

Study on detection method for mixed network structure robustness in 4G network

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Abstract. detection method for mixed network structure robustness in 4G network is researched. BP neural network algorithm is utilized to detect mixed network structure robustness in 4G network, because the 4G network reflects the exchange of information between individual and individual, randomness factors of network information is prominent, weights of BP neural network transmit into solid condition, leading to large detection error for robustness. Therefore, this paper proposes a fuzzy correlation theory to construct the detection model for mixed network structure robustness in 4G network. On the basis of given new robustness measure for mixed network structure in 4G network, according to small domain communication efficiency and the size of connected graph, the two attribute are utilized to calculate the robustness of single node of mixed network structure in 4G network, the quantized robust value is divided into two independent feature subspace and non feature subspace, in the corresponding space, the correlation robustness of region nodes is calculated, so as to complete robustness detection of mixed network structure in 4G network. Simulation results show that, the new 4G network mixed network structure robustness detection model can reduce evaluation error of mixed network structure in 4G network greatly, the system has better robustness, can effectively promote the operation and development of 4G network.

1 Introduction

The 4G network model is the communication platform for communicating between individuals, because of the openness of 4G network, the structure of 4G network is complicated, the network structure crisis and network structure safety problems exist commonly [1]. The network structure robustness analysis and the trustiness mathematical model of 4G network are studied, to establish 4G network structure robustness detection mechanism [2-4], so as to promote the healthy development and operation of 4G network mode, and protect scientific development of application field like 4G network user interests and security, which have great research value and practical value [5-7].

BP neural network algorithm is utilized to detect mixed network structure robustness in 4G network, because the 4G network reflects the exchange of information between individual and individual, randomness factors of network information is prominent[8-10], weights of BP neural network transmit into solid condition, leading to large detection error for robustness.

In order to avoid the disadvantages of the traditional algorithm, this paper proposes a fuzzy correlation theory to construct the detection model for mixed network structure robustness in 4G network. On the basis of given new robustness measure for mixed network structure in 4G network, according to small domain communication efficiency and the size of connected graph, the two attribute are utilized to calculate the robustness of single node of mixed network structure in 4G network, the quantized robust value is divided into two independent feature subspace and non-feature subspace, in the corresponding space, the correlation robustness of region nodes is calculated, so as to complete robustness detection of mixed network structure in 4G network. Simulation results show that, the new 4G network mixed network structure robustness detection model can reduce evaluation error of mixed network structure in 4G network greatly, the system has better robustness, can effectively promote the operation and development of 4G network.

2 principle of mixed network structure robustness detection in 4G network based on the related nodes

2.1 The quantitative calculation of robustness of single node in mixed network structure of 4G network

Through communication efficiency of the mixed network structure in 4G network and other node robustness features and the following formula, the network node robustness of 4G network structure is obtained:

$$S = \sqrt{(t_1 - p_1)^2 w_1 + (t_2 - p_2)^2 w_2 + \dots + (t_{14} - p_{14})^2 w_{14}} \quad (1)$$

In the formula, t_i represents the robustness feature vector of mixed network structure nodes in 4G network requires to be detected, p_i represents standard nodes feature vector of 4G network; w_i is weight.

The above formula does not describe the fluctuation of 4G network node robustness features and the relevance of robustness and testing process. After 4G network nodes are affected adversely, its robustness will be reduced, but model constructed by actual sampling has strong stability. Therefore, the above formula results in certain error for sampling nodes robustness characteristics values. Thus the fluctuation of node robustness features and the relevance of robustness and testing process have to be analyzed comprehensively, robustness feature attributes can be adjusted reasonably, and the fluctuation of node robustness features can be analyzed sufficiently when computing similarity.

