Big Data Intelligent Collection and Network Failure Analysis Based on Artificial Intelligence

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To study smart data collection and network error analysis, this paper proposes intelligent data collection and network error analysis based on artificial intelligence. It examines the establishment of an enterprise-level information security situation awareness system and proposes specific information security models, architectures, and implementation methods. By designing and deploying the system, businesses can effectively detect information security threats, receive threats, filter risks, control threats, and comprehensively improve businesses' ability to detect security threats and security attacks. Test results: Through this platform, it is possible to manually intervene in the unknown threat of large data analysis in the system, and professionals can perform a detailed analysis to determine the means, goals and objectives of the attack and restore the complete picture. Intruder through artificial intelligence combined with big data knowledge and intrusion. Dimensional human characteristics. Including similar Trojans and malicious servers with different application forms, encodings, and attack principles, they "track" intruders by their general characteristics, constantly detect unknown threats, and ultimately ensure the accuracy of unknown threat detection, creating a local threat intelligence analytics platform. Practice has shown that the intelligent acquisition of large data by artificial intelligence can effectively analyze network failures.

Povzetek: S pomočjo umetne inteligence je narejena analiza napak v omrežjih in zbiranje podatkov.

1 Introduction

Artificial intelligence belongs to a key branch of computer science. Relying on the essence of intelligence, in order to generate intelligent machines similar to human intelligence, its key research objects are the application systems and technologies that simulate, expand and expand human intelligence. Artificial intelligence technology highly simulates many thinking processes and intelligent behaviors of human beings, providing great convenience for people's daily life, so it has received high attention from all fields of society [1-2]. As shown in Figure 1, the system will investigation and analysis of the whole security device logs and network traffic after discovering offensive behavior, so as to determine the specific degree of behavior, and solve these problems as far as possible. In the enterprise passive cycle of information security defense system, the vast majority of enterprises will put more energy on the defense process, but ignore the determination and analysis of the attack cause. There is relatively little investment and research in system repair, which is usually passive repair based on patches from the original manufacturer's products. At the same time, enterprises constantly optimize and improve defense policies to improve system defense capabilities and effectively resist external attacks. The defense means of information security has been effectively optimized. Many enterprises have established a network anti-virus, terminal management, security audit, access restrictions, and integrated security systems, such as the leak was found to be able to ensure the safety of the enterprise business reliably, reduce the information security risk to the enterprise, achieve the unity of the enterprise early

be able to ensure the safety of the enterprise business reliably, reduce the information security risk to the enterprise, achieve the unity of the enterprise early warning, unified management and traceability, reduce information risk's influence on the enterprise normal business activities [4].

Intelligent fault diagnosis technology includes fuzzy technology, grey theory, pattern recognition, fault tree analysis, diagnosis expert system and so on. The first four technologies only use logical reasoning knowledge to some extent and partly solve the problems such as fuzzy information, incomplete information, fault classification and location in the diagnosis process, while the diagnosis expert system can take itself as a platform and integrate other diagnosis technologies to form a hybrid intelligent fault diagnosis system. The narrow sense of intelligent diagnosis technology generally refers to expert system. Due to its inherent super adaptability and learning ability, artificial intelligence has been widely used in many fields and solved many problems that are difficult to be solved by traditional methods. The unique nonlinear adaptive information processing ability of neural network overcomes the defects of traditional artificial intelligence methods in intuition, such as pattern recognition, speech recognition and unstructured information processing, and makes it successfully applied in neural expert system, pattern recognition, intelligent control, combinational optimization, prediction and other fields. The combination of neural network and other traditional methods will promote the continuous development of artificial intelligence and information processing technology.

