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THE RESEARCH ON MONITORING AND WARNING METHOD OF NETWORK PUBLIC OPINION

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Abstract. *On basis of existing research, this paper considers the concept of network public opinion, reviews its characteristics and factors, summarizes the related studies of index system, as well as some monitor models. Then the index system of this paper was designed. Meanwhile, we apply AHP and use Matlab7.0 to measure weight of each index. Afterwards, we employ the three valuation models and control chart theory, combining with specific heated network events, to monitor the network opinion, verifying the applicability measurability and effectiveness of the method we proposed.*
Keywords: Network public opinion, Index system, Monitor, Coping strategies

1. **Introduction.** Exposed to the complex and polytropical modern society, many social contradictions are increasingly emerging; regardless of public or personal events, all can bring about heated public opinion on the Internet. In addition, the ubiquitous media environment exerts influence on the information interaction, where anonymity and liquidity of network blend all kinds of good or bad information. So if we cannot effectively control or give correct guidance to the bad public opinion, it may cause worse offline mass incidents, damage our economy and superstructure. Therefore, it is essential to monitor the dynamic public opinion in the current complex network environment. However, many researches were still in theoretical level, lacking quantifiable and operational methods. Thus, this study engaged in building a measurable index system, coupled with AHP, to measure weights of indexes. Subsequently, in combination with 15 heated online events, we employed three valuation models and control chart theory to identify those events which need to be alert, developing corresponding strategies to quiet down the bad public opinion, making for its benign development. Our study fills the existing lack of empirical application, which allows the real-time monitoring and early warning for specific events.

2. **Problem Statement and Preliminaries.** Considering the concept of network public opinion, in the work [1], network public opinion was a combination of emotions, attitudes, opinions, expressed through Internet; it summarized its characteristics, including freedom and controllability, interactive and real-time, richness and diversity, secrecy and explicitness, individual and group polarization. The work [2] emphasized that network opinion was triggered by events, demonstrating features of being content intricate, opinion interactive, emotion infectious and overall controllable. Comparing with the traditional public opinion, network opinion's subjects are more disperse; the formation process is faster; content is more fruitful and more direct response to events. Additionally, noise released can disturb the normal dissemination of opinion, adversely influence the spread of real information. On account of the harmful impact negative public opinion may bring, many scholars studied the influential factors analyzing from different perspectives. The work [3] highlighted the force of media during the Britain election. While work [4] thought

that negative opinion the elites released can reduce public support for Europe, emphasizing opinion leaders' influence. Scholars further explored various monitoring and warning mechanisms. The work [5] investigated the usage of Twitter under crisis events, proved its help to crisis management. While work [6] proposed a method called SABIR, which can classify the posts as positive or negative, can locate those negative posts to analyze the influence. Generally, emergency network opinion has no regularity, it spreads quickly and may trigger group irrational, even may cause undue offline public behaviors. Hence, we aimed to achieving dynamic real-time monitoring and warning of online opinion, coupled with empirical analysis, offering a theoretical and practical basis for government crisis management.

3. Establishment of Index System.

3.1. **Index design principles.** The index system presented is usually applied to quantifying network opinion. The work [7] mentioned that building index system should abide by measurability, reliability, orientation, integrity and dynamic, etc. In addition, constructing index system should be more detailed and complete.

3.2. **The index system.** We build a three-level index system, consisting of target layer, criterion layer and index layer, which can be seen in Figure 1.

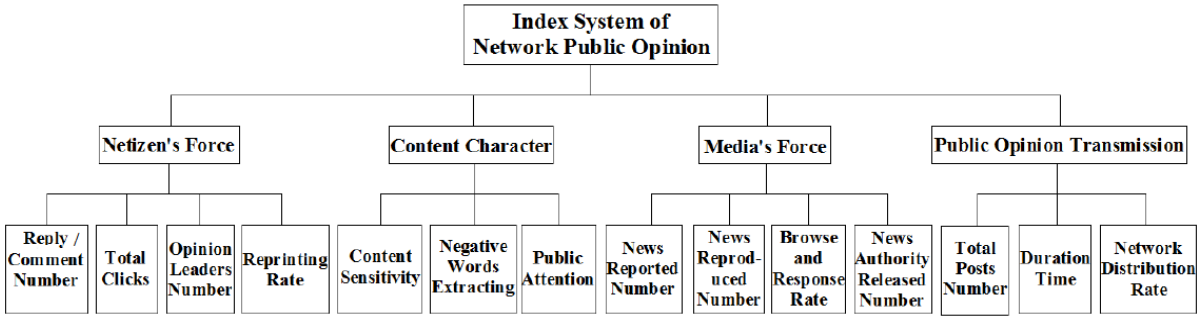

FIGURE 1. Index system

3.3. **Index description.** Through learning and analysis of related literature at home and abroad, incorporating expert opinion, combination with public opinion work guidance that our President Xi Jinping proposed, we attained the indexes of public opinion. Drawing from I-space model and monitoring index system proposed in [9], we developed the above index system (seen in Figure 1), the detailed description shown in Table 1.

