

# Research on the Severity Assessment of Unexpected Events Based on the Web Information

Cai Huali\*, Wu Fang, Jiang Yawei, Duan Qi, Kang Jian

Quality Management Branch, China National Institute of Standardization, Beijing, China  
(\*chl2081@126.com)

*Abstract*— A method of assessing the severity of unexpected events was proposed. The assessment indexes included five aspects, such as media coverage, degree of public concern, influence sphere, influenced groups and consequence of event. And then the assessment method and representation for the assessment was given.

*Key words:* web information, severity assessment, unexpected event

## I. INTRODUCTION

In recent years, unexpected events have frequently occurred in the world. The information volume disclosed by Internet media has witnessed an exponential growth upon the occurrence of such events. And the content and volume of web-based information has tended to change differently as these events evolved. By mining web information [1][2], we are able to promptly measure the status of these events [3] in a quantitative manner and provide a significant support for management of emergency response to unexpected events.

This paper will elaborate the severity assessment of unexpected events from the perspectives of selection and quantification of assessment indexes, severity grading and representation methods.

## II. SELECTION AND QUANTIFICATION OF ASSESSMENT INDEXES

Media coverage, degree of public concern, influence sphere, influenced groups and consequence of events were considered in this paper to determine the severity of a news event.

### A. Media Coverage

Media coverage is the sum of comprehensive portal coverage and professional website coverage. Media coverage reflects the concern of media on a specific news event and the severity of the event to some extent. The wider the media coverage is, the more severe the event will be likely to become and vice versa.

Quantification of media coverage: news events are classified into five grades according to the number of news captured by the system from comprehensive portals and professional websites: less than 100, count 1; 100-250, count 2; 250-400, count 3; 400-550, count 4; above 550, count 5.

### B. Degree of Public Concern

Degree of public concern is the sum of number of forums, number of micro-blogs, number of web chats and number of blogs. Degree of public concern reflects the attitudes of the public towards a specific new event and the severity of the event to some extent. The higher the degree of public concern is, the more severe the event will be likely to become; and vice versa.

Quantification of degree of public concern: similar to media coverage, news events are classified into five grades according to the number of news captured by the system from forums, micro blogs and blogs: less than 200, count 1; 200-400, count 2; 400-600, count 3; 600-800, count 4; above 800, count 5.

### C. Influence Sphere

Influence sphere is the largest administrative division influenced by a specific news event. If not only one province (autonomous region or municipality under the central government of China) is influenced by a specific news event, a special committee shall be set up by the State to deploy and guide the following tasks. If one province (autonomous region or municipality directly under the central government of China) is influenced, the government at the provincial level shall offer emergency control and treatment, and so on. The sphere of influence determines what level of government will lead and deploy the further tasks and reflect the severity of such event to some degree. The wider the influence sphere is, the more severe the event will be like to become; and vice versa.

Quantification of media coverage: if the influence sphere is limited to one county, count 1; more than one county but within the same municipality, count 2; more than one municipality but within the same province, count 3; more than one province, count 4; and other country or countries, count 5.

### D. Influenced Groups

Influenced groups: victims or potential victims influenced by a specific news event. Influenced groups may be divided into common groups and disadvantaged groups. Disadvantaged groups may be further sub-divided into infants, children, the elderly, and the disabled and other disadvantaged groups. If disadvantaged groups are influenced by an event, the event would easily bring about concerns and debates from the media and the public and evoke anger, dissatisfaction, worry, other extreme emotions or even some irrational behaviors. If relevant

authorities fail to take some effective action in time, some severe consequence may possibly be triggered. It can be seen that influenced groups reflect the severity of an accident to some extent. If disadvantaged groups are influenced by an accident, the more severe the accident will tend to be and if common groups are influenced, the less severe the accident will tend to become.

Quantification of influenced groups: if only part of the common groups is influenced, count 1; if only most ordinary people are influenced, count 2; if other disadvantaged groups except infants, children and the pregnant are influenced, count 3; if infants, children and the pregnant are influenced, count 4; and if both common and disadvantaged groups are influenced, count 5.

### E. Consequence of Event

Consequence of event: consequence caused by an event. If casualties are concerned in a specific event, the more severe the event will be; and if the negative consequence of the event is controlled during the stage of potential hazard, the less severe the event will be.

Quantification of consequence of event: if the consequence of an event is controlled during the stage of potential hazard and no actual loss is incurred, count 1; if the accident has occurred and caused no other losses, count 2; if the accident has caused injury to any person or affected its safety, count 3; if the accident has injured less than 5 persons, count 4; and if the accident has injured 5 or more persons or even caused human death, count 5.

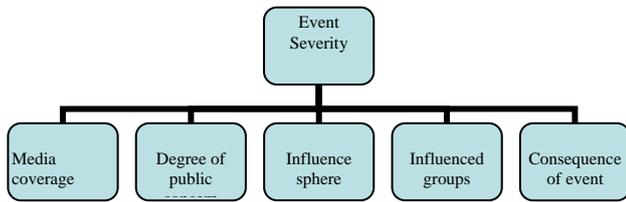


Fig. 1 Event Severity Assessment Index System

### III. METHOD FOR ASSESSMENT OF EVENT SEVERITY

According to their severity, events can be divided into five degrees: extremely severe [Grade 5], severe [Grade 4], major [Grade 3], common [Grade 2] and minor [Grade 1].

