand the direction of public opinion and grasp the focus. Thirdly, companies need to strengthen responsibility awareness and have courage to take responsibility. Fourthly, follow-up management system and propose corrective measures should be carried out.

Keywords: Internet public opinion; Coping strategies; Compare research; Semantic network; Sentiment analysis

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1. Introduction

With the rapid development of Weibo platform, Weibo has gradually evolved from a way of information dissemination into an emerging public opinion field for the vast number of netizens[1] below. In recent years, negative public opinion events have become more and more common among enterprises. Public opinion has the characteristics of fast dissemination, wide coverage and great influence[2] in anonymous and open social network media. These negative public opinion events continue to ferment on the Internet, which may bring serious crises and losses to enterprises, and even affect their survival. Some studies have shown that social platforms such as Weibo play a key role in these enterprises' management[3].

Based on the text mining, this study selects two online public opinion crisis caused by corporate emergencies, "Pinduoduo Employee's Sudden Death" and "Huolala Girl Jumps from the Car". Both incidents occurred in 2021 and caused massive discussions on the Internet. In addition, both Pinduoduo and Huolala have great reputations, making these two incidents have strong social influence. 27,225 comments were collected from Sina Weibo. Then the similarities and differences between the two cases were compared and discussed from the aspects of network public opinion dissemination process, semantic network, emotional trends and public opinion strategies. The results show that, compared with the incident of "Pinduoduo Employee's Sudden Death", the effect of online public opinion processing of enterprises in the incident of "Huolala Girl Jumps from the Car" is more prominent. Finally, specific countermeasures and suggestions for enterprises to effectively respond to the crisis of network public opinion were proposed. The suggestions can help enterprises to grasp the attitudes and opinions of netizens on emergencies more quickly, and then help enterprises to effectively respond to network public opinion.

The main contributions of this study are as follows: (1) To overcome the drawbacks of relevant empirical analysis in the existing literature and the lack of comparative analysis of multiple cases, this paper selects two public opinion incidents and discusses the correct strategies for enterprises to deal with online public opinion from a comparative perspective. (2) Methods, such as semantic network and sentiment analysis, were used to analyze the results of different corporate coping strategies and to summarize scientific and effective coping strategies. This study also provides strategies and suggestions for enterprises to deal with public opinion on emergencies and improve the management ability of new media.

2. Literature review

In recent years, some researches have conducted a series of studies on how to deal with negative online public opinion events. These studies are analyzed from the perspectives of research methods, research cases.

From the perspective of research methods, with the development and maturity of data analysis technology, some scholars have begun to use text mining technologies, such as semantic network analysis [4] and sentiment analysis[5], to discuss the crisis of network public opinion. Gu [6] argues that semantic networks objectively convey the expression and perception of message creators, and are ideal for studying distributed social media dissemination and user-generated content. Pan et al.[7] used semantic network technology to build connections between nodes, so as to explore the content and related information in related topics. Zhao et al. [8] selected the "Daxian Village flood disaster event", conducted a quantitative test of network public opinion, identified the relationship between important nodes, obtained its structural characteristics and evolution laws. Wang et al. [9] crawled data and calculated the sentiment value to obtain sentiment trends and dimensions by sentiment analysis.

From the perspective of research cases, the analysis of user sentiment in social network platform is the main research direction. Scholars generally focus on social network platforms such as Twitter, while most scholars in China choose Sina Weibo as the research object. Zhang et al. [10] used the community network algorithm to analyze public opinion data valuable to researchers during the epidemic. They discussed the public's emotional changes, and provided decision-making basis for public opinion research on public emergencies. Gu et al. [11] chose the comments after the outbreak of the corporate crisis and the corresponding measures of the company as the research object. They used sentiment changes over two periods to assess the effectiveness of the firm's corresponding actions. Sun et al. [12] selected the "Bus crashing into the lake in Guizhou" topic as the research object. They studied the evolution process of public opinion event emotion based on text mining method. Ma et al. [13]took public opinion incidents on the use of epidemic aid materials as an example, and analyzed Weibo comments based on sentiment

analysis and topic extraction. Jiang et al. [14] added the emotional dictionary of a specific object and obtained the emotional intensity and type to divide the evolution stage of network public opinion in "Luo Yixiao" topic.

Recently, most of the public opinion research based on semantic network and sentiment analysis are related to public emergencies. However, the research related to corporate public opinion is mostly a theoretical discussion of content analysis, and few studies the changes in public sentiment value brought about by corporate strategies based on sentiment analysis. Meanwhile, there are few empirical analyses in the existing research, which mainly based on the analysis of a single event. Our work selected two typical representative cases from the corporate public opinion incidents in the real society. The data were collected from the Sina Weibo. Then we made a comparative analysis of two cases and summarized the success and insufficiency of enterprises in responding to public opinions.