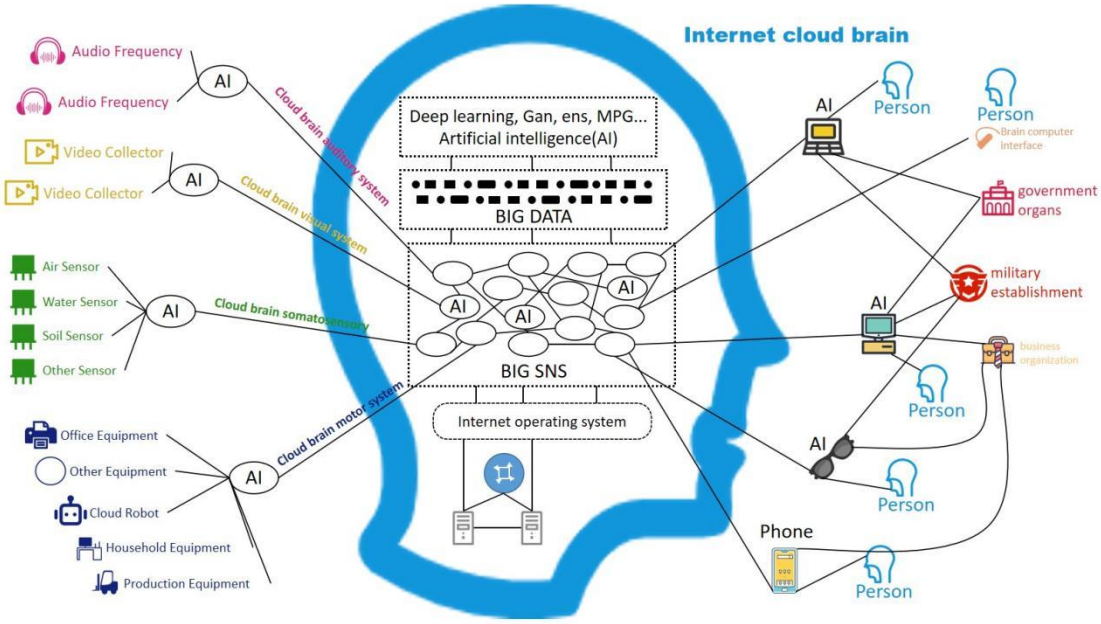

Figure 1 Intelligent collection of big data with artificial intelligence

2 Literature review

Fault diagnosis technology has developed greatly from methods to means, and the emergence, development and penetration of a large number of relevant scientific and technological achievements have also promoted its development. At the same time, because of the rapid development of computer technology, the fault diagnosis technology has unprecedented application value and popularization. However, the penetration of various disciplines only changes its methods and means, and its fundamental purpose is still to obtain and interpret the information of equipment operation state, so as to ensure the normal operation of equipment and maintenance according to the situation, reduce or eliminate accidents. In all walks of life, due to the application of fault diagnosis technology, not only effectively prevent the occurrence of many serious accidents, but also achieve great economic and social benefits. Cheng, L. proposed a cloud computing based on big data, information preprocessing optimized clustering algorithm and Chinese NLP (natural language processing) sentiment tendency analysis algorithm artificial intelligence network public opinion analysis platform. Speed up the

screening speed of effective information and the speed of public sentiment-oriented analysis; ensure that under the environment of massive network data, timeliness and effectiveness of public opinion monitoring. Finally through the experiment, compared with the traditional statistical big data information analysis system, this method has fast information convergence speed, information analysis is efficient and reliable, especially after doing a good job of classification training in key areas of focus, as the amount of collected data grows, the results of public opinion-oriented analysis are also more accurate [5]. Wang, J. restored the data in combination with the technology of the system, made precise analysis of the data, and then published the specific data so that other enterprises could store and use the data through the enterprise platform [6]. Zhan, J. believes that with the continuous application of new technologies, the means and methods of attack are increasingly hidden and difficult to detect. Covert attack means that can bypass various traditional security detection and defense measures and achieve targeted attacks through careful camouflage, long-term latency and continuous penetration [7]. Mengyuan, H. Constructed artificial intelligence detection technology of malicious code through artificial search engine, based on a large number of samples of malicious software and normal software, searched for information data features existing in different samples, and constructed an effective machine learning model for security scanning of unknown programs [8]. Zhang, Z. Intelligent operation and maintenance mode of transmission network based on artificial intelligence and big data analysis, can save labor costs, save equipment investment and improve network performance, effectively support the company's Internet-based operation transformation, effectively support the market, improve customer perception, it has good application promotion value. With the emergence and development of new technologies such as artificial intelligence, big data, cloud computing and SDN/NFV, traditional operation and maintenance technology of communication operators based on manual methods, it has been unable to meet the needs of cost and efficiency, automation and intelligent operation and maintenance technology has become an inevitable choice [9]. Karim, A. H. Research results in data analysis and visualization technology, it is possible to build an epidemic prevention and control platform based on big data and artificial intelligence technology, the platform can provide timely and accurate epidemic information for government agencies at all levels, and decision-making support for epidemic prevention and control, provide technical support for the implementation of the major policy of "highlighting key points, overall planning, classification guidance, and district implementation of policies" [10]. Hussein, H. A. T. outlines the basic meaning of network information retrieval, from FTP (File Transfer Protocol) search tools, menu-based search tools, three aspects of keyword-based search tools, analyze the classification of network information retrieval tools, and use this as a basis, put forward the application countermeasures of artificial intelligence in network information retrieval in the era of big data [11]. Raisan, A. Through barcode technology, radio frequency technology, internet of things, global positioning system technology, geographic information system technology, ERP, CRM, wide application of technology such as industrial control system, can quickly collect, process, and analyze data, promote industrial enterprises to realize the interconnection of all links in the production process. Regarding the current status of big data acquisition methods, the main problems in data acquisition methods, analyze the changes and strategies of future acquisition methods, and expounds the trend of change in the way of big data acquisition [12]. Lei, Y. will first introduce big data and artificial intelligence, after analyzing the application of artificial intelligence in computer networks in the current era of big data, in this way, it can be used as a reference for relevant people to communicate [13]. Xia, M. Can use the effective application of artificial intelligence virus detection and killing technology in enterprise information security situation awareness system can realize the effective identification and timely detection and killing of virus, and reduce the damage caused by virus to computer system [14-18].Because these studies have large loopholes, or the detection is not comprehensive enough, this paper proposes a method based on artificial intelligence on the basis of existing studies [19-27]. The design and deployment of the system, effective detection, threat perception, determination and threat risk tracking of information security threats can realize the comprehensive improvement of enterprises and their ability to detect security threats and security attacks [28-35].

