Research on the Method of Information System Equipment Performance Analysis Based on Big Data

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Abstract. As the business scale of the information system continues to increase and refined management, the increase in the load of the information system has become increasingly obvious, and the requirements for the reliability and stability of the information system are getting higher and higher. In order to improve the reliability and stability of the information system, a safe and stable performance analysis system must be established. Therefore, first obtain performance indicators such as throughput and response time of the information system. Secondly, establish a performance baseline between load, response time, and resource consumption. At the same time, it is necessary to introduce time, external time and other parameters for big data analysis, and finally conduct a situation assessment of the information system.

1. Introduction
With the rapid development of information technology, the level of information processing has increased day by day, and many communication management systems have been established. While the communication management system brings convenience to the company’s operation and management, it also faces many problems. Among them, the reliability and stability of the information system is the most serious. Due to the defects of the information system and the openness of the network environment, plus the information, the diversity and uncertainty of the system network structure, the stability and reliability of the information system are facing huge challenges. Information system situation assessment can predict and estimate information system network security and change trends, and can provide reference opinions for formulating corresponding preventive measures. For this reason, information system network security assessment research has become a major topic at present. Situation assessment occupies an important position and role in research. It is the focus and key link of the entire process. Situation assessment refers to security incidents generated through summary, filtering, and correlation analysis equipment, and then an appropriate mathematical model is established based on the construction of security indicators. Finally, use the model to analyze the stage of the system to grasp the security status of the network. Sometimes, situation understanding is equivalent to situation assessment, or the core of situation understanding is situation assessment. Through the situation assessment, the hidden dangers and threats in the information system can be discovered as early as possible. A full assessment of the scope and severity of these hidden dangers and threats can help managers grasp the current system security status so as to take measures against these threats before they occur. Containment and prevention measures protect the system from attack.
and destruction, and make it fully protected. Only by assessing the situation can the situation of the information system be clarified, so as to grasp the situation of the entire network and provide a basis for the next situation prediction. The important role of situation assessment is to provide strong support for its implementation.

With the advent of the information age, massive amounts of information data appear in information systems. We are now in the era of big data. At the same time, with the improvement of computing power and the further development of machine learning algorithms, the use of big data technology to process massive amounts of information and data has played a role in promoting the development of various industries. Therefore, the machine learning algorithm is used to extract the characteristics of massive data and the network, and then the appropriate algorithm is used to further process these characteristics. Finally, the generated model is used to predict and evaluate the performance of the information system, which can detect bad behaviors in the network in time and deal with it immediately. It can realize the intelligent analysis of the information system and build a networked, safe and intelligent information system.

2. Related research
With the continuous development of information and communication technology, more and more information system performance analysis methods are applied to work. The safe operation of the information system is directly related to the safety of the entire network system. Therefore, strengthening the assessment of the information system network security situation at this stage and taking security measures in advance have important practical significance for the operation of the system.

Situation assessment is the method used to realize the situation understanding in network security situation awareness and its related behavior process, and it is the core element of network security situation awareness (also situation understanding). Generally speaking, the meaning of situation assessment refers to the real-time extraction of security data and events generated by network security equipment, calculation and evaluation through certain models and methods, and dynamic reflection of the actual operating conditions of the network. Sometimes, the meaning of situation assessment can also be extended to predict future security trends through offline analysis of historical data, using data mining and other methods and corresponding algorithms, because the impact of security incidents on the network is quickly assessed. It is necessary to predict the future network security situation, so as to select security measures in time; so many people classify the two together as situation assessment. But in fact, there are differences in the model algorithms and methods used for evaluation and forecasting. Here, it is more inclined to separate the situation prediction part and focus the situation evaluation on its essential connotation-calculation and evaluation.

In the past ten years, many scholars have conducted in-depth research on information system evaluation issues and proposed many information system network evaluation models. According to different working principles, information system evaluation models can be divided into two categories: qualitative analysis evaluation models and quantitative analysis evaluation models. Among them, the information system evaluation models of qualitative analysis mainly include Delphi method, fuzzy theory, etc[9]. They describe the overall change situation of the information system network. The evaluation results are relatively intuitive, but the information system evaluation error is relatively large, which makes the information system evaluation. The credibility of the results is low. Quantitative analysis of information system evaluation models mainly adopts analytic hierarchy process and neural network. These models have their own advantages, but their shortcomings are also very obvious. For example, the information system evaluation accuracy of the analytic hierarchy process is low, and the neural network is easy to get overfitting. System network evaluation results[12].
3. Information System Situation Assessment System

