Research of Wireless Network based on Immune Genetic Algorithm

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Abstract: Aiming at the defects of uneven distribution of wireless sensor and cyber source, puts forward the research resource allocation algorithm based on immune optimization. Based on analysis and experiment, immune gene, polyclonal antibody model results show that the immune algorithm can realize the wireless cyber source balanced distribution is higher, the detection accuracy compared with the traditional higher.

Keywords: Immune gene; Wireless network; Resource Allocation

1. Introduction

Wireless sensor network consists of sensor nodes, to all kinds of information perceived objects of interest to the user in the deployment of real-time monitoring, sensing and collecting nodes (such as light intensity, temperature, humidity, noise, etc.) and processing the information sent to the user via [1] wireless network mode. At present, the application of wireless sensor network is more and more widely, such as military reconnaissance, environmental monitoring, medical care, smart home, industrial production control and so on. Resource allocation problem is a key problem in wireless sensor networks research. The main objectives are: how to dynamically adjust the parameters of the wireless sensor network nodes, such as the detection target and communication time slot, and accomplish the detection task of multiple tasks under the condition of limited energy of nodes [2]. At present, different researchers have proposed different resource allocation schemes for wireless sensor networks [3-7]. However, these methods mainly have the problems of large communication delay and low success rate of target detection. In general, the resource allocation algorithm needs to take full account of the residual energy of the sensor nodes, the distance between the target and the target, the important degree of the target, the priority of the task, and so on. Therefore, the complexity of the algorithm is improved exponentially, and the optimal solution is a NP hard problem. Existing research shows that intelligent optimization algorithm is an effective method to solve this kind of problem. Based on this, this paper proposes a resource allocation method of wireless sensor network based on immune complement optimization algorithm, which can improve the detection efficiency by adjusting the parameters of the wireless sensor network dynamically. Simulation results show that the algorithm can achieve a higher success rate of target detection.

2. Immune Algorithm

The optimal solution of the resource allocation in wireless sensor networks is a NP hard problem . Therefore, in this paper, the immune optimization algorithm is used to solve the problem.

Artificial immune system is a kind of intelligent optimization system inspired by biological immune principle. At present, the clonal selection principle, immune network model and negative selection principle in artificial immune system have been widely used in the field of control, image processing, network security and other engineering applications. But these algorithms and models have many limitations. Therefore, it is an important direction for the development of artificial immune system to continue to dig deep into the other mechanisms of biological immune system.

The information processing mechanism of biological immune system is the source of the artificial immune algorithm, and it is worth learning from. The complement system is present in person or by vertebrate serum and tissue fluid in a group of soluble proteins and the presence of a group of membrane in the blood cells and other cell surface binding protein and complement receptor composed, with precision regulating mechanism of complex protein reaction system. Complement activation is carried out by means of complement activation in the complement system, and in this process, complement constantly self division and combination, the final formation of the target cells to dissolve the destruction of the membrane attack complex. From the point of view of information processing, the complement activation process is actually the continuous use of the complement of the division, binding and other acts, so that the continuous reorganization of complement, screening out a better evolution of the individual process optimization. Therefore, it is necessary to put

forward a new idea of immune optimization algorithm to simulate the principle of complement activation.

Based on the principle of complement activation and the principle of clonal selection, this paper proposes an immune complement optimization algorithm to solve the resource allocation in wireless sensor networks. The objective function and constraints of the target cell in the immune complement algorithm. Optimal solution of complement corresponding optimization problem. This algorithm consists of 5 operator, namely, selection, splitting, binding, affinity mutation and memory operator.

3. Algorithm Realization

This design follows the basic steps of algorithm (step 1 step 4):

Step 1: Initialize

Set up an evolutionary algebra U is 1, random initialization population, The initial population is denoted as:

$$s = \min_{x \in k} \left[p_k f_k(x) \right]_{k=1}^{l} \tag{1}$$

$$f_2(x) = \frac{1 \le i \prec \sum_{1 \le i \le j} h_{ij}}{m(m-1)/2} \tag{2}$$

Step 2:The Target Number of Dang

According to the objective function to be optimized, can be calculated according to the affinity of the antibody population, and the antibody affinity arranged in descending order, select the first K to update the memory f_3 (x) antibody population.

$$l_{mv} = \min s_i \le m \le k \le s, l_{ij} \tag{3}$$

Step 3: Termination Condition judgment

If the maximum number of iterations is reached K, the algorithm terminates, and the best result is obtained by mapping the highest affinity antibody in the memory population, otherwise, the turn step is 4.

