

Application of Artificial Intelligence in Computer Network Technology

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Abstract— With the innovation and development of computer network technology, the current era has become the era of big data. It is a new challenge for how to deal with the huge amount of data generated in the Internet, which broadens the space for the development of computer network information technology. If artificial intelligence technology and computer network technology are integrated with each other, they will definitely get higher value. In this paper, we introduce the application of artificial intelligence technology in artificial neural network, intrusion detection, anti-spam, network security evaluation, expert system, etc. in computer network technology and the specific implementation methods.

Index Terms—Artificial intelligence; computer network technology; big data

I. INTRODUCTION

With the innovation and development of computer network technology, social production and life have entered the era of big data. Thanks to the massive amount of data and the development of computing hardware, artificial intelligence has been developed at a high speed, and its superiority has been gradually demonstrated through cross-application with computer network communication technology. Nowadays, the Internet generates EBs of data every day, and the massive amount of data generated and the speed of data and information diffusion require the abandonment of traditional information processing methods and the creation of new methods. Therefore, we can use artificial intelligence technology to improve the efficiency of data processing, especially in some complex data processing. This paper introduces the advantages of big data and artificial intelligence, and the use of artificial intelligence in computer network technology.

II. PROCEDURE FOR PAPER SUBMISSION

A. Big data

The main function of Big Data is to integrate all kinds of data and information in the network and apply relevant processing technology to ensure the operation of information that cannot be effectively processed in the database. Generally speaking, this kind of data and information mainly includes the following characteristics: First, diversity, with the development of network technology, the amount of information is getting larger and larger, and the data sources are different, and its diversity is very obvious, such as

information forms, information content and so on. Secondly, the scale is large, because of the continuous improvement of modern computer network technology, the basic ability of information is constantly enhanced, and the information obtained can be analyzed and processed, and then can be used for different purposes.

B. Artificial Intelligence

The concept of artificial intelligence was first introduced in 1956 and has grown considerably over the past 50 years to become a broad cross-cutting and frontier science. In recent years, thanks to the development of massive data and computing hardware, AI has reached a new level of development, gradually showing its superiority through cross-application with computer network communication technology. At this stage, artificial intelligence is already playing a role in many fields, such as medicine, machinery, agriculture and many others. This technology not only facilitates people's daily lives, but also enables them to perform technically demanding tasks. By combining it with computer network technology, the level of computer network technology can be greatly improved. Artificial intelligence can be broadly divided into specialized AI and general AI. Dedicated AI systems for specific tasks (e.g., Go) have a single task, clear requirements, clear application boundaries, rich domain knowledge, and relatively simple modeling, resulting in a single breakthrough in AI and even surpassing humans in local intelligence tests. While general AI still exists in theoretical form, recent advances in AI at this stage are mainly in the area of specialized intelligence. For example, AlphaGo defeated the human champion in the game of Go, AI programs have surpassed humans in large-scale image recognition and face recognition, and artificial intelligence systems have reached the level of professional doctors in diagnosing skin cancer. In this era, traditional network data analysis techniques are no longer suitable for handling today's vast amount of data, which is also very complex and diverse. The use of artificial intelligence in computer networks allows the processing of data and the accuracy of judgments to be effectively improved.

Artificial intelligence is an effective tool for efficiently processing information data in the era of big data, and is a product of the combination of computer networks and information data technology. The advantageous features of artificial intelligence are mainly reflected in the following aspects: First, it is highly efficient; in the past, information processing in computer networks took a lot of time and was inefficient, but artificial intelligence can apply knowledge from various fields in a scientific, rational and effective manner. The application of artificial intelligence to computer networks can help computers obtain more accurate data and thus improve computing efficiency. Second, it is low cost and

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low resource consumption. Artificial intelligence is faster and saves a lot of time when dealing with large amounts of data. In turn, it reduces the resources consumed by computers in the process of data processing.