Robustness characteristic quantity of original node in network structure of 4G networks are I_1 and I_2 respectively, using $\Delta = I_1 - I_2$ to describe fluctuations of robustness node feature vector, in accordance with these variables, the computing formula of node similarity can be accessed:

$$S(I_1, I_2) = P(\Delta \in \Omega_i) = P(\Omega_i | \Delta) \quad (2)$$

In the formula, Ω_i represents variation quantity of detection model of a node in mixed network structure of 4G network under different influencing environment, namely the similar variation; Ω_E is used to describe variation of robustness testing model, under another interference environment, namely the heterogeneous variation. The $P(\Omega_i | \Delta)$ is used to describe similar posteriori probability when the robustness is fluctuating, the probability can be obtained with $P(\Delta | \Omega_i)$ and $P(\Delta | \Omega_E)$. Therefore, the optimized similarity arithmetic can analyze the situation of node robustness affected adversely comprehensively, such as the relevance between testing error caused by the fluctuation of node robustness and the change. The optimized computation formula of robustness is as shown in the following formula:

$$S(I_1, I_2) = \frac{P(\Delta | \Omega_i) P(\Omega_i)}{P(\Delta | \Omega_i) P(\Omega_i) + P(\Delta | \Omega_E) P(\Omega_E)} \quad (3)$$

In the formula, $P(\Omega_E)$ is used to describe the specific external conditions. Such as the quantitative indicators of adverse influencing factors under detection conditions, and the association probability of number of tests. Thus, robustness detection process can be transformed into a process of calculating related probability, calculates the probability of node robustness characteristic change Δ belongs to Ω_i or Ω_E , so as to make accurate analysis for node robustness of mixed network structure in 4G network.

2.2 calculation of similarity based on correlation degree of

By adopting the above analysis method to process quantization operation for nodes in mixed network structure of 4G network, and the corresponding results are processed as follows:

The calculated single node robustness is divided into two sub regions without any relevance:

features sub region and the non-feature sub region, respectively described by R and \hat{R} . In feature sub region R , M node robustness feature vector similarity node of low latitude are as shown in the following formula:

$$\hat{P}(\Delta|\Omega) = \frac{\exp\left(-\frac{1}{2} \sum_{i=1}^M \frac{y_i^2}{\lambda_i}\right)}{(2\pi)^{M/2} \prod_{i=1}^M \lambda_i^{1/2}} \bullet \frac{\exp\left(-\frac{\varepsilon^2(\Delta)}{2\rho}\right)}{(2\pi\rho)^{\frac{(N-M)}{2}}} - P_F(\Delta|\Omega) \bullet P_F(\Delta|\Omega) \quad (4)$$

Wherein, $P_F(\Delta|\Omega)$ represents the actual edge density of R sub region; $\hat{P}_F(\Delta|\Omega)$ is edge density predicted in \hat{R} ; y_i represents the principal component; $\varepsilon^2(\Delta)$ is residual energy; the average value of eigenvalues of sub region \hat{R} can be used to describe the weight parameters ρ :

$$\rho = \frac{1}{N-M} \sum_{i=M+1}^N \lambda_i \quad (5)$$

Among them, $P(\Delta|\Omega_i)$ and $P(\Delta|\Omega_E)$ are subject to the three-dimensional Gauss distribution, and:

$$\begin{cases} P(\Delta|\Omega_E) = \frac{e^{-1/2} \Delta^r \sum E^{-1} \Delta}{(2\pi)^{\frac{D}{2}} |\sum E|^{1/2}} \\ P(\Delta|\Omega_i) = \frac{e^{-1/2} \Delta^r \sum EI^{-1} \Delta}{(2\pi)^{\frac{D}{2}} |\sum I|^{1/2}} \end{cases} \quad (6)$$

Among them, \sum is used to describe the covariance matrix. The difference between I_k and I_j are obtained, the difference is Δ vector, $P(\Delta|\Omega_i)$ and $P(\Delta|\Omega_E)$ are calculated from the feature vector of principal components of Gauss density function within class and between class, then computing correlation robustness of mixed network structure of 4G network. In order to reduce the complexity of the algorithm, two albino vectors can be fit into robustness results:

$$i_j = \wedge_I^{-1/2} \vee_I I_j, \quad e_j = \wedge_E^{-1/2} \vee_E I_j \quad (7)$$

