Application of Artificial Intelligence in Industrial Automation Control System

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Abstract. Automatic control system is an important part of industrial production and manufacturing. With the rapid development of computer technology, a new generation of intelligent technology represented by artificial intelligence has been applied to industrial automation system. This paper introduces the development of the current industrial automation control system in detail, and then describes the relevant theory of artificial intelligence technology. Finally, it describes the application of artificial intelligence technology in industrial automatic control system and its future development trend. This paper aims to provide a reference for the research of industrial automation control system.

1. Introduction

With the rapid development of social economy and the improvement of people's living standards, more and more attention has been paid to the future development of industrial automation control system. With the gradual improvement of the level of artificial intelligence technology, artificial intelligence technology is widely used in various fields. In the industrial automation control system, artificial intelligence technology can greatly improve the level of automation control, while reducing production costs. The organic integration of automation technology and artificial intelligence technology can promote the industrial automation control system to be more efficient, and promote the industry to achieve a leap forward. Therefore, in this environment, it has become one of the main research hotspots in related fields to carry out the application research of artificial intelligence in industrial automation control system, explore the future development path of industrial automation control system, and improve the intelligent level of industrial automation control system.

2. Development of industrial automation control system

Industrial automation control system has a large number of applications in the industrial field, mainly concentrated in power, mining, construction and other important infrastructure industries related to national living standards. There are three kinds of automatic control system applied in industrial production, including PLC automatic control system, industrial PC automatic control system, DCS automatic control system, as shown in Figure 1.
PLC automatic control system belongs to a kind of programmable control product. The main mechanism of realizing automatic control is to operate and control PLC by means of digital operation, so that the controller can execute the set instructions according to the content of programming and logical operation, so as to realize the comprehensive and effective control of mechanical equipment in industrial production.

Industrial PC automatic control system is divided into two forms according to the different industrial control computers, one is IPC industrial control computer, the other is compact PCI industrial control computer, the automatic control mechanism is using PC as the server and client of the system, PC has the functions of management and control. It is a comprehensive industrial automation control system, which can realize the timely sharing and exchange of production data and related information in industrial enterprises.

DCS automatic control system is a relatively new industrial centralized automatic control system. It can greatly improve the production efficiency, reduce the production cost and obtain greater economic benefits when applied to industrial production. It has a good development prospect.

These three kinds of industrial automation control systems are the most widely used systems in industrial production, but the functions of the systems are still relatively single, and they need to be designed according to the past experience and Enlightenment to play a role. Moreover, the ability of each system to analyze data is limited, and there is no perfect data feedback mechanism. Therefore, the overall application effect is not good, to the system failure or abnormal it is difficult to realize automatic analysis and judgment, and also requires manual control, which is not the real automatic control system.

3. Artificial intelligence technology

3.1. Principle of artificial intelligence

In the application of artificial intelligence algorithm, two kinds of equipment provide technical support, namely data processing equipment and computing equipment. Among them, the main function of computing equipment is to calculate huge data algorithm. Through the use of relevant equipment, part of the big data can be centralized processing, and the processing results are analyzed. Based on the processing results, the human intelligence and its intellectual response can be imitated accordingly. Artificial intelligence technology involves knowledge of many disciplines, such as sociology and natural science. It can help language and text processing, computer programming, UAV and so on. In addition, this technology must be based on a large number of data support.

3.2. Basic situation of artificial intelligence technology

With the continuous development of science and technology, computer technology has been integrated with modern production technology, creating advanced production technology, ushering in the era of intelligent production. At present, artificial intelligence technology has been widely used in many production fields, which greatly reduces the human and material resources needed by social
production, effectively alleviates the problem of resource waste, thus greatly improving the utilization rate of resources and reducing the production cost. Artificial intelligence is an important part of computer science and a challenging subject. By placing intelligent system in the robot, integrating human thinking and imitating human behavior, it can make it have human thinking and perception ability, and then can deal with various situations efficiently. With the gradual progress of artificial intelligence technology, artificial intelligence algorithm appears. Artificial intelligence algorithm, also known as machine intelligence, is highly marginal. The basic principle of this subject is to use intelligent robots to imitate the intelligent response of human beings. At present, artificial intelligence algorithm has been applied to many fields.

