A Brief Discussion about Application of Artificial Intelligence in Computer Network Technology in the Era of Big Data

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Abstract: With the rapid development of science and technology, the era of big data has come in full swing. A critical problem meriting reflection at present is how to take full advantage of this era in order to continuously improve the technological application level. As one of emerging technologies in modern society, artificial intelligence (AI) has achieved favorable effects when applied to different fields, e.g. AI computer network technology (CNT). The era of big data and AI were briefly expounded, the development of AI and its extensions in the era of big data were analyzed, and its application in CNT and development prospect were deeply explored, expecting to contribute to further application and development of AI in the era of big data.

1. Introduction:
According to China Machine Vision Industry Development Prospects and Investment Forecast Report, 2018-2023, the market scale of the computer network technology (CNT) field has been continuously expanded since 2017, developing from RMB 6.8 billion anticipated in 2017 to RMB 78 billion, and the annual compound expansion rate reaches 125.5%. Artificial intelligence (AI) is rightly the main technology in the computer vision market. AI has been introduced into all kinds of computer systems to research and develop AI chips and realize deep AI + industry integration. In order that AI technology can be widely applied to CNT, the current development status of AI technology as well as different AI computer application systems like AI firewall, AI detection technology and artificial neural network should be mastered, and emerging technologies such as big data, cloud computing and IoT should be comprehensively combined for the sake of R & D deepening. In this way, the data processing efficiency of CNT can be continuously improved, and the application advantages of AI in CNT can be fully embodied [1].

2. Era of big data and AI

2.1. Concept of era of big data
Since 2012, big data has become one of internet buzzwords. This word has been mainly used to describe bulk data in the era of mass information and serves as the name of related technologies and products. It has emerged on the covers of international journals like New York Times and Wall Street Journal, and thus become one of significant R & D directions in modern social development. With increasing data size in modern society, some enterprises have gradually recognized problems triggered...
by data explosion, and meanwhile, strengthened the management and control of internal data information.

As described in Global Data Traffic Development in and Before 2020, the first development tide brought by data came into being in the 1980s with main contents of transaction data, PC data and document data; following the gradual popularization of smartphone, namely since 2007, data traffic presented explosive growth, and people proceeded to “data era”; up to 2015, data became one of the main information generated in people’s daily life and work, and moreover, data monitoring, analysis and utilization became an important method of further improving working efficiency and living standard in modern society.

![Fig. 1 Global data traffic development graph in and before 2020](image)

### 2.2. Concept of AI

AI mainly refers to intelligence embodied through machinery equipment, and, generally speaking, can also mean human intelligence technology reflected via computer programs. The core of AI lies in constructing knowledge learning, knowledge planning, exchange, moving object, perceptual ability and manipulating ability, which are similar to human beings. In the current phase, a large number of tools and technologies have been gradually combined with AI, and then CNT forms like logical reasoning, logical operation and mathematical optimization have been put forward; meanwhile, attempts are made to apply AI to bionic field, cognitive psychology, conceptual research field, etc. [2].

### 2.3. Application advantages of AI in the era of big data

AI is an emerging technology in modern society with strong adaptability and application ability. Under the background of big data, when applied to the CNT field, AI technology will show the following advantages:

First, it can improve the stability of CNT system. From the angle of CNT application, AI is capable to realize mass data exchange and task processing simultaneously as well as dynamic data transmission. Furthermore, system upgrading can be realized via AI, so as to effectively solve difficult data problems, further improve the stability of network systems and facilitate their better operation.

Second, the reasoning and operation level of computer network can be elevated through AI. After AI starts being used, it can process bottom-layer data information and apply the processed result to computer network. Any problem found can be handled through AI. Meanwhile, it can conduct...
searching and operations by virtue of databases, thus improving the reasoning accuracy and providing a more scientific and effective basis for solving practical problems.

Third, it can further improve the scientificity and operating efficiency of application systems. Big data contains abundant data types and information, the capacity and scale of which are large. With the rapid updating and development of valuable data, the data analysis and control become difficult. AI, if used, can effectively guarantee the operating safety of big data and improve the processing efficiency of data information.