C. Advantages of Artificial Intelligence

For artificial intelligence technology, the smooth operation of the cyberspace environment can only be ensured by ensuring the security and stability of the cyberspace environment, while the effective transmission and processing of information is fundamental to the construction of a stable cyberspace environment. In practice, the management of computer systems is the core work in the processing and operation of information, and the application of artificial intelligence technology can effectively improve the efficiency of the system's information transmission. It can seamlessly connect multiple networks and has a strong level of fuzzy logic and analysis, making it easy to handle dense data. In addition, AI technology can work with automatic logical secondary variation, simplifying the processing of large amounts of data, balancing information redundancy, and maximizing the information processing capabilities of computer network systems [1]. Artificial intelligence technology can also be used to conduct simulation experiments to verify nonlinear problems, which can optimize the allocation of resources more efficiently and improve the performance of the computer network environment. At this stage of development, computer network communication technology has been used in many fields and has shown a clear dominant role. As a result of this technology, more and more data is being processed in both industrial production and everyday life. Through systematic data mining, analysis and integration. It is possible to extract 30%-50% of the value from the existing data, which is guaranteed to be of great help to the development of traditional industries and SMEs [2]. From the perspective of enterprise Big Data, data is updated and changed very quickly and generally covers many important data sources. For a long time, the data collection and processing methods were outdated and did not meet the processing standards of big data. Especially with the emergence of new data formats and data sources, it poses a great threat to the security of computer information networks. Therefore, there is a need to apply Big Data processing technologies to ensure the security of the whole process.

With the comprehensive promotion of intelligence, informationization, and Internet of everything, it is increasingly important to do a good job of network security management. In the past, the level of security technology adopted in computer network systems was relatively low, which could only protect against explicit viruses, but could not contain the invisible viruses in the network, and the computer network system itself could not dispose of a large amount of data. The application of artificial intelligence technology can improve this problem. Artificial intelligence technology can automatically generate a security management system, collect information on the operation of the computer network, analyze the occurrence of faults and potential faults in the context of the network, and optimize the settings of the system to ensure the safety and stability of the network system.

III. THE USE OF ARTIFICIAL INTELLIGENCE IN COMPUTER NETWORK TECHNOLOGY

This section will introduce the use of artificial intelligence in computer networking technologies such as artificial neural networks, intrusion detection, intelligent anti-spam, network security evaluation, and expert systems, and how these applications are implemented.

A. Artificial Neural Networks

The artificial neural network is an abstraction of the neural network of the brain, which is a complex network structure formed by the interconnection of simple neurons, capable of intelligent processing of external information, with strong learning and self-adaptive capabilities [3]. It is actually a complex network with a large number of simple elements interconnected as shown in Figure 1, with a high degree of nonlinearity, capable of complex logical operations and nonlinear relationships.

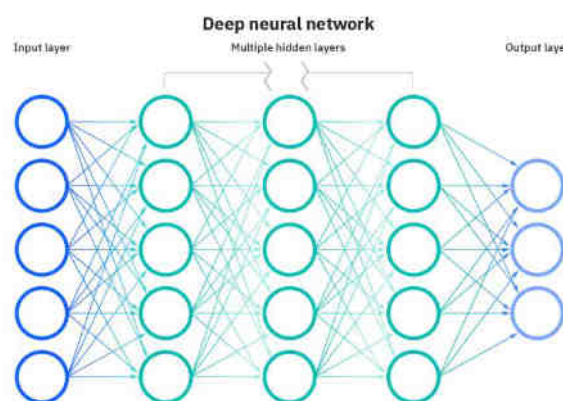


Figure 1 Neural network structure diagram

A neural network is an operational model consisting of a large number of nodes (or neurons) interconnected with each other. Each node represents a specific output function, called the activation function. Each connection between two nodes represents a weighted value for the signal passing through that connection, called a weight, and the neural network simulates human memory in this way. The output of the network depends on the structure of the network, the way it is connected, the weights and the activation function. The network itself is usually an approximation of some algorithm or function in nature, or it may be an expression of a logical strategy. Artificial neural network is an important direction of artificial intelligence applied to computer network technology, which can build a relatively stable and mature network system through the interconnection of neurons, and can think like a brain. The core approach is to simulate the operation of the human brain, which is highly receptive and fault-tolerant.

B. Intrusion Detection

Computer network technology in the era of big data brings convenience to data processing, but also brings network security problems like a double-edged sword. Artificial intelligence technology can be used for intrusion detection to improve network anti-interference capability and ensure network security by analyzing and inspecting logs of network behavior and data, issuing alerts when malicious attacks are detected, protecting the safety and integrity of network resources, and improving network security. In recent years,

the community has focused on the openness of information on the network, which continues to affect the development of the computer industry. In fact, viruses and network hackers can not only lead to data leakage, but also cause serious economic losses and bad social impacts. In order to avoid these malicious events, it is necessary to develop security protection functions for online user information and mobile data, and to build a reliable network security management system. In particular, to address the problems of malicious leakage of online payment network passwords and leakage of citizens' personal information, relevant technical personnel should develop network intrusion data detection security technology in conjunction with artificial intelligence. Objectively speaking, the advantage of network intrusion data detection security technology is that it can detect and process data in real time, detect and troubleshoot abnormal information, find network security problems and solve them in time.