3.1. Algorithm choice
Compared with the algorithm using neural network, support vector machine is a data mining technology that better overcomes the "overfitting" defect of neural network. It can fit the information system evaluation change situation, and there are many information system network evaluation indicators. It is very important to select the most effective evaluation index, and reasonably determine the weight of the index, and accurately describe the role of each index in the evaluation of information systems. Therefore, the support vector machine algorithm is used to solve the problem of information system situation assessment. In order to solve some of the problems in the current information system situation assessment modeling process, an information system situation assessment model based on data mining is proposed. First, the gray level analysis method is used to determine the weight value of the information system situation assessment index system; then the support vector machine is used to establish the information system situation assessment model; finally, the performance of the information system situation assessment simulation experiment is analyzed. Support vector machine algorithm (SVM) is a new type of data mining technology that can find solutions to problems from small samples. Support vector machines include classification and regression methods. The goal of classification is to find such an optimal classification plane, which can divide all samples into 2 classes while protecting the maximum distance between the 2 classes of samples. The working principle is shown in Figure 1.

![Figure 1. Support vector machine classification plane](image)

3.2. Algorithm implementation steps
In order to facilitate the understanding of the level and content of the situation assessment, it can be examined from the perspective of the overall process and data processing. The model framework proposed by scholars in the reference field, based on the need for data processing in cyberspace processes, divides the corresponding data processing process into five levels, namely data collection, data preprocessing, information extraction, situation analysis, and situation presentation, such as As shown in Figure 2.
Figure 2. Flow chart of situation analysis

For the information system network security situation assessment sample set \{x_i, y_i\}, x_i ∈ \mathbb{R}^n, i = 1,2,...,n, x_i is the information system situation assessment index set; y_i is the corresponding information system situation assessment post:

1. Construct and solve constrained optimization problems

\[
\min_{\alpha} \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \alpha_i \alpha_j y_i y_j K(x_i, x_j) - \sum_{i=1}^{N} \alpha_i
\]

s.t. \sum_{i=1}^{N} \alpha_i y_i = 0

0 ≤ \alpha_i ≤ C, i = 1,2,...,N

Find the optimal solution:

\[\alpha^* = (\alpha_1^*, \alpha_2^*, \ldots, \alpha_N^*)^T\]

2. Calculation:

\[w^* = \sum_{i=1}^{N} \alpha_i^* y_i x_i\]

And select a positive component of \(a^* a_j^* > 0\), calculate:

\[b^* = y_j - \sum_{i=1}^{N} \alpha_i^* y_i (x_i.x_j)\]

3. Find the classification decision function:

\[f(x) = \text{sign}(w^*.x + b^*)\]

4. Experimental results

This paper chooses the support vector machine in the machine learning algorithm to evaluate the situation of the information system. Data information is obtained from the information system of the communication company, including throughput, response time, external time, load and other data information. This paper chooses the analytical hierarchy process (AHP) and Neural network (BPNN) for comparison experiments.

Information System Situation Assessment Steps of Data Mining

- Establish an information system situation assessment indicator system, and collect historical samples of a certain information system situation;
- Process the historical samples according to the information system network security situation assessment weights to obtain the training set and verification set of the information system situation assessment;
- Set the super parameters of the support vector machine, and learn the training set of the information system situation assessment according to the super parameters;
- Calculate the information system situation evaluation effect according to the cross test, if it does not meet the actual requirements, adjust the parameters and continue learning;
- Establish an information system situation assessment model, and test and analyze the verification samples.

Adopt analytic hierarchy process, BP neural network and the method of this paper to establish the information system network security situation assessment model. Each model is tested 4 times to make the experimental results fairer. Statistics of their information system situation assessment correct rate and misjudgment rate, as shown in Figure 3 and Figure 4.
(1) The information system situation assessment of the analytic hierarchy process has the lowest correct rate and the highest rate of misjudgment. This is mainly because the analytic hierarchy process is a linear analysis method that cannot describe the random change characteristics of the information system situation, and has obvious defects;

(2) Compared with the analytic hierarchy process, the accuracy rate of BP neural network information system situation assessment is improved, which effectively reduces the misjudgment rate of information system situation assessment. This is because BP neural network has better non-linear learning ability and can better describe the characteristics of information system situation changes, but due to the small number of samples for information system situation assessment, BP neural network has obtained some "over-fitting" information system situation assessment results, resulting in the assessment accuracy rate not reaching the highest;

(3) The accuracy rate of the information system situation assessment of the method in the article is much higher than that of the analytic hierarchy process and the BP neural network. This is mainly because this article uses support vector machines to establish a better information system situation assessment model, which accurately describes the information system situation change characteristics reduce the rate of misjudgment.
5. Conclusions
The result of situation assessment directly affects the stability of the communication information management system, and the current model does not consider the difference of the evaluation index on the situation assessment of the information system network, which makes the situation assessment error of the information system relatively large. For this reason, the information system situation assessment based on machine learning is proposed. The model uses support vector machines to mine the information system situation, and obtains the information system situation assessment results with higher accuracy.

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