3.3. Characteristics and advantages of artificial intelligence applied to industrial automation control system

Artificial intelligence algorithm is closely related to many disciplines, such as computer science, mathematics, psychology and so on. It has very significant characteristics, mainly including the following four points: first, it has high reliability. Using artificial algorithm, we can realize the convenient operation of industrial automation control system, and then improve the working efficiency of industrial automation control system, at the same time, enhance the accuracy of its control, and finally improve the efficiency and quality of industrial production, which plays a great role in promoting the modernization of enterprises. Second, in the industrial design, if the artificial intelligence algorithm is applied, it is not necessary to master the actual dynamic and parameter changes of the control object in detail. Thirdly, for artificial intelligence algorithm, it is necessary to keep the consistency between the artificial controller and the driver, which is conducive to improving the accuracy of the artificial intelligence algorithm. Fourth, during the design of the controller, the use of artificial intelligence algorithm can significantly improve the ability of anti-interference, in addition, it can further improve the adaptability of information and data, which is conducive to accelerating the speed of design modification and expansion.

4. Application status of artificial intelligence in industrial automatic control system

With the rapid development of information technology, especially network technology, the continuous application of artificial intelligence theory in industrial production and automatic control is boosted. With the support of artificial intelligence technology, all kinds of problems in industrial automation control can be comprehensively recognized and systematically solved, and industrial automation control will be more intelligent, unmanned and autonomous. The artificial intelligence methods applied in the construction of industrial automatic control system include: neural network control platform, fuzzy control technology and expert decision system, as shown in Figure 2.

![Figure 2. The artificial intelligence methods applied in the construction of industrial automatic control system](image)
4.1. Neural network control platform
Artificial intelligence technology develops a neural network control platform by simulating the process of animal neural system perception, transmission and stress. The platform is connected by a number of functional components and networks, and generates neural-like network structure in the process of large-scale integration and parallel. On the basis of simulating biological neural network, data and data are processed by means of collection, processing, processing and decision-making information. Based on large-scale storage equipment, cloud platform and new generation Internet, the new generation of neural network control system has the possibility of realization, the ability of platform processing has been further improved, the distributed characteristics of various components and systems in the network are more obvious, the ability of receiving signals and identifying information is more accurate, and the interactive and effective imitation of neural network is realized. The industrial automatic control system can effectively improve the weight coefficient and dynamic level, and realize the automatic control of industrial production and processing through independent driving and decision-making in the case of no intervention and supervision.

4.2. Fuzzy control technology
In the process of industrial automation control, due to the time-varying and complexity of the controlled process, it is difficult to establish a more accurate mathematical model due to the influence of many factors. Therefore, the fuzzy logic control can be used to carry out the control technology of imitating human thinking without depending on the object model. The fuzzy control system has the function of collecting, processing and transforming the industrial data. It can feedback the collected data to the controlled object in the form of analog signal. Fuzzy controller is the core of artificial intelligence technology. In the application of industrial automation control system, different types of controllers are used to collect the data of the control object according to the system configuration and the characteristics of the control object. The common industrial automation fuzzy control system takes the fuzzy controller as the center, and includes the controlled object, detection device, data interface and execution structure. The executive structure is mainly composed of motor. According to the actual needs, different types of motors are used to execute the commands issued by the upper computer. In addition, the function of the detection device in the fuzzy control system is similar to the sensing device. The main function is to collect and transform the signal of the controlled object and transmit it to the upper computer through the data interface.

4.3. Expert control system
Expert control system in the field of industrial automation control has many advantages, such as reliable operation, strong versatility, relatively flexible control and processing. The reason why artificial intelligence technology can play an important role in the field of industrial automation control is that the functions of automatic learning and real-time monitoring are the main factors to realize automatic control. In the limited industrial structure knowledge base, the inference structure as simple as possible is used to meet the real-time requirements of industrial automation control system. The expert control system based on artificial intelligence can give full play to the advantages of the existing stage of artificial intelligence technology, and use computer information technology to achieve the acquisition and expression of professional knowledge, database construction and positive logical reasoning, etc., so it has the advantages of rapid response, real-time detection, self-healing and logical reasoning in industrial automation control system. In the design of expert control system based on artificial intelligence, it can be realized by using relevant models combined with the operation mechanism of artificial intelligence technology, and complex system logic reasoning can be realized depending on simple parameter setting. In addition, the current stage of artificial intelligence technology is established under the premise of classic logic reasoning, which can maximize the accuracy and rationality of the system, so as to maximize the advantages of artificial intelligence technology in industrial automation control system.
5. Conclusion
Artificial intelligence technology is a subject of continuous development. At present, artificial intelligence technology has been gradually applied to many fields. Artificial intelligence technology in industrial automation control system is becoming the core technology of future industrial development. Due to the limitation of existing technology level and application mode, artificial intelligence technology still has many limitations in industrial automation control system, which requires experts and scholars in relevant fields to reasonably apply artificial intelligence technology according to the development characteristics and actual needs of industrial automation technology, so as to further improve the overall performance of industrial automation control system.

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