3. Research methods

This study selected two public opinion emergencies that occurred in 2021, "Pinduoduo Employee's Sudden Death" and "Huolala Girl Jumps from the Car" to compare and analyze the strategy research of enterprises in responding to emergencies. The research framework is shown in Fig. 1, which including data collection and processing, data analysis and conclusion. Firstly, comment data related to two events from Sina Weibo platform was collected and preprocessed. Secondly, we analyzed the evolution process of events based on time series, and introduced semantic network for comparative analysis. In addition, we used the sentiment analysis method based on sentiment dictionary to extract the positive and negative sentiment ratios of the comments in the two events. The trend graph of the negative sentiment values of network users was drew. Finally, Finally, we compared the two events. The similarities and differences summarized in this study can help enterprises to deal with network public opinion in a targeted manner.

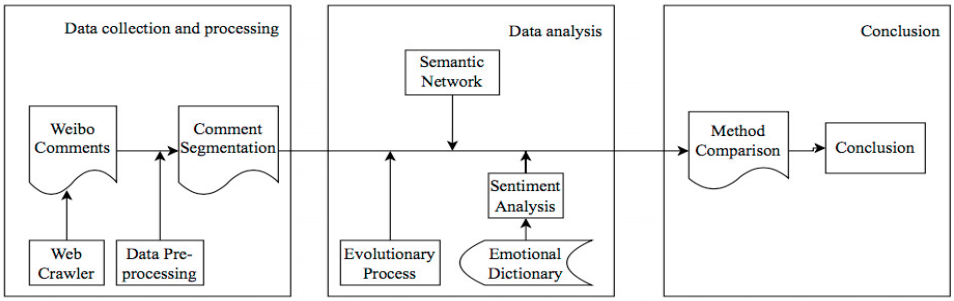


Fig.1 The research framework

3.1. The evolution process of enterprise network public opinion

By comparing and analyzing the various dissemination processes of public opinions, it would help enterprises to grasp the situation of public opinions at each stage. It also helped other enterprises to respond to emergencies in a professional way. This paper counted the number of comments on Sina Weibo within a certain time range. The occurrence time of corporate emergencies was divided into several time periods by 6-hour intervals. A line graph of the cumulative number of comments published in each time period was drew. We could get a dissemination situation of network public opinion with the development of time. Finally, we got the evolution process of events by observing the curve changes of the trend graph.

3.2. Semantic network

First, JIEBA toolkit in Python was used to perform Sina Weibo comments segmentation. But one of the disadvantages of word segmentation is that it will destroy the overall structure of the comment. It is also difficult to perform more complex analysis of the sentence after word segmentation. Therefore, we used the semantic analysis tool in the ROSTCM6 software developed by Wuhan University to connect the words that have been segmented. This step integrated the relationship between the connected words into a smooth corpus, and recovered the real

content and emotions that Weibo comments want to express. We can further dig out more information and connections about emergencies in Weibo comments.

3.3. Sentiment Analysis

3.3.1. Construction of sentiment dictionary

The first step was to construct a sentiment dictionary. Until now, many scholars and institutions already established basic Chinese sentiment dictionaries, among which the representative ones are BosonNLP, Hownet, National Taiwan University NTUSD, Tsinghua University Li Jun Chinese dictionary of praise and derogation [15]. To increase the accuracy of the sentiment tendency classification, the above four dictionaries were all used to extract the positive and negative sentiment words. Then, put them into two different documents for manual judgment, and deleted the irrelevant content and duplicated content in the dictionary. Finally, a positive and negative sentiment dictionary suitable for this study were obtained.

Emotional tendencies could be classified into two categories: positive emotions and negative emotions. In this paper, words such as “happy”, “joy”, “praise”, and “support” in the emotional categories were classified as positive emotions. Words such as “anger”, “horrible”, “disgusting” and “garbage” were divided into negative emotions.

3.3.2. Calculation of sentiment value

First, we processed each Weibo comment as an independent sentence for word segmentation. Then we compared the word segmentation results with the sentiment dictionary constructed in this paper, and extracted the sentiment words in each Weibo comment. Third, based on the sentiment value of a single sentiment word, we added the sentiment values of all sentiment words in each Weibo comment to obtain the sentiment value of each comment. The calculation method is as shown in equations (1) and (2).

