Research on the Application of Artificial Intelligence and Computational Intelligence in the Internet of Things

Bing Li¹*, Dan He¹, Yan Jiang¹

¹Guangdong Vocational College of Post and Telecom, GuangZhou 510630, China

*Corresponding author e-mail: libing0503@gupt.edu.cn

Abstract. The integration of AI and computational intelligence tech in the Internet of things has gradually become an important support for industrial upgrading and economic restructuring, so it has important research value. Based on this, this paper first analyses the connotation and development status of the Internet of Things (IoT), then studies the specific utilization of AI and computational intelligence in the IoT, and finally gives the utilization strategy and utilization trend of AI and computational intelligence in the IoT.

Keywords: Artificial Intelligence, Computational Intelligence, Internet of Things

1. Introduction

With the iterative progress and maturity of computer tech, modern info tech represented by AI tech has been widely and deeply studied and popularized in many fields. Especially the utilization in the Internet of Things (IoT) valuably promotes the efficiency and quality of network info internet. The popularization of network info tech has a significant effect on people's life and work. A large number of activities in all walks of life are increasingly inseparable from the support of network info tech. Specifically in people's life, more and more smart home devices come into people's daily life, which not only brings great convenience to people's life, but also puts forward higher requirements for the intelligent control of electrical equipment. In the aspect of industrial utilization, with the help of intelligent IoT, it helps to achieve industrial upgrading and improve the operation level of enterprise intelligence and informatization.

As a tech based on the IoT to realize the high-speed interconnection of things and info, the IoT uses info sensing equipment to realize the info interaction and correlation control between items, so as to build an intelligent network of identification, positioning, tracking and management [1]. With the gradual maturity of AI tech, intelligent machines and systems can organically simulate the functions of human brain and further expand, so that the computer system can perform the processes as shown in
Figure 1 below. AI tech realizes the operation of physical symbols through knowledge utilization and reasoning, and integrates the knowledge content of multiple disciplines to complete the solution and operation of related problems with reference to the related functions of nature.

![Intelligent perception process of AI tech](image)

**Figure 1.** Intelligent perception process of AI tech

In a word, the utilization of AI tech and computational intelligence in the IoT organically extracts the related features and computational models of things, generates corresponding intelligent algorithms, and completes the collaborative work of related modules [2]. In addition, in the aspects of knowledge and method promotion, info perception, info interaction, task scheduling and work implementation, all tasks are interconnected with the help of intelligent info processing, thus establishing the info premise for the integration of interdisciplinary, interdisciplinary and industry. It can be seen that the integration of AI and computational intelligence in the IoT has gradually become an important support for industrial upgrading and economic restructuring. Therefore, it is of great practical value to study the utilization of AI tech and computational intelligence in the IoT.

2. **Connotation and development status of IoT**

2.1. **Connotation and typical characteristics of IoT**

As the core and foundation of the Internet, the IoT aims to realize the interconnection and related computing between things without the limitation of time and space, which constructs a huge info network. 5g mobile network with its typical characteristics of low latency and high speed further promotes the interconnection between objects and promotes the info interaction of many scenes [3]. With the help of info collection equipment, the IoT exchanges and shares the info of items with others after they are uploaded to the network. With the progress of AI tech, its utilization advantages in the field of IoT are gradually highlighted, which makes the IoT have a wider utilization space and potential.

2.2. **Development status of IoT tech**

At present, the IoT has great potential, the market scale has exceeded one trillion industries, and the number of IoT devices in the world has exceeded 40 billion [4]. The rapid development and utilization of the IoT has deconstructed the existing industrial fields and element resources, and then re integrated them together to achieve the extension or breakthrough of the industrial value chain, making the industrial boundary increasingly blurred, highlighting the trend of cross-border integration, and
promoting the rapid expansion of the overall income scale of the IoT industry. The growth rate of IOT utilization scale in China is shown in Figure 2 below.

