A Intelligent Evaluation Model Framework of Online Public Opinion Crisis in Higher Vocational Colleges

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Abstract. Higher vocational colleges should establish a real-time online public opinion monitoring mechanism. Before deterioration trend occurs, take relevant measures to relieve and guide. The current ability to deal with online public opinion crisis needs to improve. This paper puts forward the principle of the warning index system of the online public in higher vocational colleges, designs a new evaluation index system, builds the intelligent evaluation model framework based on AHP, fuzzy evaluation method and BP neural network which can effectively learn the knowledge and experience of evaluation experts. This model framework can make full use of available data in the big data environment and reduce manpower.

1. Introduction
With the rapid development of the Internet and the widespread popularity of computers, expressing opinions and expressing emotions through the Internet is becoming an important channel. Higher vocational college students are eager to express themselves to the world. However, because students do not really have access to society, their ability to identify information is weak, they are more likely to be deceived and become promoters of false information. Some events can lead to parades, rallies, and even violence. These bring hidden danger to the normal development of colleges. Therefore, it is necessary to monitor online public opinion in order to achieve the purpose of early intervention and diversification.

At home and abroad, some studies have noted similar problems. Nan F et al. [1] analyzed the new characteristics and the sentiment of Weibo by using the improved Single-Pass algorithm and UML language. Tang J et al. [2] gave a review on the fuzzy set method in granular computing based online public opinion from the big data perspective, which including online public opinion warning, online public opinion threat estimation, online public opinion communication and online public opinion evolution. Liu Z et al. [3] researched a novel clustering algorithm based on the time factor and dynamic adjustment. Ravi K et al. [4] gave a review on opinion mining and sentiment analysis. The methods of sentiment analysis and data acquisition are systematically summarized. This survey is organized on the basis of sub-tasks to be performed, machine learning and natural language processing techniques. Due to the wide range, great influence and fast speed of online public opinion, researchers can use natural language processing, data mining, machine learning and other methods to automate analysis and improve the frequency. However, complexity of the information in the network forum, the large amount of data, the fast spread speed and the wide range, are some factors that contribute to challenges in the monitoring of the online public opinion [5]. According to the characteristics of the dynamic expansion of unexpected events and the interactive nature of public sentiment, from the
perspectives of the cause, development and outcome of public sentiment, Wang T et al. [6] constructed the index system of the online public opinion. Mei Y et al. [7] proposed a method to grade crisis levels by combining the Analytic Hierarchy Process and a fuzzy environment with triangular fuzzy sets. Liu et al. [8] proposed a super-internet model for online opinion prediction and governance. Another prediction model was built based on the grey system theory and the fuzzy neural internet [9].

Summarizing the above works, we can find that most research is based on mass media, such as Weibo, Blog and BBS. Out of these, we should give full consideration to the campus media and new media, such as: campus websites, school Weibo, campus APP, Wechat, QQ and other online platforms. In these media, there is a lot of data or statistical indicators that we can use directly. In addition, the conventional public opinion judgment is carried out manually, which needs a lot of manpower.

In the big data environment, we should study new evaluation index system, and establish intelligent evaluation model, which can make full use of available data and replace manual judgment.

2. Warning Evaluation Index System of Online Public Opinion Crisis

First of all, we should determine the construction principle of the evaluation index system, and then construct a scientific and reasonable index system.

2.1. Construction Principle of Warning Evaluation Index System

The purpose of the index system is to warn online public opinion crisis. Therefore, the establishment of the index should reflect the characteristics of the colleges and the characteristics of the network information dissemination. Data should be relatively easy to obtain, also take into account its economy. The index system should have clear levels and reasonable structure design. One of the most important is that we should make full use of existing big data and statistical indicators.

2.2. Construction of Warning Evaluation Index System

Based on the above principles, constructs a warning index system of online public opinion crisis, which is shown in Table 1.

| Table 1. Warning evaluation index system |
|-----------------------------------------|
| Fist-level                              |
| Publisher influence                     |
| Influence degree                        |
| Credibility                             |
| Sensitivity                             |
| Amount of forwarding                    |
| Development degree                      |
| Number of approvals                     |
| Search volume                           |
| Guidance ratio                          |
| Control degree                          |
| Behavioral tendencies                   |

We can construct a warning index system of online public opinion crisis which includes three first-level indexes and eight second-level indexes. The design of the index system achieves the maximum early warning effect with the minimum number of indexes, and mainly focuses on quantitative indexes, which is easy to collect, process and calculate automatically.