3 Introduction to theory and computer network failures

The fault diagnosis of computer network is studied. Trained neural networks can store knowledge about processes and learn directly from historical fault information.

The main work is as follows:

①In the computer network management for computer network failure to select the appropriate data.
②Self-organizing feature mapping (SOM) neural network is used to cluster computer network faults.
③Set appropriate weights for the clustering results and add the sample data to establish the BP neural network model.
④ Computer numerical simulation, and the simulation results are compared.

3.1 Learning algorithm of BP neural network

The jth neuron in the k layer of the BP neural network has the following input and output relationship:

$$y_j^{(k)} = f_j^k\left(\sum_{\text{i-1}}^{N_{k-1}} W_{ij}^{(k-1)} y_i^{(k-1)} - \theta_j^{(k)}\right)(k=1,2,\cdots M; j=1,2,\cdots,N_k) \quad (1)$$

Among them, the connection weight of the ith node the $k-1$-th layer to this node is $W_{ij}^{(k-1)}$; $\theta_j^{(k)}$ is the function of the node; N_k is the number of nodes in layer k; M is the total number of layers. $f_j^{(k)}$ is taken as the Sigmoid function $f(x)=\dfrac{1}{(1+e^{-x})}$.

BP neural network uses error back propagation algorithm for learning, and the adjustment of weights is as follows:

$$W_{ij}^{(k-1)}(t+1) = W_{ij}^{(k-1)}(t) + \eta\sum_{h-1}^{I}\delta_{hj}^{(k)} y_{hj}^{(k-1)} \quad (2)$$

Among them, I is the total number of samples, $0<\eta<1$ is the learning step size, and $\delta_{hj}^{(k)}$ is the error transmission term.

For the output layer:

$$\delta_{hj}^{(M)} = \left(\hat{y}_{hj}^{(M)} - y_{hj}^{(M)}\right) f_j\left(y_{hj}^{(M)}\right) \quad (3)$$

For other layers:

$$\delta_{hj}^{(k)} = f_j\left(y_{hj}^{(k)}\right)\sum_{i=1}^{N_{k+1}}\delta_{hj}^{(k+1)} W_{hj}^{(k)}(t) \quad (4)$$

The output error ε_1 of the network is calculated as follows:

$$\varepsilon_1 = \sum_{h-1}^{I}\sum_{j-1}^{N_M}\left(\hat{y}_{hj}^{(M)} - y_{hj}^{(M)}\right)^2 \quad (5)$$

3.3 LM and fuzzy theory

If $\varepsilon_1 > \varepsilon$ (ε is the error of the preselection setting), then continue to the next round of learning to adjust the weights, otherwise, the network stops learning. The network formed by the weight of W_{ij} after learning can achieve the desired output within the error range set by ε [36-38].

3.2 SOM network implementation process

The algorithm process of SOM network learning is

①Initialization. For N input neuron bands, the connection weights are small. Select the set S_j of output neurons j "adjacent neurons". Among them, $S_j(0)$ represents the "adjacent neuron" set of neuron j at time t=0, $S_j(t)$ represents the set of "adjacent neurons" at time t. Area $S_j(t)$ keeps shrinking with time [16].

②Provide a new input mode X.

