

Comprehensive Evaluation Model of Software Architecture Reliability Based on Pattern Recognition Algorithm

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Keywords: pattern recognition, software architecture, reliability evaluation

Abstract: With the wide spreading of systematic application, the comprehensive evaluation of the reliability of software architecture is becoming more and more important. The comprehensive evaluation model of reliability also emerges in an endless stream. Pattern recognition algorithm is a widely used algorithm for artificial intelligence and information science. Comprehensive evaluation of software architecture reliability also begins to move forward with the trend of artificial intelligence. Based on pattern recognition algorithm, the paper studies the comprehensive evaluation model of software architecture reliability, and a reliability prediction model is created to achieve software reliability Predictive analysis which comes from the improvement on neural network algorithm.

1. Introduction

In the era of information, all walks of life have accelerated the construction of information technology. An endless stream of various types of software emerges with software features and its complexity gradually increased. All of these lead to the probability of error in software development. With the increasing wide usage of information software, actual work may be compromised once the software has errors. Therefore, in order to reduce the software error rate and reduce the software error caused by the loss, the reliability of the software architecture needs to be evaluated. The current comprehensive evaluation of software architecture reliability has become an important part of the work of software reliability. The comprehensive evaluation of software architecture reliability is mainly based on the information of information software system, and evaluates whether the system can meet the actual requirements and whether it has good reliability, based on which the software architecture is designed.

With the continuous development of computer technology and the emergence of artificial intelligence technology, people hope that some people's brain activity can be replaced by a computer, which leads to the emergence of pattern recognition discipline. Pattern recognition is a process of describing or classifying phenomena or things. As to the application of pattern recognition, the main part is the comparison analysis of the input mode and standard mode, from which people can find the most similar standard mode. The model's class name is served for output the class name of the input mode, which in turn helps to complete the description of things. Pattern recognition is often used in fields such as information science and artificial intelligence. Pattern recognition algorithms include a variety of algorithms such as non-linear function of the judgment, linear function, genetic algorithm, and neural network algorithm. The neural network algorithm is one of the most widely used algorithms in the current pattern recognition algorithms. Neural network algorithm is to simulate the human brain thinking in accordance with certain logic inference process.

Various types of algorithms are rather important for the implement of the comprehensive evaluation of software architecture reliability. With the extensive application of pattern recognition algorithm, pattern recognition algorithm began to be introduced in the evaluation of software architecture reliability. This paper studies the comprehensive evaluation model of software architecture reliability based on the pattern recognition algorithm. Neural network algorithm is based on artificial intelligence. With the gradual rise and development of artificial intelligence, the study of the paper is specifically realized through the neural network algorithm of pattern

recognition algorithm.

2. Prediction model technology of neural network

A good prediction of reliability and high precision of the constructed prediction model can be achieved through the introduction of artificial intelligence in the evaluation of software architecture reliability. As an important method of artificial intelligence, neural network can also be applied to the comprehensive evaluation of the reliability of software architecture. The building process of prediction model based on neural network is shown in Figure 1.

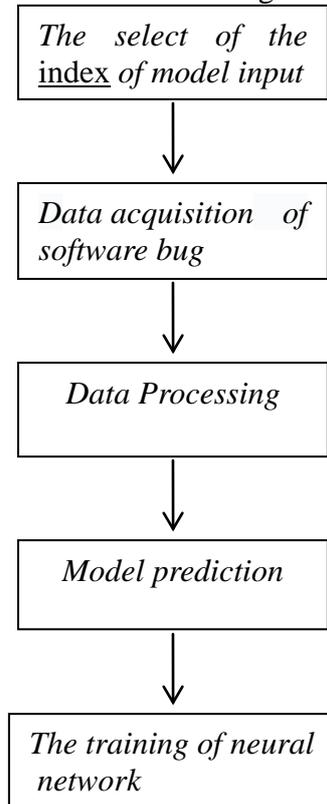


Figure 1. The building process picture of prediction model based on neural network.

The construction process of software architecture reliability evaluation model based on neural network algorithm is the same as the traditional model building process, except for the structure and the algorithm. Restrictions exist in neural network algorithm data input and output applications, they usually located at $[0, 1]$ or $[-1, 1]$. Based on this requirement, in order to realize the application purpose of the neural network algorithm, the data needs to be processed and transformed, and the data distribution should be changed so that the data better meets the input and output needs. There are two main ways to do data transformation: (1) Linear transformation method: The application of this method is very simple, its data transformation is mainly based on the original data range and make it located at the range of $[0, 1]$ or $[-1, 1]$. (2) Normal transformation method: Compared with linear transformation method, this one is more complex, it needs to be calculated, that is, calculate the average and standard deviation of the input and output data, in order to achieve the original data processing.

3. Software architecture reliability evaluation model based on improved neural network algorithm

The Improvement of Neural Network Algorithm.

