

# Computer Network Security Evaluation Based on Intelligent Algorithm

SUN Ming  
Xinxiang Vocational and Technical College  
China  
sunmingsmmsu16@163.com



**ABSTRACT:** *In our country, the type and quantity of network attacks have continued to grow. China's network infrastructure and the important information system is also facing serious security challenges. A variety of network attacks and other network security incidents have become the bottleneck of the development of our national economy, and even endanger the social stability and national security of the country. Computer network is an important part of modern social production and life; therefore, the security of computer network is a problem that has been attached great importance to. Computer network security assessment is the process of identifying the behaviors that endanger the safety of computer network, and it is a relatively active defense measure. On the basis of relevant domestic and international theory and research, and in view of the current problems, the computer network security evaluation model based on swarm intelligence algorithm is proposed in this paper. The feasibility of the algorithm was verified by simulation experiment.*

**Keywords:** Intelligent Algorithm, Computer Network, Network Security Evaluation

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## 1. Introduction

Lin Sinus [1] in 2012 pointed out that computer communication network has become an essential part of social production and life, and it has been extensively used in various industries. At present, it has penetrated into every corner of the world. Shorthand [2] in 2013 proposed that computer network security problems arise with the development of the network. Standardization and openness of the network facilitate the operations; meanwhile, it also leads to a trend of rapid growth of the network security incidents, which causes great loss. Li Min [3] in 2015 put forward that hacker attacks, computer viruses and denial of service attacks are the three main threats to computer network security. With the advancement of computer network, the attack mode changes from system-based attack to network-based attack. Ramirez [4] in 2014 thought that with the improvement of attack tools, even if the attackers do not acquire professional knowledge, they can also complete the attack process. Tchaikovsky [5] in 2013 explained that computer network security assessment is a supplement to the security mechanism, which increases the protection of the system in depth. However, there are still some difficulties in the technology of computer network

security assessment. Most products have certain problems, and the development requires more participation and efforts of technical personnel.

Based on this premise, and according to relevant domestic and international theories and research results, the security threats and defense mechanism of computer network are studied in this paper. Section 2 discusses the development status of computer network security evaluation and the theory of intelligent algorithms. Section 3 proposes the computer network security evaluation model based on swarm intelligence algorithm in view of the existing problems. Section 4 carries out the simulation analysis. The research process and conclusions are summarized in section 5. In the current technology background and in the dynamic and complex network environment, the network security situation assessment face the challenges of the current network security situation and effective quantitative assessment and timely reflect the security status of the target network. In order to achieve effective control of the administrator, the status of network security be targeted to reduce the network attack on bearing the network itself and its business losses, effectively improve the network security management capabilities.

## 2. Current Condition

### 2.1 The Development Status of Computer Network Security

Computer network security uses network management control and technical measures to protect the confidentiality, integrity and availability of data in a network environment. It includes two aspects of physical security and logical security [6]. Physical security refers to the physical protection of system equipment and related facilities. Logical security includes integrity, confidentiality, and availability of information. Computer network security includes not only the hardware of the network and the software of network management and control, but also includes shared resources and efficient network services. Therefore, the definition of network security should cover all the contents involved in the computer network.

There are many factors that threat the computer information, including human factors, natural factors and accidental factors. Human factors are the biggest threat to the security of computer information network. The Internet is an open network to the whole world. Any unit or individual can easily transfer and access all kinds of information on the Internet. The characteristics of openness, sharing, and internationalism of Internet poses the challenge to the security of computer network [7].

In the technical aspect, the computer network security technology mainly refers to the real-time scanning technology, the real-time monitoring technology, the firewall, the integrity inspection protection technology, the virus analysis report technology and the system security management technology. At the same time, in addition to security technology and preventive measures, the computer network security management still depends on the management measures taken by it and the implementation of computer security laws and regulations. Only the combination of the two can make the computer network security effective [8]. The following figure is the network security situation related diagram.



Figure 1. The network security situation

In today's society, with the continuous development of science and technology, social dramatization level enhances unceasingly. The computer network in people's daily life and work of the application widely, especially in the document processing, network office, etc., have made great progress. Some enterprises, establish the enterprise internal network, and increase the ability to communicate external network and the global Internet. And in practical application, while the computer network in information communication and exchanges play an important role, it also brings more serious information security problems. To do this, the computer network security evaluation system based on neural network, for the use of computer network security plays an important role.