Assuming that the text information content of each Weibo comment is composed of sentences S_i, by summing the sentiment value F(S_i) of a single sentence Si, we can aggregate the sentiment value F(S) of Weibo comments:

$$F(S_i)=\sum S_{w_i} \tag{1}$$

$$F(S)=\sum F(S_i) \tag{2}$$

Among them, S_{w_i} represents the sentiment value of sentiment word Wi in a single sentence. The value of F(S) reflects the intensity of the public sentiment. If F(S)<0, the sentiment of the comment is judged to be negative sentiment. If F(S)=0, the comment sentiment is judged to be neutral sentiment. Similarly, if F(S)>0, it means that the public sentiment of this Weibo comment is positive.

We took six hours as the unified unit of time to calculate the cumulative negative sentiment ratio of Sina Weibo at each time point, and generated a comparison trend graph of users’ negative sentiment.

4. Empirical Analysis

4.1. Data collection and preprocessing

4.1.1. Data Collection

The comment data from Sina Weibo can directly get posters’ real expressions and feedbacks on corporate public opinion events. Therefore, Sina Weibo comment is an ideal sample data and used as data source in this paper.

Based on the advanced search function in Weibo, our work used “Pinduoduo Employee’s Sudden Death” and “Huolala Girl Jumps from the Car” as the search keywords. By using the webpage crawling technology, Weibo comments related to the Pinduoduo incident from January 3, 2021 to January 17, 2021, and comments related to the Huolala incident from February 21, 2021 to March 7, 2021 was collected respectively. The collected data includes poster ID, Weibo posting time, Weibo posting content, number of comments, commenter ID, comment content and comment time. We collected 13,798 pieces of comments about the Pinduoduo incident, and 13,427 pieces of comments about the Huolala incident.

4.1.2. Data Preprocessing

We cleaned the original data of Weibo content by manual. First, duplicate Weibo data was removed from the original data. Then, to remove the Sina Weibo data irrelevant content, such as Weibo pictures, links and incomplete entries. Finally, JIEBA toolkit in Python was used to segment the text content. In this process, it is necessary to

remove meaningless words, such as various symbols and stop words. Finally, 24,960 valid comments related to the online public opinion incident were obtained, of which 12,829 were related to the incident of "Pinduoduo Employee's Sudden Death" and 12,131 were related to the incident of "Huolala Girl Jumps from the Car".

4.2. Comparative analysis of public opinion evolution

4.2.1. Time series comparative analysis

Through the comparative analysis of the time-series graphs of the cumulative number of comments on the "Pinduoduo Employee's Sudden Death" incident and the "Huolala Girl Jumps from the Car" incident, the similarities and differences in the evolution of public opinion for these two incidents were obtained which shown in Fig. 2. In general, the heat of the two events gradually spread after a period of time, but there was a small change in the middle and late stages, and the latter entered a recession stage.

(1) The number of comments on Pinduoduo incident was large at the beginning and in the diffusion stage

The "Pinduoduo Employee's Sudden Death" incident had a large number of comments at the beginning. During the official response stage, the number of comments reached its peak. It entered the recession phase on the third day, and the transmission volume remained at a relatively low level. It was not until the official response on the eighth day, there was a relatively large fluctuation in the amount of data. Finally, with the passage of time, the number of Weibo gradually decreased.

(2) The number of comments in the early stage of the incident of Huolala was relatively small

The number of the incident of "Huolala Girl Jumps from the Car" stabilized within a relatively small range in the early stage. People did not pay much attention to this incident. From the third day, the number of the comments began to enter the diffusion stage. Soon after, the heat dissipated quickly and approached zero. Until the official website explained the rectification problem again, the number of the comments quickly rebounded and reached a small climax. Then the heat dissipated and entered a recession period.

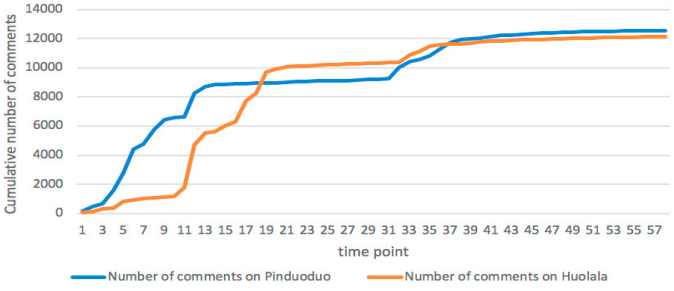


Fig. 2 Time trend of the cumulative number of comments

4.2.2. Comparative analysis of word cloud

(1) Pinduoduo's comments focus on the corporate institutions and labor law

As shown in Fig.3(a), the words that appeared frequently in the incident of "Pinduoduo Employee's Sudden Death" include "company", "overtime", "employee", "capitalist" and "work". It can be seen that sudden death of Pinduoduo employees has caused a series of discussions about labor laws. Many people were concerned about the working hours, so the "overtime" in the incident caused the public's dissatisfaction with the company.