In the formula, \wedge and \vee respectively represents the diagonal matrix of the maximum robustness eigenvalues and eigenvectors matrix corresponding to these eigenvalues of $\sum I$ and $\sum E$, dimension of corresponding sub regions are M_I and M_E . The above probability calculation process can be regarded as the process to calculate robustness of mixed network structure in overall 4G network, there are:

$$\begin{cases} P(\Delta|\Omega_I) = \frac{e^{-1/2} \Delta^T \sum I^{-1} \Delta}{(2\pi)^{D/2} |\sum I|^{1/2}} \\ P(\Delta|\Omega_E) = \frac{e^{-1/2} \Delta^T \sum E^{-1} \Delta}{(2\pi)^{D/2} |\sum E|^{1/2}} \end{cases} \quad (8)$$

3 simulation experiments and results analysis

The simulation experiment is carried out in the Matlab simulation software, through the long-term data collected by the research group in 4G network environment, 10000 data were

selected from 4G network mixed data network structure as the training data, 2205 data were regarded as test data, the data was normalized, so as to improve the convergence speed and the robustness properties of mixed network structure. The data is input into the detection system for the robustness of mixed network structure in 4G network, the obtained training output results as shown in the diagram below, it can be seen from Figure 1, using this system to train the network, after 23 times of training, the preset precision 0.05 can be achieved.

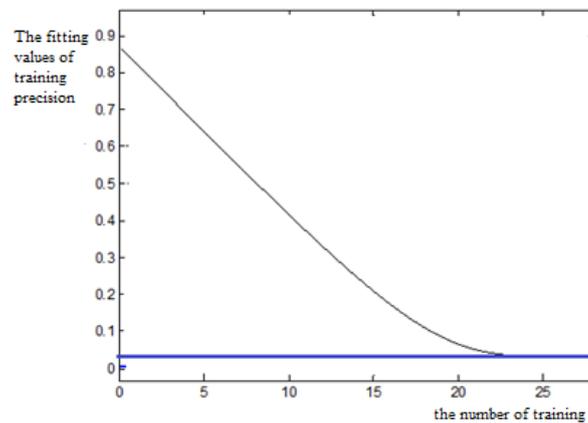


Figure 1 simulation results of the number of training times and the training precision

Eight groups of training samples were selected, the expected output and actual output, that is observation value and fitting value, were shown in Table1. 5 groups of test sample simulation were chosen, observation value and fitting value were shown in Table2, It can be known from Table2, that the fitting value between expected output value and actual output value has small error, the system has better training effect, and strong robustness.

Table 1 the observation value and the fitted value of training samples

Training Sample	1	2	3	4	5	6	7	8
The observed value	3.7	3.2	2.9	3.4	3.6	3.9	2.1	1.9
The fitted value	3.34	2.95	2.64	3.17	3.47	3.98	2.18	1.87

Table 2 the observation value and the fitted value of test samples

Training Sample	1	2	3	4	5
The observed value	3.39	3	3.43	3	3
The fitted value	2.786	2.947	2.776	3.198	3.125

4 Conclusion

During the detection process of mixed network structure robustness in 4G network, aiming at the defect caused by prominent randomness factors of 4G network information, weights of BP neural network transmitted into curing condition, and large detection error for robustness, this paper proposes a fuzzy correlation theory to construct the detection model for mixed network structure robustness in 4G network. On the basis of given new robustness measure for mixed network structure in 4G network, according to small domain communication efficiency and the size of connected graph, the two attribute are utilized to calculate the robustness of single node of mixed network structure in 4G network, the quantized robust value is divided into two independent feature subspace and non-feature subspace, in the corresponding space, the correlation robustness of region nodes is calculated, so as to complete robustness detection of mixed network structure in 4G network. Simulation results show that, the new 4G network mixed network structure robustness detection model can reduce evaluation error of mixed network structure in 4G network greatly, the system has better robustness, can effectively promote the operation and development of 4G network.

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