## **2.2 Intelligent Algorithm**

Swarm intelligence is defined as a new collection of natural computing paradigm. The algorithm is in the range of the model, and it is parallel to other natural computing techniques [9]. Since the swarm intelligence has been proposed, because of its superiority in solving complex combination optimization problems, it has achieved a more successful application in robot field, power system, network and communication, computer, semiconductor manufacturing and engineering design. The number of infected hosts in our country in the world, fully embodies the Internet vulnerability and carry out network security analysis and monitoring in China. The necessity of China National Computer Network Emergency Response Coordination Center released Chinese Internet Network Security Report (2011) pointed out that Internet application mode in China continues to change, the network heterogeneity and the complexity continues to increase, although in the joint efforts of all parties, the security state of the network in China has improved overall, but the threats faced show a series of new features and trends. With the new technology of Internet in China, the rapid development of new applications, the network security situation will be more complex. From the legislation and supervision, many aspects of their protection and international cooperation improve the network security level.

At present, the research of swarm intelligence is still in the primary stage. However, due to its characteristics of distribution, self-organization, cooperation and robustness, it provides a fast and reliable foundation for the solution of complex problems in the absence of global information. Meanwhile, it opens up a new way for the research of the basic theoretical problems in the fields of artificial intelligence and cognitive science as well as providing a new solution for the practical engineering problems [10].

## **3. Methodology**

### **3.1 Quantum Behaved Particle Swarm Optimization**

Based on the research results of the convergence behavior of the particle, a new algorithm model is proposed from the point of view of quantum mechanics. According to this model, the particle has the behavior of quantum, and a particle swarm optimization algorithm with quantum behavior is finally proposed. In the quantum space, the properties of particle aggregation state are completely different. The global search performance of the quantum behaved particle swarm algorithm is far better than that of the standard algorithm because the former can search in the whole feasible solution space[11]. In the quantum space, the velocity and position of the particle cannot be determined simultaneously. Therefore, by means of stochastic simulation, the position equation of the particle can be obtained by describing the state of the particle through the wave function and gaining the probability density function of the particle appearing at a certain point in space. In the quantum behaved particle swarm optimization algorithm, the state of the particles only needs to use the position vector to describe, and there is only one control parameter; therefore, the selection and control of this parameter are very important, because this parameter is related to the convergence rate of the whole algorithm[12].

The quantum behaved particle swarm optimization algorithm can overcome the defects of convergence performance of general particle swarm optimization algorithm. This is because the quantum system is a complex non-linear system; besides, it is consistent with the principle of state super-position, consequently, the quantum system has more states than the linear system. The quantum system is an uncertain system which is different from typical stochastic systems. In such a system, the particle does not have a definite trajectory; therefore, the particle can appear in any position in the search space with a certain probability. In the traditional algorithm, the particles must search within a limited search range to ensure the aggregation of the particle swarm. In this way, the algorithm converges to one of the optimum points or local optimum point. However, in the quantum behaved particle swarm algorithm, the particle can appear in any position in the whole search space with a certain probability, and such a position may have better adaptive value.

### **3.2 Quantum Behaved Particle Swarm Optimization Algorithm**

Although the global searching ability of the quantum behaved particle swarm algorithm is much better than that of the general

algorithm, there is a trend of early maturity like the standard algorithm. When the group evolves, the diversity of the population will inevitably decrease. This is because each particle proceeds to search by learning itself regardless of whether the information has a tendency to local optimal. Network security situation awareness system needs to be based on the existing network security infrastructure and technology. It learns from the mature theory and technology of situation awareness and its application in the field of network security management, rapidly and dynamically change the complex environment. The efficient organization of all kinds of information, will have some representation of integrated elements of the network of local features, and can express the network macro, overall state of a multi-level alarm, warning system, so as to strengthen the management and control of the network. It improves the network administrator's ability to understand the network and to provide decision support for senior commanders. If the search space is in the case of a complex system with many local optimal values, particles are likely to fall into local optima[13]. The fitness value of each particle in the population is determined by its one dimension at the same time. A certain one-dimension of some particles may have reached the global optimal, but they are still abandoned because of the poor search results of other dimensions. In this case, the good genes are discarded. As in the human society, everyone has his own advantages, and everyone has the value for others to learn. Hence, every particle can proceed to search by learning itself and other particles[14].