2.3. The Meaning of Each Index and Data

The following is an explanation of each index:
- Publisher influence. Different publishers have different influence. The influence of publishers is directly related to the scope and speed of online public opinion dissemination. The index data is based on the number of publishers’ fans.
- Credibility. Refers to the authenticity of online public opinion events. Real-name users need to be responsible for their own statements, so the information released by real-name authenticated users has high credibility. The index data can take the proportion of real-name authenticated users.
- Sensitivity. The degree of sensitive topics can be used to measure the possible development of online public opinion. The higher the sensitivity, the longer the public opinion event lasts, the higher the possibility of online public opinion crisis. This index can be used to describe the level of sensitivity from 1 to 9, with the lowest sensitivity being 1 and the highest being 9. We can realize automatic judgment through a comparison table.
- Amount of forwarding. Refers to the number of times that information is forwarded by other students. The larger the amount of forwarding, the wider the scope of information dissemination, and the deeper the impact. The index data is based on the forwarding amount of all platforms.
- Number of Approvals. Refers to the total number of students’ support for relevant comments. The larger the number, the greater the likelihood that the crisis of online public opinion will occur. This index data mainly counts the total number of approval.
- Search volume. Search volume objectively reflects the interests and requirements of students. Relevant statistical data can be obtained in search engine.
- Guidance ratio. The ratio of colleges opinion leaders to participate in topic discussion. The higher the degree of participation of opinion leaders, the less likely the public opinion crisis will occur.
- Behavior tendencies. To guide the possibility of malignant events such as conflict, violence, strikes, demonstrations, etc. The index can be described by percentage, the lowest is 0, the highest is 100%. We can make word segmentation, and then use the combination of word frequency statistics and emotional analysis to make a judgment.

3. Intelligent Evaluation Model Framework of Online Public Opinion Crisis

Artificial neural network is a complex network composed of a large number of simple information units called neurons connected extensively, which is used to simulate the structure and behavior of neural network in human brain. Error Back Propagation BP Neural Network is the most commonly used artificial neural network. It has strong self-organizing, self-learning and self-adapting abilities. It is famous for dealing with non-linear problems. It has great advantages applied to the crisis monitoring and early warning of online public opinion.

Neural networks require a certain number of samples as training data and testing data. The samples should be the authoritative evaluation results with high credibility. We can obtain evaluation results based on the fuzzy comprehensive evaluation model. Trained neural networks can be used as intelligent expert systems. For the example to be evaluated, as long as the necessary input is provided, the model can give the score or warning level of online public opinion crisis.

3.1. Obtain Samples Using Fuzzy AHP Model

According to the historical data of online public opinion crisis on typical events in the higher vocational college over the past years, We can use the fuzzy comprehensive evaluation method to get the grading results.

Wang T et al. [6] proposed a online public opinion early-warning model based on fuzzy comprehensive evaluation method. We can use a similar model. The model can provide training samples and test samples for the intelligent evaluation of online public opinion crisis later. In this model, AHP(Analytic Hierarchy Process) can be used to confirm the weight of every index in the evaluation system. Warning level of online public opinion crisis can be divided into four levels: security, light, medium and heavy.
The public opinion evaluation experts in the group are made up of public opinion researchers, front-line students, administrators and school leaders with rich experience in online public opinion management.

3.2. BP Neural Network Design

The essence of BP neural network is to extract the characteristic relation implied by samples according to the provided sample data through learning and training, and store the knowledge of experts in the form of the weight of connections between neurons[10][11].

In this framework, a three-layer network structure of BP neural network is adopted, which is composed of an input layer, an implicit layer and an output layer. Layers are fully interconnected, and there is no connection between neurons in the same layer. It has been proved that three-layer BP network is available. Therefore, as long as the given sample set is truly scientific and has strong authority, the results are convincing. It overcomes the difficulty of determining weights and the influence of fuzziness and randomness, which is an intelligent comprehensive evaluation method.

The basic process of BP neural network algorithm is divided into three steps, the first step is to initialize the network weight and neuron threshold, the second step is to propagate forward, and the third step is to propagate backward, that is, to modify the weight and threshold according to the formula, until the conditions for termination are met.

Because the dimension of each index is different, it is necessary to standardize them to [0,1]. The indexes are divided into positive indexes and negative indexes, which need direction consistency processing.

Positive Index Processing: Dimensionless is based on the minimum value, processing formula is:

\[ y_i = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}} \]  \hspace{1cm} (1)

Negative indicator processing: Dimensionless is based on maximum value, processing formula is:

\[ y_i = \frac{x_{\max} - x_i}{x_{\max} - x_{\min}} \]  \hspace{1cm} (2)

Above \( y_i \) represents the quantified index value, \( x_{\max} \) and \( x_{\min} \) represent the maximum and minimum of the index respectively.

Input data are standardized according to formula 1 or 2. Four-dimensional vectors 0000, 0100, 0010 and 0001 are used to express the different levels: security, light, medium and heavy. we can train and test three-layer BP neural network. The input node is determined to be 8 according to the index number, the output node is determined to be 4 according to the four-dimensional vectors above, the number of hidden layer nodes get a proper number such as 23 (or determined after several adjustments).

Assuming that output of the BP neural network is \( y_i \) (i=1,2,3,4), the result of the conversion is \( y_i^* \) (i=1,2,3,4), the conversion formula is as follows:

\[
\begin{cases} 
0 & y_i \leq 0.1 \\
0.5 & 0.1 < y_i < 0.9 \\
1 & y_i \geq 0.9 
\end{cases}
\]  \hspace{1cm} (3)

Different training parameters have different influence on the results. After many experiments, the appropriate parameters can be found. As long as we have enough samples, this step is not difficult,
there are many tools available. After the model training is mature, we can use the model to make automatic judgments without human intervention. This greatly reduces the output of manpower.

4. Conclusions  
In order to fully understand student's speech and thought in the big data environment, this paper designed a new intelligent evaluation model framework based on AHP, fuzzy evaluation method and BP neural network. The framework is relatively easy to implement. We can use the trained model to judge the current situation in real time. It provides a new method to monitor development trend of online public opinion in higher vocational colleges. It biggest advantage is that can make full use of available data and reduce manpower output.

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