In order to better apply the neural network algorithm to the software architecture reliability evaluation model, we need to improve the neural network algorithm through the following aspects:

(1) In the Neural network algorithm, the learning rate is established. However, the convergence speed will be affected by the learning rate, so the learning rate needs to be improved to make it a variable factor.

(2) The network structure is designed to improve network performance and accuracy.

In selecting the initial weights, a step-by-step search is adopted to divide the initial weight into several regions and then select and divide the region with the smallest error function. This process is repeated until the selected error does not change.

The interval detection method is the primary choice in optimizing the hidden layer of neural network.

4. Reliability evaluation model of software architecture to improve neural network algorithm

3.1 Determine the model structure

(1) Input and output need to be determined. The table below is the training sample data.

Table 1. Training sample data.

Group	1	6	8
1	0.825	0.871	0.392
2	1.001	0.608	0.651
3	0.958	0.392	0.434
4	0.782	0.651	0.564
5	0.912	0.436	0.303
6	0.871	0.564	0.392
7	0.608	0.303	0.521
8	0.392	0.392	0.348
9	0.651	0.521	0.216
10	0.434	0.348	0.392
11	0.564	0.216	0.521
12	0.303	0.392	0.173

(2) Network structure has to be determined, which mainly contains three levels, namely, input layer, hidden layer and output layer. The number of nodes at every level is different, with 5 at input layer, 12 at hidden layer and 1 at output layer.

(3) Determine the transfer function. Functions of the input layer and the hidden layer are mainly hyperbolic tangent functions. While the hidden layer and the output layer mainly use the pure linear transfer function. Figure 2 shows the network structure prediction.

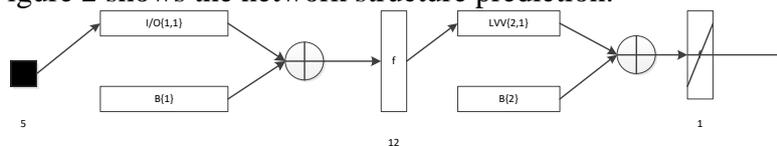


Figure 2. Chart of Network Structure Prediction.

3.2 Set the neural network parameters

The main parameters are as follows: number of training steps is five thousand, the initial value 0.0005, increasing coefficient 8, and reducing coefficient 0.05.

The realization of model in comprehensively evaluating and predicting reliability. Based on the

above steps, process diagram in the Matlab environment can be drawn as Figure 3.

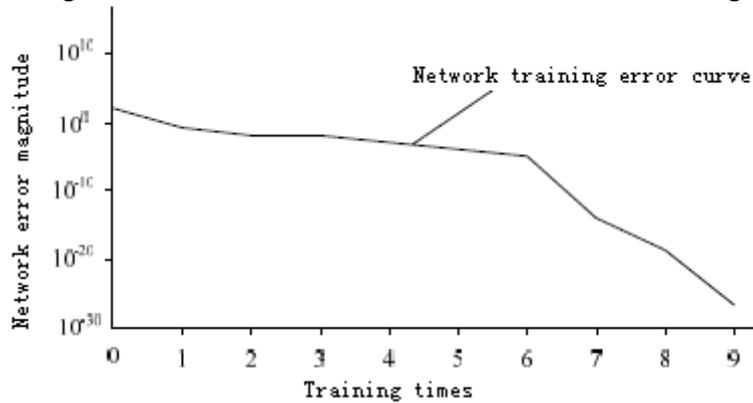


Figure 3. Training Process Diagram.

Frequency of training.

Orders of magnitude of training error.

Curve of network training error.

According to the figure can be drawn simulation results, reliability prediction.

(1) Simulation Results Analysis: According to the figure above, input the data of 6, 7. When input, take two groups of data as 8 groups of input vectors, each $k-k+4$, the output $k+5$. The first vector input is 6 to 10 days of data in 6 groups, and the 11th day of data is used as the output to repeat the input and output.

(2) Reliability Prediction: Predictive experiments show that the reliability prediction of software architecture based on neural network has higher accuracy. Input the 8th data $D = (0.087 \ 0.043 \ 0.043 \ 0.087)$, can be drawn $X_{32} = 0.013309$. This shows that on the 32nd day, a conversion failure may occur. However, the number of failures needs to use the original fault data that is 0.3. With the increasing importance of comprehensive evaluation of software architecture reliability, how to use the correct algorithm to build a comprehensive evaluation model and improve the accuracy of reliability prediction is an important issue in the reliability evaluation of software architecture.

Through the application of the improved neural network algorithm in the comprehensive evaluation model, the application of the pattern recognition algorithm improves the accuracy of the reliability prediction, realizes the reliability evaluation purpose of the software architecture and ensures the reliability of the software architecture.

References

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