3.4. **Index weights calculation.** This paper applied AHP, designed the questionnaire, and invited 35 experts to compare the relative importance of the indexes. Then, this study disposed the questionnaire, utilized matlab7.0 to test, ultimately obtained the weights and CR values, which conformed to the consistency check. This method is convenient and efficient, which has high reliability and credibility. Judgment matrix can be seen as follows, while the weights shown in Table 1.

3.4.1. *Criterion layer of judgment matrix.*

$$G = \begin{pmatrix} 1, 0.9522, 0.9936, 2.5527 \\ 1.0502, 1, 1.4738, 2.4151 \\ 1.0064, 0.6785, 1, 2.5363 \\ 0.3917, 0.414, 0.3943, 1 \end{pmatrix}$$

Table 1. Index description

Goal	1st-level	2nd-level	Explanation	Weight
G	A: Netizen's Force (0.2897)	A1: Reply/comment	Measure netizens' participation [8,9]	0.0736
		A2: Total clicks	Mirror the heat of events [8,9]	0.0721
		A3: Opinion leaders	Person who influences others' opinions [10]	0.0574
		A4: Reprinting rate	Measure citizens' contribution to the propagation of public opinion [8,9]	0.0866
	B: Content Character (0.3252)	B1: Content sensitivity	Key words emerged in web news [9]	0.1755
		B2: Negative words extracting	Describe citizens' negative emotions to the events [9]	0.0881
		B3: Public attention	Total visiting people, high attention needs our care and monitoring [9]	0.0616
	C: Media Force (0.2680)	C1: News reported	News original media reported [11]	0.0689
		C2: News reproduced	Non-original media reproduce news, promoting dissemination [8,9,11,12]	0.0974
		C3: Browse and response rate	Mirror media's influence on citizens' participation [8]	0.0501
		C4: News authority released	The topic official media participation [12]	0.0576
	D: Public Opinion Transmission (0.1171)	D1: Total posts	Reveal dissemination intensity [13]	0.029
		D2: Duration time	Network opinion influential temporal [12]	0.0559
		D3: Network distribution rate	Distribution range and intensity of Internet users [9]	0.0322

3.4.2. *Index layer judgment matrix.*

(1) Judgment matrix of specific indexes on Netizen's Force.

$$A = \begin{pmatrix} 1, 1.3161, 1.0656, 0.7865 \\ 0.7598, 1, 1.2806, 1.0428 \\ 0.9385, 0.7809, 1, 0.5686 \\ 1.2715, 0.959, 1.7586, 1 \end{pmatrix}$$

(2) Judgment matrix of specific indexes on Content Character.

$$B = \begin{pmatrix} 1, 2.0536, 2.7617 \\ 0.487, 1, 1.4738 \\ 0.3621, 0.6785, 1 \end{pmatrix}$$

(3) Judgment matrix of specific indexes on Media's Force.

$$C = \begin{pmatrix} 1, 0.7759, 1.3449, 1.2443 \\ 1.2888, 1, 1.9396, 2.0668 \\ 0.7436, 0.5156, 1, 0.9522 \\ 0.8037, 0.4838, 1.0502, 1 \end{pmatrix}$$

(4) Judgment matrix of specific indexes on Public Opinion Transmission.

$$D = \begin{pmatrix} 1, 0.5192, 0.8994 \\ 1.9259, 1, 1.7332 \\ 1.1119, 0.577, 1 \end{pmatrix}$$

4. Empirical Analysis and Early Warning Mechanism.

4.1. **Application of index system to measure public opinion.** We select 15 heated events on the Internet, quantifying each index of every event; data are mainly collected from weibo which has wide users. The monitoring time ranges from April 24, 2016, 0 clock to May 3, 2016, 0 clock. Then we normalize these index data, and calculate the public opinion value of each event, as shown in Table 2.

TABLE 2. Network public opinion value

Network public opinion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value x_i	0.485	0.544	0.176	0.286	0.419	0.574	0.265	0.238	0.446	0.295	0.234	0.268	0.323	0.208	0.485

4.2. **Three valuation models.** This model assumes that uncertainty variables obey a certain probability distribution, but unable to determine the distribution function; however, we can estimate the maximum value, the mean value and the minimum value. Thus, we count mathematical expectation and variance from the above three values. Assuming that x is an uncertainty variable, based on the network opinion value of 15 events, we estimate the following three numbers (1)-(3). Then we estimate (4)-(5), and equations are as follows.

$$a = \min x \tag{1}$$

$$m = \overline{x} \tag{2}$$

$$b = \max x \tag{3}$$

$$\mu = \frac{a + 4m + b}{6} \tag{4}$$

$$\sigma^2 = \left(\frac{b - a}{6}\right)^2 \tag{5}$$

The above are the well known three valuation models. This method helps us select events which need further analysis and attention. Therefore, we calculated μ and σ:

$$\mu = 0.35823 \qquad \sigma = 0.0044$$

We select events from the above 15 events, whose public opinion values outweigh the mean value μ, that is: event 6, 2, 15, 1, 9, 5.