Intrusion detection system algorithms can be broadly classified into the following types: i. The development of feature engineering detection algorithms based on automatic extraction of network intrusion characteristics is one of the directions; ii. The method of statistical analysis is to analyze the difference between normal behavior data and intrusion data by means of mean-variance and Markov process, and then determine the intrusion behavior. For example, an intrusion detection system using deep convolutional neural networks [4] consists of three modules: data preprocessing, transformation, and prediction. The preprocessing module converts the input irregular or unrecognizable data into numerical data that can be recognized by the computer, and reduces the impact of redundant data on the model. Finally, the convolutional neural network is trained. The input data of the intrusion detection system based on deep convolutional neural network is $R1 \times 41$ one-dimensional data, which needs to be transformed into $R21 \times 21$ two-dimensional data. Suppose the algorithmic network contains $L(n_1, n_2, n_3, n_4, \dots, n_{L-1}, n_L)$ hidden layers and each layer $M(m_1, m_2, m_3, m_4, \dots, m_{L-1}, m_L)$ cells, and x_i denotes the training samples of the data set, then the specific algorithm flow is as follows

- 1) Format conversion of the input data
- 2) Multiple training of the training sample x_i , while adjusting the hyperparameters of the model according to the training structure, and continuously optimizing the system performance.
- 3) x_i is the input value of the first layer, and so on, the output of n_1 layer is the input of n_2 layer to obtain the output value, weight and bias value among the hidden layers of the network, and the depth of the network, i.e., the number of hidden layers, is obtained by the correlation characteristics among the output data of the hidden layers.
- 4) Use the test data to verify the performance of the model, and repeat the training steps to adjust the system parameters until the system performance requirements are met.
- 5) Evaluate the system performance by checking the generalization ability and accuracy of the model.

C. Intelligent anti-spam

Intelligent anti-spam is a comprehensive monitoring of computer emails. If emails carry virus risks, they will be intelligently screened by the system and dealt with in a targeted manner. At the same time, users can also use the intelligent anti-spam system to check their mailboxes

comprehensively before using emails, and the test results will be quickly fed back to users, so that they can delete or keep emails with better understanding. The intelligent anti-spam technology can prevent the viruses in emails from causing harm to the security of computer network operation.

For example, the i-CNN model-based email classification method [6] using deep convolutional nerve network and inception V1 model [5]. Although the traditional CNN model has reduced the parameters by partial linking and downsampling in the convolutional and pooling layers, the data sparsity phenomenon will occur as the sample data increases, resulting in space wastage and the problem of high dimensionality, which increases the computational complexity. In order to solve this problem, the i-CNN model is proposed by combining the Inception V1 model with the CNN model and adding a 1×1 convolutional kernel after the convolutional layer to reduce the parameters by decreasing the number of channels of the feature vector and improve the computational efficiency and classification accuracy. The processed word vectors are input into the model, and the feature vectors are obtained by using filters; the window size is changed to obtain multiple feature vectors; the pooling layer filters the strongest feature vectors, and finally the probability of the output category is obtained, and the loss is calculated by matching the labels; finally, the model parameters are adjusted by back propagation to make the network converge.

D. Network Security Evaluation.

With the popularity of computer networks, it provides great convenience for people's work and life, but also brings corresponding information security problems, so it is very important to do a good job of computer network security evaluation. Conventional computer network security evaluation can be achieved with the help of firewall antivirus software, but in the face of complex computer network application areas, it is necessary to adopt security evaluation methods with good operability and wider applicability. The GABP neural network algorithm is a combination of the GA genetic algorithm and the BP neural network algorithm [8], which is an algorithm based on the evolutionary laws of the biological world. The BP neural network algorithm is based on the existing algorithm of BP neural network, which selects an arbitrary set of weights, treats the given target output as an algebraic sum of linear equations, constructs a system of linear equations, and solves the equations to obtain the weights to be solved, which can solve the problems of slow convergence and local minima of traditional methods. The problem of slow convergence and local minima can be solved. The computer network security evaluation system based on GABP neural network algorithm has the following key points: firstly, the input module: the input module is not only responsible for data input, but also for data processing; secondly, the operation module is mainly divided into two word modules, one is for data index analysis, and the other is the evaluation model analysis module which can describe the system security status and grasp the data. Then comes the output module: the output module, which contains several target modules: first, the security monitoring module can evaluate the current security status of the computer network; second, the security warning module can start the warning process at any time from the actual situation of the computer network; third, the security control module can judge the

warning information sent to make reasonable control to ensure the security and operation of the system. Third, the security control module can make reasonable control on the sent warning information to ensure the safety and stability of system operation.