$$n_{ij} = \begin{cases} 0 & if\ s_i\ and\ s_j\ \ or\ l_{ij} \prec l_{\max} \\ \min\limits_{i \notin m} n_{ki} & if\ l_{ki} \prec l_{\max} \end{cases} \tag{4}$$

Step 4: Immune Clone

When the clone was cloned, the degree of the antibody was cloned. In the process of immune response, the antibody with high affinity and low concentration will be promoted. According to this feature, the definition of the incentive degree of antibody fs (x) (s = 1,2,, L):

$$f_3(x) = \frac{1 \le i \prec \sum_{i \le j} l_{ij}}{m(m-1)/2} \tag{5}$$

$$f_1(x) = \frac{|s|}{m} \tag{6}$$

$$l_{ij} = \min \left\{ \min \min_{1 \le k \le s} l_{ik} \right\} \tag{7}$$

4. Simulation experiment analysis

The results of the validation algorithm are simulated under the network simulation software OPNET. The monitoring range, the target detection and sensing node distribution of random position in the field, sensing node effective sensing radius is the radius of clusters, each node can detect a target detection task, each task goals need to be aware of more than 2 nodes.

In the immune based intrusion prevention model, the biological analogy is the network, the node in the biological immune system is analogous to the host in the network, and the antigen in the immune system is the network behavior in the intrusion prevention system. Among them, the self antigens, non self antigens were compared to normal network behavior, illegal network behavior. Antibodies (including mature antibodies and memory antibodies) are used as detectors for intrusion prevention systems. In biological immune system, it is the process of the detection of the normal (invasion) of the network behavior that the antibody recognizes the antigen as the self / non self, as Figure 1 shows.

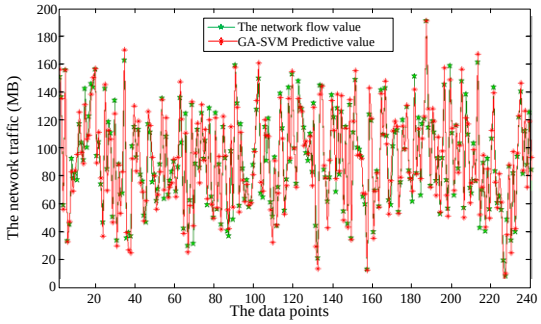

Figure 1. Number of wireless detection 1

Experimental data from the network security laboratory communication data, through the data acquisition program. 40 computers in the laboratory participated in the experiment, these computers were externally provided with WWW, FTP, E-mail and other services, the operating system for Windows2003. To collect the normal network data of the network for a week as the training data. Using attack tools on the network Smurf, flood syn, teardrop and other attacks, the network traffic generated by the attack together with the normal network traffic as a test data. Figure 2 show the comparison results of the algorithm and the correlation algorithm in the number of different sensor nodes. It can be seen from the simulation results that the performance of the algorithm is poor, the number of targets is small, and the detection rate is low. The main reason is that the random assignment is easy to cause the majority of sensors in a region to focus on the detection of a target while ignoring the other targets, leading to the detection of the area of the blank. Dynamic programming algorithm can have a good detection effect when the number of nodes is small, but the detection rate is lower when

the target number to be detected is relatively low. The algorithm in this paper through the design of various immune clonal algorithm, effectively guarantee the effectiveness of search, improve the performance of the algorithm, the target number is successfully detected, higher detection rate, achieve better detection results.

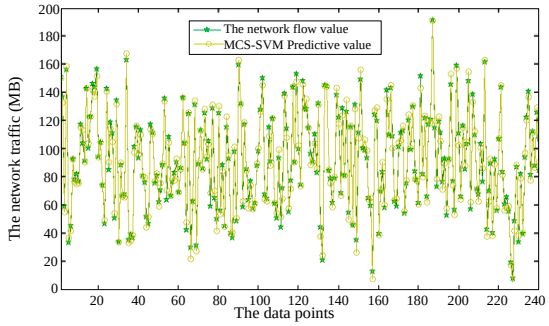

Figure 2. Number of wireless detection 2

5. Conclusion

With the rapid development of wireless network sensor technology, the traditional algorithm can not meet the needs of resource allocation, in order to solve this problem, proposed immune gene research of wireless network. Through the analysis of experimental data, the algorithm assigns detection rate is not only fast and accurate, and has practical value.

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