4.3. **Control chart theory.** It is an effective way to evaluate network public opinion, also called X-control chart. It does not need to group the values; instead, we can use them directly. Given this theory, we choose "reply/comment number" index from the index system, to analyze the public opinion (other indexes are processed in the same way). We take "event 2 – Changzhou poison land" for example.

4.3.1. *Control chart theory.*

(1) Build control chart. We pick up n values, $(x_1, x_2, \ldots, x_n)$, and calculate (6)-(7). Then we count values of (8)-(10).

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{6}$$

$$S = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2} \tag{7}$$

$$UCL = \overline{x} + 3S \tag{8}$$

$$CL = \overline{x} \tag{9}$$

$$LCL = \overline{x} - 3S \tag{10}$$

(2) Analyze and judge control chart.

4.3.2. *Real-time monitoring and warning analysis.*

(1) Monitor chart. We monitor the alternation of comment numbers, take 8 hours as an interval, from April 26, 0 clock to May 5, 0 clock, a total of 27 time slots. Then we use matlab7.0 to describe its control chart (seen in Figure 2). Based on the theory, we get:

$$\overline{x} = 1215; S = 3453.15; UCL = 11574.45; CL = 1215; LCL = -9144.45$$

(2) Comprehensive analysis. We take "reply/comment number" as example to sketch the control chart by matlab7.0, which demonstrates that all time intervals are in control. The other indexes are processed in the same way as how "reply/comment number" disposed. If indexes suggest that the event is out of control, it is time for us to make warning and further analysis.

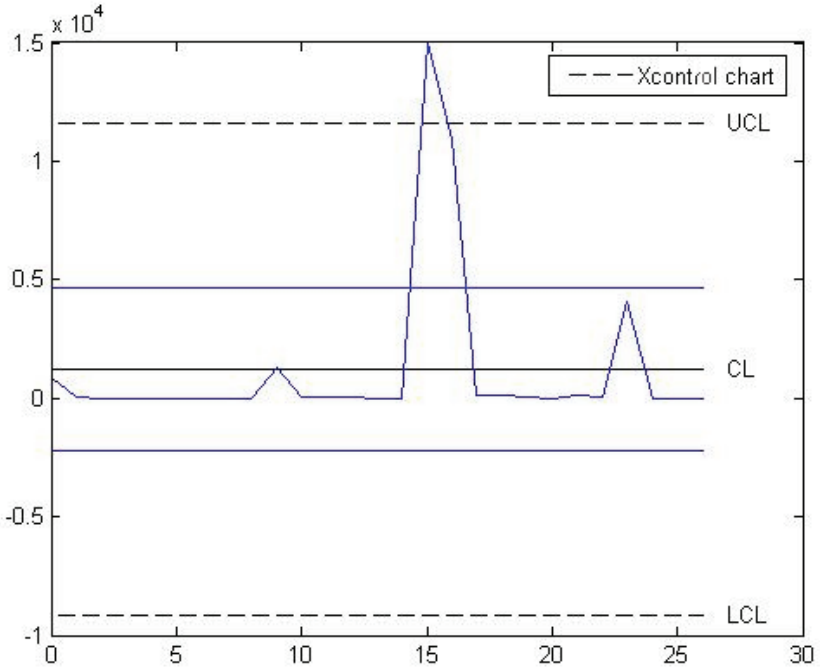

FIGURE 2. Monitoring chart of comment number index

4.4. **Coping strategies.** Hot public opinion often embodies people's attention. Therefore, guidance at the key period of time is vital for the benign development of public opinion. However, in recent years, lacking of timely response to the sudden network opinion happens occasionally. Additionally, the study [14] mentioned that uncertainty information has a very strong restraint on the sudden crisis, which always traps the government and society easily in passive abnormal situation. Actually, just as what our president said, we should know that the boost of topic and solutions is the real "guidance". This paper mainly focuses on dynamic monitoring of the sensitive events, then taking action mainly from the aspect of government, social media, opinion leaders, and related department. For example, to cope with sudden public opinion, the mainstream media should strengthen the release of related facts; authorities should send the investigation team to investigate the truth without delay; additionally, media should issue timely the evolvement of events, to respond to social concern.

We will draw up related control charts to monitor and make some suggestions if needed for reference, give early warning and insert human intervention to boost the well development of topic and develop effective solutions to calm it down and avoid its resurgence.

5. **Conclusion.** The purpose of our study is to establish functional index system and monitoring model. Before the occurrence of offline behaviors, we engage in dynamic monitoring of network public opinion. Judging from their controllable or not, we devised different strategies to guide its orderly development. This paper focuses on probing the public opinion monitors method which is practical and feasible. In the future, we will devote to developing a real-time monitoring and warning system, where we build a monitoring network of public opinion, to make comprehensive analysis of the heated events, avoiding the comeback of the bad public opinion. Then we draw up strategies on account of these events' developing rules, to induct rational development of network opinion.

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