In addition, AI tech makes ubiquitous and intelligent IoT have the possibility of comprehensive promotion. The industrial ecology of IoT can be divided into hardware, network, platform and utilization services [5]. Among them, sensors, modules and other hardware are the premise to realize the transportation function of IoT, network connection is the basis to realize info interconnection, IoT platform is the carrier and platform, and utilization service is an important means and tool to expand the value of vertical industry.

![Figure 2. IoT utilization scale in Chinese market](image)

### 2.3. Influencing factors of IoT tech promotion

The further development of the IoT is affected by many aspects, including tech maturity, standardization and cost of related industrial utilizations [6]. The maturity of relevant technologies represented by AI, cloud computing and big data and the clarification of standards have provided a realistic foundation and conditions for the further promotion of the IoT. The continuous expansion of the IoT utilization is inseparable from the assistance of related systems and standardization. At present, the standards and system framework of the IoT utilization have been formed as a whole, which are conducive to the acceleration of the utilization and promotion of the tech.

### 3. Utilization of AI and computational intelligence in IoT

#### 3.1. Functions and core technologies of IoT

The IoT has the functions of comprehensive perception, reliable transmission and intelligent processing. Among them, at the level of comprehensive perception, the IoT uses RFID, sensors, two-dimensional code to obtain the info of objects anytime and anywhere. In the reliable transmission level, through the integration of wireless network and Internet, the info of the object can be transmitted to the user in real time and accurately [7]. In addition, in the aspect of intelligent processing, AI technologies such as cloud computing, data mining and fuzzy recognition are applied to analyze and process massive data info and implement intelligent control of objects. The core technologies of the IoT include RFID tech, sensor tech, wireless network tech, AI tech and cloud computing tech, as shown in Table 1 below.
Table 1. The core technologies of IoT

| Core tech | Contents | Functions |
|-----------|----------|-----------|
| RFID      | Normative and interactive info | Automatic collection of item info |
| Sensor    | Receive item content | Info processing, transformation and kernel recognition |
| Wireless network | Data transmission channel | High speed info transmission |
| AI tech   | Simulating the thinking, behavior of human brain | Realize automatic processing |
| Could tech | Terminal computing and storage | Data storage and calculation |

3.2. AI intelligent IoT model

The data layer of IOT intelligent model based on AI tech and computational intelligence includes several aspects as shown in Figure 3 below. Among them, the real-time database stores the status data of equipment items. Knowledge stock contains the experience of interpreting a certain kind of problems [8]. The model inventory contains the abstract model of practice processing. The historical database stores some previous states and data processing results. As a model of neural network behavior characteristics, AI is an algorithm mathematical model for distributed parallel info processing. The data layer is the core of intelligent IoT and the basis of processing layer.

![Figure 3. The data layer of IoT intelligent model based on AI tech](image)

In addition, the man-machine interaction layer of IOT system includes web monitoring interface, table query, data update, control instructions and other parts, which are windows for intelligent processing and monitoring at the same time. The intelligent processing state can be queried and tracked, and interacted through the human-computer interaction layer and the IoT.

3.3. Utilization of AI and computational intelligence in IoT

The utilization of AI in the IoT includes two modes, that is, the mode of programming to make the system more intelligent; and the mode of simulation. The former is not based on the mechanism of organisms, while the latter is close to the mechanism of organisms and local model, so as to simulate the heredity and evolution of organisms [9]. Under the background of intelligent demand, AI tech is
applied in the perception info of the IoT to collect data and info, and sort out the collected info to improve the applicability of info. In addition, through data transformation and reconstruction, the processed data is presented to IoT users.

4. Utilization strategy and trend of AI and computational intelligence in IoT

4.1. Utilization strategy of AI and computational intelligence in IoT

The utilization of AI and computational intelligence in the IoT mainly includes family life, public services, daily office and production of enterprises, IoT, intelligent driving, intelligent manufacturing, smart grid, and smart medical and smart city [10]. Among them, the utilization of intelligent driving improves the degree of automation of vehicles. In the utilization of intelligent manufacturing, through the formation of an integrated intelligent system, activities can be carried out in the manufacturing process. Through the cooperation between human and intelligent machine, we can expand, extend and partially replace the traditional mental work. The utilization process of AI in the IoT of intelligent manufacturing is to realize the prediction of intelligent manufacturing through data acquisition and processing, human-computer communication and interaction, decision-making and judgment of data info, etc.