E. Expert Systems

Expert systems are a development of artificial intelligence, and are even used in medical, military, geological exploration, teaching, chemical and other fields to produce great economic and social benefits. In addition to deductive methods, inductive and abstract methods are sometimes required in the process of problem solving; iv. The knowledge-based problem solving approach is used, which will be a trusted high-level intelligent assistant for human beings in the present and future, is an important means of applying artificial intelligence technology combined with computer network technology in practice.

The knowledge base is used to store the knowledge provided by the experts. The problem solving process of the expert system simulates the expert's way of thinking through the knowledge in the knowledge base. Therefore, the knowledge base is the key to the quality of the expert system, i.e., the quality and quantity of the knowledge in the knowledge base determine the quality level of the expert system. In general, the knowledge base in the expert system is independent of the expert system program, and the user can improve the performance of the expert system by changing and improving the knowledge content of the knowledge base. The interpreter can explain to the user how the expert system behaves, including the correctness of the reasoning conclusions and the reasons why the system outputs other candidate results. Knowledge representations in artificial intelligence are generative, frameworks, semantic networks, etc. The more common knowledge used in expert systems is generative rules. In this context, generative rules are understood in a very simple way: if the preconditions are satisfied, the corresponding action or conclusion is generated. The reasoning machine repeatedly matches the rules in the knowledge base with the conditions or known information of the current problem to obtain new conclusions to obtain the solution of the problem. Here, there are two types of reasoning: forward and backward reasoning. Forward reasoning is to match from the antecedent to the conclusion, while backward reasoning assumes that a conclusion holds first and sees if its conditions are satisfied. Thus, reasoning is like the way of thinking of experts in solving problems, and the knowledge base is realized through the reasoning machine.

The human-machine interface is the interface through which the system communicates with the user. Through this interface, the user enters basic information, answers relevant questions from the system, and outputs reasoning results and related explanations. A comprehensive database is used to store the raw data, intermediate results, and final conclusions required in the reasoning process, often as a temporary storage area. The interpreter is able to explain the conclusions and solution process according to the user's questions, thus giving the expert system a more human touch. Knowledge acquisition is the key to the superiority of the knowledge base of an expert system, and is also the "bottleneck" of expert system design.

IV. CONCLUSION

With the advent of the Big Data era, there are higher requirements for the processing of massive amounts of data and information in computer networks, and the application of artificial intelligence technology can well meet this demand. In general, the application of artificial intelligence in computer network technology can be summarized as follows.

1) Enhance the stability of the network: Information in computer networks is interactive and fluid, and the complexity of the information processing process can affect the efficiency if traditional methods are used. The application of artificial intelligence technology can avoid confusion and delays in the processing of data and information. By collecting and organizing a large amount of information and analyzing it effectively, we can ensure the quality of network information data and the stability of network system operation, thus better improving the data security of information.

2) Promote intelligent management mechanism: The information in computer information network may contain a large amount of hidden information, and because of the unknown source of information, it will have a direct impact on the stability and management efficiency of the whole computer information system, and even bring a lot of trouble to the management work. In the process of information management, artificial intelligence can monitor and collect various kinds of information in real time, and classify and collect various types of information data in a targeted manner, so as to make the operation of computer information system more stable and guarantee information security at the same time.

3) Strengthening core technology development: The diversity of information network data types and the wide range of sources are representative of the big data era. Nowadays, big data technology has been widely used in working life, but how to process various network information data more effectively has become a challenge. Therefore, the core technology of artificial intelligence determines the quality and efficiency of processing various information.

4) Improving network information security: The application of AI in the network by weight is mainly reflected in intrusion detection technology and firewall technology, which is crucial for the security of network data. In the network world, various virus infections and hacker invasion pose a great threat to the safety of users' personal information, and once leakage occurs, it will have irreversible effects on enterprises and individuals. Therefore, the security of network information is important, and the establishment of a new network information security system is one of the main ways to solve the current security problems. The introduction of artificial intelligence technology can detect various viruses and hacking behavior, and timely find the abnormal behavior of users in the process of using the network, so as to ensure the security of network system information and promote the healthy development of computer network technology.

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