③j is distance from the input and the output:

$$d_j = \|X - W_j\| = \sqrt{\sum_{i=1}^{N}\left[x_i(t) - w_{ij}(t)\right]^2} \quad (6)$$

And find a neuron j^* with the smallest distance, that is, a certain unit k is determined, so that for any j, there is $d_k = \min(d_j)$.

④Give a surrounding neighborhood $S_k(t)$.

⑤Correct the weight of output neuron j^* "adjacent neuron":

$$w_{ij}(r+1) = w_{ij}(t) + \eta(t)\left[x_i(t) - w_{ij}(t)\right] \quad (7)$$

η Gain item, gradually reduced to 0

$$\eta(t) = \frac{1}{t} or \eta(t) = 0.2\left(1 - \frac{t}{10000}\right) \quad (8)$$

⑥Calculation output o_k:

$$o_k = f\left(\min_j \|X - W_j\|\right) \quad (9)$$

Among them, $f(.)$ is generally a 0-1 function or other non-linear function.

There are also some different strategies, such as BP algorithm combined with other techniques such as fuzzy theory or genetic algorithm [39-43].

Let x_k be the approximate value of the k-th iteration, and F be the objective function

$$H(s)=\sum_{t-1}^{M} w_i^2(r)=w^R(r)v(s) \quad (10)$$

$v(x)=(v_1(x),v_2(x),...,v_N(x))^T$ in the above formula. Then the LM algorithm is:

$$\Delta s_k = s_{k+1}-s_k = -\left[H(s_k)+\mu_k I\right]^{-1} J^T(s_k)v(s_k) \quad (11)$$

J is the Jacobi matrix of F:

$$J(x)=\begin{bmatrix} \frac{\partial v_1(x)}{\partial x_1} & \frac{\partial v_1(x)}{\partial x_2} & \cdots & \frac{\partial v_1(x)}{\partial x_n} \\ \frac{\partial v_2(x)}{\partial x_1} & \frac{\partial v_2(x)}{\partial x_2} & \cdots & \frac{\partial v_2(x)}{\partial x_n} \\ \cdots & \cdots & \cdots & \cdots \\ \frac{\partial v_N(x)}{\partial x_1} & \frac{\partial v_N(x)}{\partial x_2} & \cdots & \frac{\partial v_N(x)}{\partial x_n} \end{bmatrix} \quad (12)$$

H is the approximate matrix of the Hesse matrix of F, which is taken as:

$$H(x_k)=J^T(x_k)J(x_k) \quad (13)$$

μ_k is greater than 0, it will be gradually used in LM algorithm. When equal to 0, it approaches Gaussian Newton algorithm. At maximum, LM drops linearly[44-51].

4 Results and Discussion

Figure 2 shows the BP neural network training process without any improvement. After adjusting the sample weight, the sampling training process using the improved LM algorithm is shown in Figure 3. From Figure 4, when the unimproved neural network is trained 100 times, there is still a big gap from the error of 10^{-2}, and the neural network combined by the SOM method and the LM method, convergence is reached after 20 trainings [52-58]. Using the above combination of SOM method and LM method, the training process is shown in Figures 4, 5 and Figures 6, 7. It can be seen from Figures 4, 5 and Figures 6, 7 and the continuous era development and the rapid progress of computer technology, in recent years, the infection types of computer virus emerge in

endlessly, which seriously threatens the normal work of computer system. Through the application of artificial intelligence virus detection technology in the big data technology can improve the perception ability of enterprises to the virus, using a variety of virus location methods can improve the efficiency of the existing virus search, improve the accuracy and scientific nature of virus detection.

