The Evaluation Index System of Information Value

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Abstract. Information spreads quickly in today's tech-connected communication network. As we all know, the way to spread information changes greatly. The flow of information has never been as easy or wide-ranging as it is today. The paper takes a historical perspective of the flow of information which relative to inherent value of information to evaluate how information changes public and opinions. We develop information value evaluation index system to evaluate the value of information, which contains two indicators. One is the value of information content, another is the quality of information's editorship. The larger the value that information contains, the bigger the possibility that information could affect public mind. The paper simulates model with 3 actual events to validate its feasibility.

Introduction

Nowadays, the tech-connected social network is becoming universally since the popularity and interactivity offered by the Internet and World Wide Web, leading to the information spreads more quickly than ever before. Every day we are informed of enormous information which are useful, helpful, crucial or fake. It's no longer the days when people were almost sealed themselves in the small village.

The mass media are going through a dramatic change and development, which not only shows up in its mode of transmission, but also changes public mode of thinking. The progress of this change can be sketched by the following picture.

Figure 1. The changes of mass media over time

Theories of mass communication have changed dramatically since the early 1900s, largely as a result of quickly changing technology and more sophisticated academic theories and research methods. In this era of information explosion, it needs to be cleared that information is not equal to news. The fast spread of information sometimes is on account of the inherent value of the information itself. Besides, the specific way of spreading, such as special groups of population, also contributes to the high flow of information through social media. With such easy way to spread the message but without much consideration to the importance level of information, it becomes to be our tasks to think more about the relationship between flow of information and the inherent value information.

Literature Review

In the end of the 1950s, Erdős and Rényi created the famous ER random-network model [1]. In 1998, Watts and Strongatz proposed the WS small world network which improved from completely regular network to completely stochastic network [2]. In 1999, Newman and Watts structured the

small world network of randomization [3]. Barabasi and Albert published an article which put forward BA scale-free network model [4].

In 1927, Kermack and Anderson created an epidemic model in which they considered a fixed population with only three compartments, susceptible, infected and removed, which is the SIR model [5]. Then, the SIR model was developed to many extensions, the SIR models with births and deaths, the SEIR model with latent phase considered, the MSIR model considering babies born with a passive immunity from their mother [6]. In 2013, Ruzhi Xu et al structured S-SEIR to study the value of the dissemination of information itself and the user behavior on the influence of information dissemination [7]. In 1999, Alexander. J. E. and Tate. M. A studied how to evaluate and create information quality on the web [8]. In 2000, Martin. J. Eppler reviewed information quality frameworks from the past ten years [9].

Information Value Evaluation Index System

Establishment of Model. In today's society, information as a strategic resource and factor of production is gradually becoming the basic of social functioning, the lifeline of enterprise development and the footstone for managers from various business to make decisions. How to evaluate information value, make use of information reasonably and effectively has become hot spots and focus in the field of the modern information science. People always change their interests and opinions easily under the edification of mainstream ideology. This paper defines the information as the criterion of the degree of how information changes public interests and opinions and puts forward information value evaluation index system and determines the weight of each index by analytic hierarchy process and builds the fuzzy synthetic evaluation model of information value. The larger the value that information contains, the bigger the possibility that information could affect public mind. We consider from two aspects to represent the value of information. One is the value of information content which shows the inherent value of the event itself. It is a key attribute of information value. We choose 7 indexes to depict it, respectively are, significance, timeliness, accuracy, integrity, foreseeability, necessity and novelty. Another is the situation of writing information. The quality of writing information will directly affect information value. The writing of the information quality including 5 indicators: the clarity of the subject, preciseness of thinking, accuracy of words, expression of simplicity, elements of the comprehensive. The paper expresses the degree of these indicators in numerical as Table 1.

Table 1 The information value of comprehensive evaluation index and its weights

First class indicator	Second class indicator	Index weight
The value of information content	Significance	0.15
	Timeliness	0.2
	Accuracy	0.1
	Integrity	0.1
	Foreseeability	0.1
	Necessity	0.15
	Novelty	0.2
The quality of the information writing	The clarity of the subject	0.203
	Preciseness of thinking	0.063
	Accuracy of words,	0.299
	Expression of simplicity	0.232
	Elements of the comprehensive	0.203

To simplify the description, the paper denotes first class evaluation index as

$U = \{u_1, u_2\}$, u_1 and u_2 represent the value and the quality of the information respectively. U_1 represents the set of 7 indicators of information content value and U_2 represents 5 indicators of information writing's quality. Evaluation sets is denoted as $V = \{v_1, v_2, v_3, v_4, v_5\}$, which represents different meaning of evaluations. Evaluate every factors of U_1 and U_2 , then we have fuzzy mapping f_1, f_2 , from U_1, U_2 to V and induce fuzzy relation

$$R_i \in F(U_i \times V), \quad i=1,2 \quad (1)$$

In reality, generally it is panelists who evaluate these indicators of the information value, and then structure evaluation vectors of each indicator and fuzzy matrix according to the result of evaluation. For example, the vertex of i indicator of U_2 is $(r_{i1}, r_{i2}, r_{i3}, r_{i4}, r_{i5}) (i=1,2,3,4,5)$, then fuzzy matrix of the corresponding indicator U_2 is

$$R_2 = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{15} \\ r_{21} & r_{22} & \cdots & r_{25} \\ \vdots & \vdots & & \vdots \\ r_{51} & r_{52} & \cdots & r_{55} \end{bmatrix} \quad (2)$$

$$\text{Where } r_{ij} = \frac{\text{number of people give level } j}{\text{total number of sprcialist}} (i=1,2,\dots,5, j=1,2,\dots,5) \quad (3)$$

The evaluation vector of the first class factor of information value respectively are

$$V_1 = W_1 R_1 = (v_{a1}, v_{a2}, \dots, v_{a5}) \quad (4)$$

$$V_2 = W_2 R_2 = (v_{b1}, v_{b2}, \dots, v_{b5}) \quad (5)$$

Hence, the evaluation vector of information value can be further available.

$$C = W \begin{Bmatrix} V_1 \\ V_2 \end{Bmatrix} = (v_{e1}, v_{e2}, \dots, v_{e5}) \quad (6)$$

The larger the value of v_{ei} is, the larger value of information i possesses, so people are more likely to change their interest and opinion after receiving the information.

Simulation with Actual Information

Assume that a newspaper office received three messages:

A: Oct 12, 2015, Tianjin Binhai New Area Explosion,

B: June 1st, 2015, "Orient Star" sank,

C: June, 2015, China stock market crash.

The paper does fuzzy assessment to this information by simulating the evaluation from 12 specialists in the computer. The result is presented in Table 2.

Table 2 Grade of each class's evaluation

	V_{c1}	V_{c2}	V_{c3}	V_{c4}	V_{c5}
A	0.027	0.13	0.482	0.295	0.066
B	0.367	0.521	0.112	0	0
C	0.758	0.238	0.004	0	0

So, according to Table 2, we can see information C has great value, the value of information A has lower value, and information B has the lowest value. Information C is strong in importance, accuracy and necessity which is regard as the information with very large value. Information A has both advantages and disadvantages in different index. The grade of all sub-index to higher rank evaluation of information B is not large, so it is the information with no much value. Therefore, information C has great influence on public opinion and decision. Actually, the result is consistent with reality.

Conclusion

By modeling and simulating with actual information, the paper demonstrates the evaluation index system of information value is correct. However, there are also some weakness. The paper simplifies the discussion about how information influence public opinion, taking Information value as the only criterion for evaluation. Results of the study may help explore the evaluation of information network in the study area and other regions.

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