(a)Pinduoduo (b) Huolala

Fig. 3 Word cloud

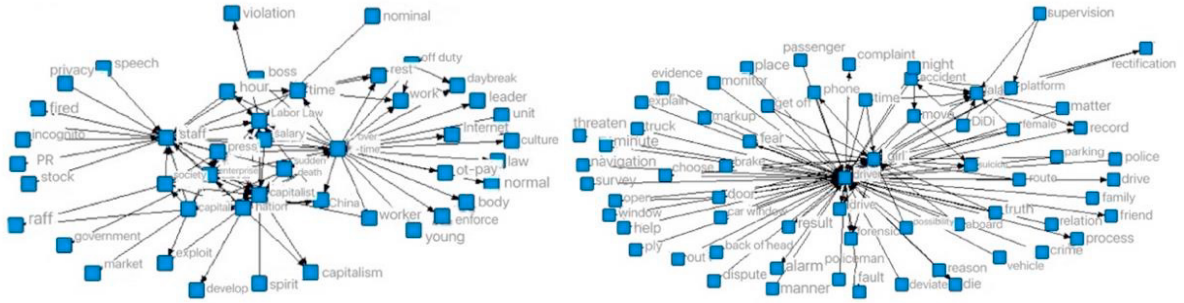
(2) Huolala's comments focus on the truth of the incident and rectification

As shown in Fig. 3(b), the words that appeared more frequently in the event of "Huolala Girl Jumps from the Car" include "driver", "girl", "platform", "DiDi" and "truth". It showed that people had a heated discussion on the event in the Huolala incident, hoping to see the truth of the incident, and at the same time expressing a strong vision for the platform to rectify. Both of the events had high frequency of "company". It can be found that when an emergency occurs, people would pay more attentions to the enterprise itself while surrounding the event itself.

4.3. Comparative Analysis of Semantic Networks

(1) The incident of "Pinduoduo Employee's Sudden Death" revolves around multiple important nodes

From Fig. 4(a), there were multiple central nodes in the semantic network of "Pinduoduo Employee's Sudden Death", among which the important nodes were "employee", "labor law" and "overtime". Similar to the focus of the word cloud, there were words such as "rest", "compulsory", "overtime pay", "body" and "young people" associated with "overtime", expressing people's concerns and disapproval of overtime. Negative sentiments such as "extraction", "exploitation", "workers" and "capitalism" associated with "capitalists" express people's dissatisfaction with companies and their condemnation of the current system. This shows that when commented on the Pinduoduo incident, people were concerned about the disadvantages of overtime work, expressed their dissatisfaction with Pinduoduo companies, and expressed their hope that government could regulate Internet companies.



(a)Pinduoduo (b) Huolala

Fig. 4 Semantic network diagram

(2) The incident of "Huolala Girl Jumps from the Car" revolves around two important nodes

From Fig. 4(b), the central nodes in the semantic network of "Huolala Girl Jumps from the Car" only had two event subjects, "driver" and "girl". Associated words were "suicide", "argument", "truth", "possibility", "deviation", "reason" and "threat". This showed that many people were concerned about the truth of the incident. At the same time, people was also actively guessing the possibility of jumping and participating in the discussion of the truth. The attitude towards "goods" and "platforms" was more about the hope of "rectification" and strengthening of "supervision".

From the comparisons of the two incidents, Weibo comments on the incident of "Pinduoduo Employee's Sudden Death" were less popular in the discussion of the incident itself. Most people discussed the disadvantages of overtime and condemned the imperfection of the corporate institutions through the sudden death of an employee. However, people was more concerned about the reason for the incident of "Huolala Girl Jumps from the Car". The comments basically revolved around the various possibilities of the car jumping. Some people were concerned about the rectification and supervision of the platform to prevent such incidents from happening again.