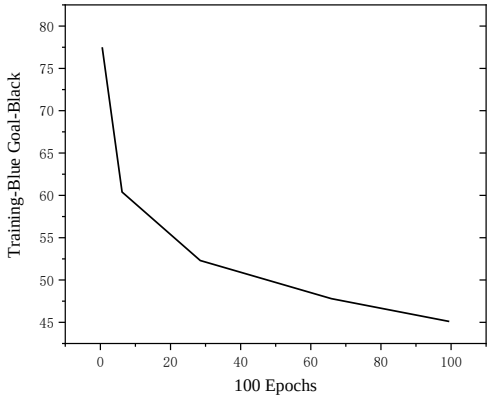

Figure 2 Training process of the combined algorithm

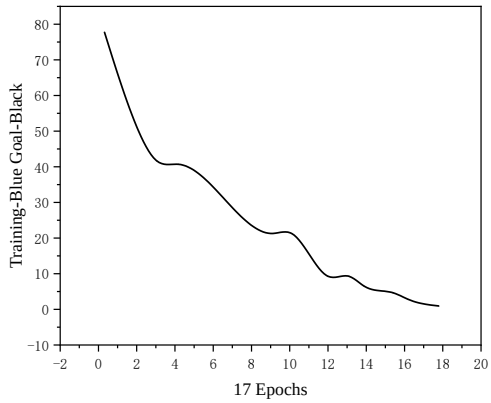

Figure 3 Training of the original algorithm

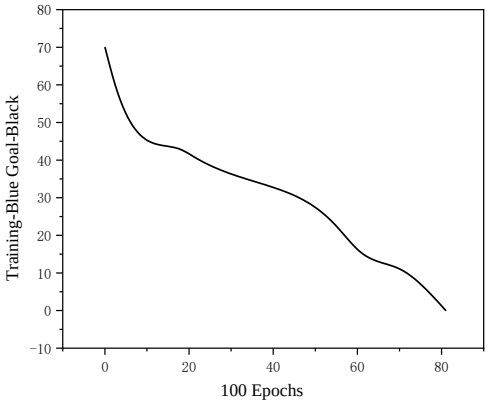

Figure 4 Combined algorithm training process

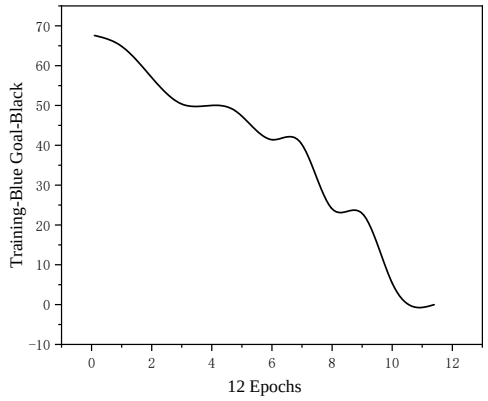

Figure 5 Training process of the original algorithm

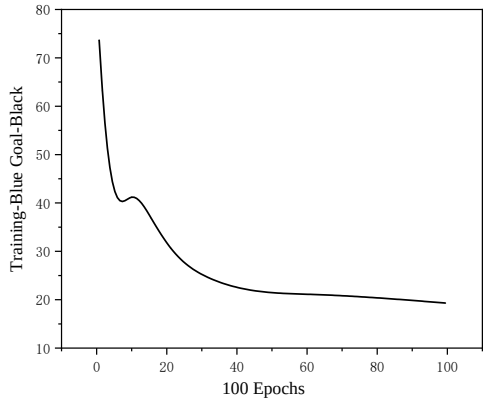

Figure 6 Combine the training process of the algorithm

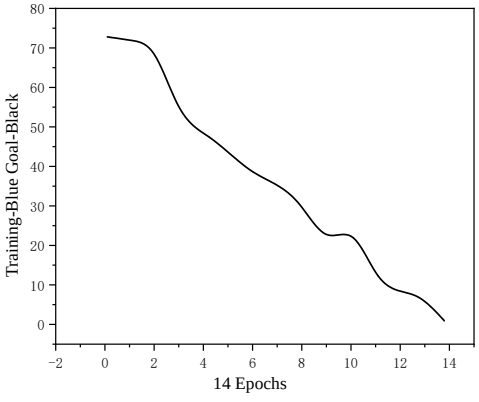

Figure 7 Training process of the original algorithm

5 Conclusions

Although neural network has achieved good results in the field of fault diagnosis, the structure and training times of neural network have great influence on the fault diagnosis ability of neural network. An insufficiently designed neural network may have poor performance in fault diagnosis. Based on large data and information security situational awareness of artificial intelligent technology for enterprise digital information security and the normal operation of the enterprise has the vital role, because the quantity of a security threat facing the enterprises growth trends, so enterprises must adopt more effective measures and means to show complete these threats, and take corresponding measures to solve it. The effective application of big data and artificial intelligence technology can improve the accuracy and accuracy of information processing, comprehensively assess the security risk status of information system, and realize the safe and orderly operation of enterprises. The main research direction in the future probably has two aspects: (1) better, fast design of the optimal neural network structure, in the fault diagnosis to achieve the best effect. If the neural network can be designed more scientifically and objectively, and can be carved scientifically with mathematical language, the neural network model can be established better and faster, laying a foundation for further research. (2) Further application of artificial intelligence. With the further development of computer science, it is believed that there will be more and better artificial intelligence models. If these intelligent algorithms are applied to the field, it is believed that in the near future there will be better results applied in the field of fault diagnosis, and further improve the scientific and intelligent fault diagnosis.

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