In addition, the construction of modern IoT is increasingly inseparable from the assistance of computational intelligence tech, mainly reflected in info collection, info extraction, info perception agent, data mining, service extraction and command classification. Among them, in the level of info and status collection, info display and processing, through the info extraction, the management info is perceived as agent, and the command and management node are generated. Through data mining, the rules and capabilities are calculated, and then stored in the database. Finally, the interactive access between intelligent terminals is realized.

4.2. Utilization trend of AI and computational intelligence in IoT

With the gradual maturity of AI tech and computational intelligence tech, their utilizations in the IoT will be further deepened in the future. On the one hand, the development of intelligent systems such as intelligent IoT system for environmental protection detection, intelligent IoT system for security assurance and intelligent IoT system for learning assistant is increasingly inseparable from the assistance of AI and computational intelligence, which makes people's life and work more and more intelligent. On the other hand, with the rapid development of AI and computational intelligence tech, the ability of data extraction, storage, processing and utilization has been valuably improved, and various platform services are becoming the ecological aggregation point of massive connection of IoT, which has laid a good foundation for promoting the business model reform of vertical industry in the future.

5. Conclusion

In summary, the utilization of AI tech and computational intelligence in the IoT organically extracts the related features and computational models of things, and realizes the interconnection of all tasks, thus establishing the info premise for the integration of cross specialty, cross discipline and industry. Through the research on the connotation and development status of the IoT, this paper analyzes the
influencing factors of the promotion of the IoT tech. By analyzing the utilization of AI and computational intelligence in the IoT, this paper studies the utilization strategy and development trend of AI and computational intelligence in the IoT.

Acknowledgments

Key scientific research platforms and projects of universities in Guangdong Province "Research on adaptive early warning system of intelligent home based on machine learning" (2018gkqncx102) and Scientific research project of Guangzhou Science and technology plan "Research on optical fiber sensing mechanism and optical fiber sensor based on liquid crystal media" (201707010496)

References

[1] Hao Wuwei. Utilization of artificial intelligence and computational intelligence in IoT [J]. Info systems engineering, 2017 (09): 92.

[2] Jia runliang. Research on artificial intelligence related technologies for IoT utilizations [J]. Computer knowledge and tech, 2016 (12): 32.

[3] Jiang Xiuchen, Luo Lingen, Yu Zhongmin, Fu Xiaofei, Sheng Gefu, Liu Yadong, Qian Yong. Key technologies and solutions of blockchain utilization in power equipment ubiquitous IoT [J]. High voltage tech, 2019,45 (11): 3393-3400.

[4] Li Miao. Utilization of artificial intelligence tech in IoT [J]. Digital communication world, 2019 (11): 175.

[5] Mao Rui. Utilization of artificial intelligence and computational intelligence in the IoT [J]. Info and computer (theoretical Edition), 2019 (14): 132-134.

[6] Wang Wanliang, Zhang zhaojuan, Gao Nan, Zhao Yanwei. Research progress of big data analysis method based on artificial intelligence tech [J]. Computer integrated manufacturing system, 2019,25 (3): 529-547.

[7] Xia Xianghong. Analysis of IOT tech and its utilization for smart grid [J]. Shandong industrial tech, 2016 (6): 195.

[8] Xu Yang, Wang Xiaofeng, he Qingyi. Multi agent decision info support tech in IoT [J]. Acta Sinica Sinica, 2017 (10): 2325-2345.

[9] Yang Zhen, Yang Ning, Xu agile. Research on artificial intelligence related technologies for IoT utilizations [J]. Telecom tech, 2016 (5): 16-19.

[10] Zhang Hua. Design and implementation of artificial intelligence image detection system based on IoT [J]. Computer measurement and control, 2017 (2): 25.