4.4. Comparative Analysis of Sentiment

By comparing the proportions of positive emotions, negative emotions and neutral emotions in the "Pinduoduo Employee's Sudden Death" and "Huolala Girl Jumps from the Car" incidents shown in Fig. 5, the negative emotions of the two events were higher than the positive emotions. Among them, the positive and negative emotions of the "Pinduoduo Employee's Sudden Death" are higher than those of the "Huolala Girl Jumps from the Car", while some people are neutral in the Huolala incident. As can be seen from Fig. 6:

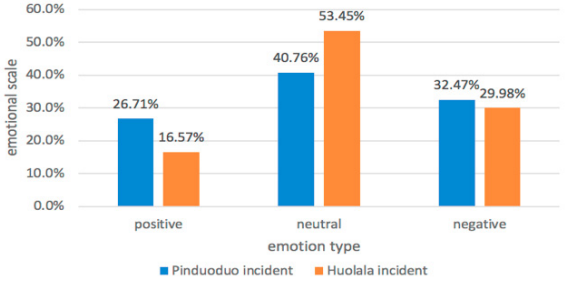


Fig. 5 Comparison of emotional proportions

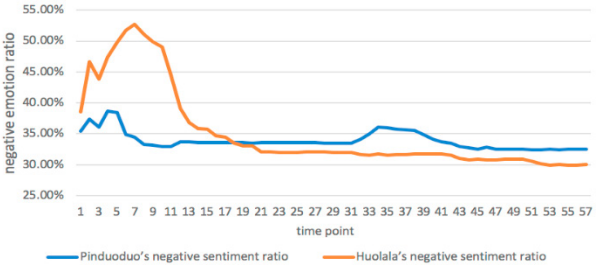


Fig. 6 Comparison of Negative Emotion Trends

(1) The negative sentiment trend of Pinduoduo is relatively stable, and the public sentiment hasn't changed much

Regarding the incident of "Pinduoduo Employee's Sudden Death", the highest percentage of netizens' negative emotions was 38.70%, which corresponds to the time after the official Weibo was released. The lowest percentage of netizens' negative emotions was 32.44%, which corresponds to the time when public opinion tends to stabilize. But the difference between the two figures was not large. There were two relatively high fluctuations in negative emotions during the evolution of public opinion throughout the incident, but as the heat dissipated and time passed, the negative emotions gradually stabilized without much fluctuation.

(2) The Huolala incident has several negative emotional ups and downs, and comments tend to be rational

At the very beginning of the incident of the "Huolala Girl Jumps from the Car", there was a high proportion of negative emotions, but after reaching the peak, the proportion of negative emotions dropped rapidly and eventually stabilized. During the incident, the highest percentage of negative emotions was 52.69%, and the lowest was 29.92%, which corresponded to the time before the company's second blog post and when the public opinion stabilized. The difference between the two values was very large.

Comparing the emotional trends in the two incidents, the differences were that the proportion of negative emotions in the two days before the "Huolala Girl Jumps from the Car" increased sharply. Then it dropped sharply after the official response. The proportion of negative emotions on Weibo in the "Pinduoduo Employee's Sudden Death" incident fluctuated twice. The first fluctuation was because Pinduoduo responded to the incident on its official Weibo account for the first time. And the other fluctuation was because Pinduoduo responded to another incident. This showed that the handling method of the cargo company is in place, and the change in the proportion of negative emotions was relatively smooth, and no unexpected negative effects have been caused again. We can see that in the early stage, the proportion of negative emotions in the incident of "Huolala Girl Jumps from the Car" was much higher than that in the incident of "Pinduoduo Employee's Sudden Death". But in the middle and late stages, the negative emotions of the "Huolala Girl Jumps from the Car" incident became even lower. This was closely related to the coping strategies of the two companies.

4.5 Comparison of public opinion strategies

The two enterprises are quite different in response time lag, response efficiency, coping strategies and aftermath management measures. Firstly, Huolala company responded in a timely manner by issuing a statement and apologizing for the incident. But Pinduoduo didn't respond in time during the golden processing time after the incident. Secondly, Pinduoduo responded only once in a while. Meanwhile, Huolala responded several times in a short period of time, which alleviated the negative impact. Thirdly, Pinduoduo issued a statement with a tough attitude and wanted to dump the blame on Zhihu.com. The company's attempt to shirk responsibility has drawn widespread public attention and condemnation of the company. Huolala had a sincere attitude, which had the

courage to admit mistakes and express apology. Through this series of strategies, the discussion has become more rational. Finally, Pinduoduo only issued one statement, and did not report the aftermath of the measures. Huolala issued the notice, attached with the progress of rectification, and launched new features for security protection.

5. Conclusion

In this paper, two incidents in 2021, "Pinduoduo Employee's Sudden Death" and "Huolala Girl Jumps from the Car" were selected to compare and analyze the public opinion dissemination process and corporate response strategies. The results showed that enterprises should guide online public opinion as soon as an emergency occurs. They should have the courage to admit mistakes and take responsibility, actively follow up on aftermath measures, and reduce the public's concerns about enterprise security issues. This study puts forward corresponding strategies for enterprises to effectively respond to the crisis of network public opinion. However, there are still limitations in this research, data from other social platforms for further analysis will be collected in the future to compare and analyze.

Acknowledgements

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