3. Development and extension of AI in the era of big data

3.1. Exploration of AI development in the era of big data
The development of AI in the current phase is manifested at three levels: machine intelligence technology, mainly referring to a sort of robot created by human, and this robot has the thinking ability of replacing human to do dangerous operations, and meanwhile, it can complete all kinds of high-risk activities efficiently; multidisciplinary intelligence development, including computer discipline, psychological discipline, physiological discipline and language discipline, which incorporate strong comprehensive thinking ability and autonomous learning ability; example analysis, AI robot Alphago defeated European Go champion in an international Go contest. This shows that the multidisciplinary robot does not just rely upon simple data reading and analysis, but moreover learns Go playing logic of the champion to conduct data analysis and reflection; AI application technology, which is mainly embodied in AI application system of CNT. The powerful CNT technology can be employed to collect mass data and establish databases, and the data processing efficiency can be improved by retrieving and using data information in the databases with the help of AI.

3.2. AI firewall
Firewall is one of important technologies in CNT. In the Internet era, many archival information and documentations can be easily retrieved, while firewall is an effective means of preventing them from being stolen. As the program of traditional firewall technology is changeless in the application process, the firewall will be intruded if a more novel deconstruction method is adopted by lawbreakers, thus failing to effectively guarantee the safety of archival data. However, the firewall system is capable of “self-evolution” after the application of AI. To be specific, the new deconstruction method is resisted according to different conditions, and moreover, the system has the SSL streaming data encryption function and can further improve the overall firewall performance. In the meantime, once an external network intrudes into the internal system, the AI firewall will clarify the access location, implement safety control tasks and realize the firewall functions. A common AI firewall at present is HiHTTPS.

3.3. AI detection technology
The intelligent intrusion detection system is mainly a fusion between AI and computer network restriction system and a form of their application. This system is mainly used to execute retrieval command sent in the access to the system network, or conduct information check of webpages, avoid virus which may impact normal system operation or destruct the system stability, timely find hidden programs, block these programs after sending a warning message, and on this basis, it can further improve the operating stability of the computer network system [3].

3.4. Artificial neural network
When it comes to artificial neural network, the operation structure of human brain is simulated by virtue of AI function, thinking and analysis characteristics of human brain are then mastered, so as to form an artificial neural network structure (Fig. 2) according with human logical thinking; In physical process, CNT is used to simulate the logical thinking flow of human brain. Mainly aiming to solve problems, artificial neural network gives full play to self-operation capacity of AI in order to improve the compatibility and logical reasoning ability of the system where the AI neural network is located.
Applied to computer systems of various industries, artificial neural network can realize intelligent network monitoring, further improve the reliability of network operation management and safety monitoring, enhance the accuracy of network monitoring, and thus boost the progress and development of CNT\cite{4}.

| Fig. G | Fig. H | Isomorphic mapping from G to H |
|-------|-------|-----------------------------|
| a --- g | 1 --- 2 | $\sigma(a)=1$ |
| b --- h | 5 --- 6 | $\sigma(b)=6$ |
| c --- i | 7 --- 8 | $\sigma(c)=8$ |
| d --- j | 4 --- 3 | $\sigma(d)=3$ |

Fig. 2 Structural chart of artificial neural network

3.5. AI data mining

AI data mining is a typical application of AI in computer network in the era of big data, and also an important achievement manifested by further improvement of computer network system construction. CNT is integrated with AI and data mining technology, the corresponding data information is acquired by using related systems and software in accordance with standard data mining flow, and meanwhile, AI-based data analysis is carried out to improve the reliability of data analysis and processing. During this process, AI is able to obtain all kinds of data information, master concrete keywords, explore the operation law, timely and accurately record intrusion data, followed by rapid judgment and analysis. After then, the prevention & control function is timely started, and a corresponding system intrusion warning is formed. On this basis, illegal intrusion is intelligently recognized and processed, thus improving the operation safety and stability of computer network system\cite{5}.