#### A. Quantification and Normalization of Indexes

Assessment indexes of event severity were marked as follows: media coverage,  $X_1$ ; degree of public concern,  $X_2$ ; influence sphere,  $X_3$ ; influenced groups,  $X_4$ ; and consequence of event,  $X_5$ . The score obtained in event severity assessment was marked as  $F$ . See Part I for quantification of all indexes above.

#### B. Determination of Index Weight by Hierarchy Analysis

##### (1) Constructing a judgment matrix

The judgment matrix was obtained as follows through analysis and discussion on the indicators for event severity selected:

$$\begin{bmatrix} 1 & 2 & 3 & 3 & 1/3 \\ 1/2 & 1 & 2 & 2 & 1/5 \\ 1/3 & 1/2 & 1 & 1 & 1/7 \\ 1/3 & 1/2 & 1 & 1 & 1/7 \\ 3 & 5 & 7 & 7 & 1 \end{bmatrix}$$

- (2) The characteristic values and characteristic vectors of the judgment vector were calculated by matlab, without output result of  $\lambda_{\max} = 5.0232$ .

Normalized characteristic vectors:

$$M_1 = (0.3445 \quad 0.2009 \quad 0.1139 \quad 0.1139 \quad 0.9028)$$

The weight of each index was obtained after the characteristic vector was normalized to make the sum of all elements 1:

$$M = (0.2055 \quad 0.1199 \quad 0.068 \quad 0.068 \quad 0.5386)$$

- (3) Consistency check

Consistency index:

$$C.I = \frac{(\lambda_{\max} - n)}{n - 1} = \frac{(5.0232 - 5)}{4} = 0.006$$

It was known by table lookup that the average random consistency index was  $R.I = 1.36$  and the consistency ratio was  $C.R = C.I / R.I = 0.006 / 1.36 = 0.004 < 0.1$ .

When  $C.R \leq 0.1$ , the adjustment matrix is accepted.

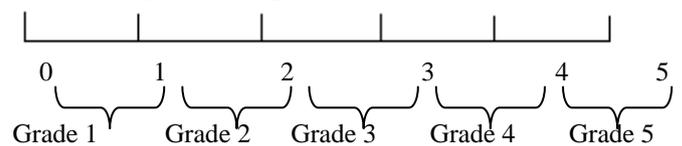
Notes: different judgment matrixes mean different index weights. The initial assigned value for judgment matrix was given, based on which weight calculation was conducted. In the following tasks, the judgment may be modified according to experts' comments so as to obtain more suitable index weights.

#### C. Calculation of Event Severity Score

According to each index weight,  $M$ , obtained in Step (2) above, the event severity score,  $F$ , was calculated through weighting and summarization:

$$M = (0.2055 \quad 0.1199 \quad 0.068 \quad 0.068 \quad 0.5386)$$

$$F = 0.2055X_1 + 0.1199X_2 + 0.068X_3 + 0.068X_4 + 0.5386X_5$$



### IV. SEVERITY REPRESENTATION METHOD

Event severity needs to be represented in a simple and clear way. Two represented methods were provided in this paper as follows.

A. *Star Representation: The more the stars are, the more severe the event represented will be.*

- Five stars [★★★★★]: Extremely severe event [Grade 5];
- Four stars [★★★★☆]: Severe event [Grade 4];
- Three stars [★★★☆☆]: Major event [Grade 3];
- Two stars [★★☆☆☆]: Common event [Grade 2];
- One star [★☆☆☆☆]: Minor event [Grade 1].

B. *Color Representation: The darker the color is, the more severe the event represented will be.*

- Red color warning ●: Extremely severe event [Grade 5];
- Orange color warning ●: Severe event [Grade 4];
- Yellow color warning ●: Major event [Grade 3];
- Blue color warning ●: Common event [Grade 2];
- Green color warning ●: Minor event [Grade 1].

#### V. APPLICATION

Through using the method ,we evaluate several events in China such as follows.

NO.	Event	Event Severity
1	toxic school uniform in Shanghai	★★★★★
2	child death caused by washing machines	★★★★★
3	furniture formaldehyde exceed	★★★☆☆
4	child hurt by toy	★★☆☆☆

#### VI. ACKNOWLEDGMENT

This work was funded by the Dean fund project of China National Institute of Standardization under grant No. 552014G-3437,

the National Key Technology R&D Program of the Ministry of Science and Technology under grant No. 2015BAK46B02 and 2015BAK46B03-3.

#### REFERENCES

- [1]. CAO Xue-yan, etc. Research on internet public opinion heat based on the response level of emergencies [J]. Chinese journal of management science. 2014, 3 [22], pp.82-89
- [2]. Zhang Yiwen, etc. Research on the Index System of Public Opinion on Internet for Abnormal Emergency [J].Journal of intelligence, 2010, 11 [29] pp. 71-75
- [3]. You Weijia, etc. Comparison of Web channels for unconventional emergency events information dissemination [J]. Journal of management sciences in China, 2014, 2 [17], pp. 19-32.