#### 4. Result Analysis and Discussion

Network situation refers to the various network equipment running status, a network behavior and user behavior factors such as the network's current state and trends. It is worth noting that the situation stressed environment, dynamic and relationship between entities, is a state, a trend, an overall and macroscopic concept any single, or status cannot be called situation. Quantum behaved particle swarm optimization algorithm and improved algorithm are used as the training algorithm of wavelet neural network to be trained to be optimized. Two models were obtained, and the parameters of each variable were determined. Finally the training test was carried out. For the two models, 1500 iterations were carried out. Contraction expansion coefficient decreased linearly, and the population number was 50. Next we carried out the normalization of experimental data. In the application of neural networks, the variable must be scaled to the range allowed by the transfer function of the processing unit in proportion. Therefore, the training sample data and the test data that input the network must be converted in the same proportion. The convergence curves of the two algorithms are shown in Figure 2.

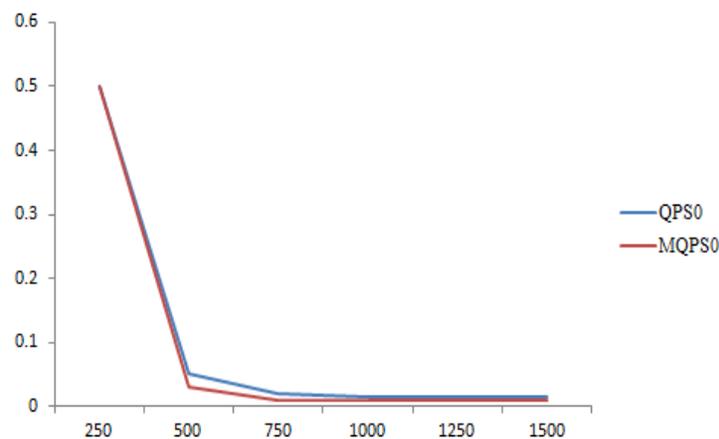


Figure 2. Convergence curve

From Figure 3, we can see that the optimized quantum behaved particle swarm algorithm is superior to the traditional quantum particle swarm algorithm in terms of the convergence rate and detection rate, which indicates that the model has universal validity. Has important significance for safety protection, in domestic and foreign countries have carried out extensive research and deployment of network security monitoring system of the country[15]. From the open literature, the United States, Japan, Europe and other countries such as China have established a network security monitoring system. The United States from the beginning of 2001 plans to develop global warning information system (WIS Global Early Warning Information System), to monitor the running state of the Internet, and the threat of possible, such as the domain name server (DNS) launched D Dos attacks and worm or virus of large scale outbreak signs were discovered and early warning. The United States Department of Defense Research and Development Agency (ARPA) in 2006 to develop scientific research plan clearly put forward the research

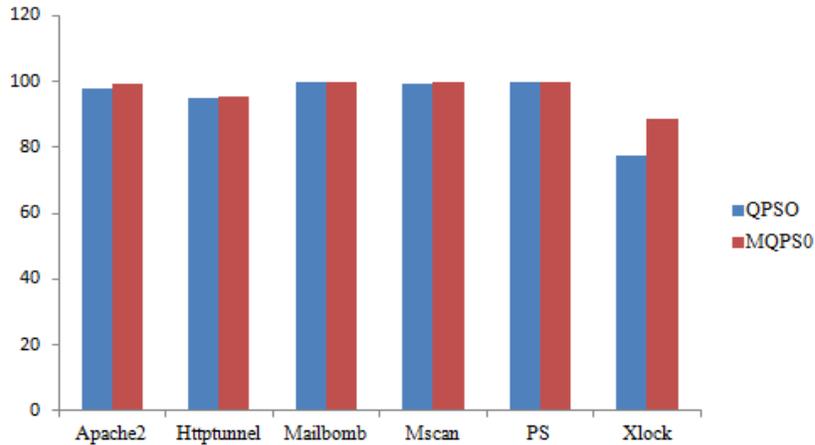


Figure 3. Detection rate of attack

awareness of network security technology, and points out that the network threat and security situation assessment and alarm correlation technology is important. The research point is the Advanced National Security Systems Research Center (NCASSR) which is SIFT (Security Incident Fusion Tool) project for the integrated framework through the development of a security incident of the fusion tool to provide security insinuation awareness.

## 5. Conclusion

Computer network security is a systematic concept. Making effective security strategy or plan is the most important task of network information security. On the basis of relevant domestic and international theory and research, in view of the existing problems, a computer network security evaluation model based on swarm intelligence algorithm was proposed. Meanwhile, the feasibility of the algorithm was verified by simulation experiment. The experimental results showed that the convergence speed and the global convergence ability of swarm intelligence algorithm were significantly enhanced without using the characteristic information of the problems, such as derivative gradient information.

Recently, there have been some new security detection technologies. They are aimed at different samples, and they have both advantages and disadvantages. It is necessary to deeply study these algorithms, and to explore the feasibility of combining them with the traditional detection methods.

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