4. Application of AI in CNT in the era of big data

4.1. Establish an intelligence expert system

For the sake of application of AI in CNT, it is suggested that the merits of AI should be fully exerted and applied to the intrusion detection field of computer network. Moreover, an expert system under the rule should be established to improve the overall operation level of computer network. During the practical process, mass professional computer knowledge and expert experience can be collected, a database with abundant contents can be constructed as the basis to build a computer logical analysis mechanism, and this logical analysis mechanism will be coded into the system with the function of intrusion characteristic analysis to determine computer code and construct a database. In case of any external intrusion behavior, this behavior can be compared with the intrusion characteristic in the system, the intrusion cause is analyzed, the intrusion type and the harms it will possibly cause are then clarified, and in the end, the intelligent defense system is automatically started to make correct and
effective response. In addition, the intelligence expert system of this type can be applied to different aspects according to different fields, scenarios and data, e.g. “learning expert system” and “intelligent transportation system”\[6\].

4.2. Develop AGENT technology
In order that AI can be used in CNT, the data mining technology should be combined with AI technology to realize operation and feedback of AI based on data analysis and processing. With AGENT technology as the main research content, bottom-layer data can be comprehensively searched and a bottom-layer data analysis structure is constructed, so as to establish AGENT automatic governance and feedback mechanism. In this structure, it is necessary to install IDS system in host computer, which will be connected to AI data mining system so that it can realize various functions such as learning, adaption, autonomous feedback, compatibility of different data specifications, etc.

4.3. Develop an intelligent problem-solving technology
The AI technology should be applied at the level of “solving practical problems”. Intelligent problem-solving technologies should be further developed to improve the operation safety, stability and reliability of computer network system. In actual process, “solving the problems in one field” may be regarded as a core task, “data collection”, “target searching”, “data operation and reasoning” and “problem solving” and other functions should be definite, the evaluation criteria for the optimal solution should be set, and the formula of optimal solution is: \( f^* (n) = g^* (n) + h^* (n) \). Afterwards, the shortest path of \( g^* (n) \) is put forward as s-n and that of \( h^* (n) \) as n-g. With this technology, the operation efficiency of the computer network system can be effectively improved, so can its problem-solving speed and then the overall level of CNT.

4.4. Application case analysis of AI in CNT in the era of big data
A further case analysis of AI application is conducted by combining the above analysis of application technology of AI in CNT in the era of big data, so its application process is clearly displayed, facilitating better understanding of the application principle of AI in CNT. In “Intelligent Examination System” prevailing in 2020, for instance, data mining technology, AI technology and computer network system are integrated. In accordance with high quality requirements for test papers faced in the automatic examination process, difficulty of test paper, average structure, reminder ratio, distribution proportion of knowledge points and allocation of question amount, etc. are proposed, and in consideration of different examination groups, e.g. pupils, middle school students and adults, intelligent examination analysis and reasoning are implemented in order to satisfy different demands to the greatest extent.

Here, the application space state is set as D; In this system, D is an integration of entity control indexes. Each control index consists of question type, question number and difficulty criterion, etc., and presents a binary form through computer coding. At the time, individuals in D can be expressed as \( d_{tar\_get} \), \( d_{request} \) or \( d_{void} \), where “\( d_{request} \)” is a question index and “\( d_{void} \)” is an unrequested index. Through the design of “intelligent examination system”, the functions mentioned above can be basically realized, such as the intelligent examination, the distribution of the amount of questions and the distribution of the difficulty of the test questions.

The above presents the concrete structure and design process of the “Intelligent Examination System”. The abovementioned functions like intelligent examination, allocation of question amount and question difficulty allocation can be basically realized through this design.

5. Conclusion:
In conclusion, AI enjoys good application and promotion prospect in the CNT field under the era of big data, and it can boost the further development of the CNT field. With the gradual popularization of AI applications, all kinds of applications such as AI firewall, AI data mining and AI detection
technology have come into being in succession, which effectively elevate the overall development level of CNT and strengthen its service capability. Given this, it is suggested that on the precondition of holding fast to the correlation between AI and big data, an intelligence expert system should be set up, and AGENT technology and intelligent problem-solving technology should be actively researched and developed, in an effort to solve practical problems and thus embody its application advantages via AI.

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