Analysis on the Application of Artificial Intelligence Technology in Electrical Automation Control

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Abstract. AI technology organically integrates the info and intelligent content of electronics, telecommunications, computer and other fields and disciplines, can achieve accurate control operation, reduce the dependence on human intervention, and greatly improve the intelligent level of these fields, so it has important research value. Based on this, this paper first analyses the AI automation control theory, then studies the electrical automation control based on AI technology, and finally gives the specific application strategy of AI in electrical automation control.

Keywords: AI, Electrical Automation Control, Application

1. Introduction

With the iterative progress and maturity of modern info tech represented by AI, it has been widely and deeply studied and popularized in many fields, especially in the field of electrical automation control, which greatly promotes the progress of electrical automation. AI tech organically integrates the info and intelligent content of electronics, telecommunications, computer and other fields and disciplines [1]. It can simulate human consciousness or thinking and be used in various fields. AI tech has the advantages of computer, can achieve accurate control operation, reduce the dependence on human intervention, effectively avoid unnecessary errors due to human factors, so its application in related fields can greatly improve the level of intelligence in these fields.

With the continuous optimization and growth of social and economic level, the requirements of electrical automation control are becoming higher and higher. In order to ensure the normal and stable operation and use of electrical equipment and facilities, it is necessary to realize the accurate control and automatic control of the entire electrical system [2, 3]. AI tech as a refined branch of computer tech and an important part of its application in the field of electrical automation control can greatly replace the traditional manual control and operation. The application of AI in electrical automation can not only greatly save human resources and cost, but also effectively improve the quality of electrical engineering, increase the safety of electrical engineering, so as to ensure the stable operation of electrical engineering.

In addition, with the continuous optimization and iteration of AI tech, the current AI tech has developed to a higher level [4]. AI tech under the blessing of electrical automation equipment is infiltrating into various fields to ensure the stable development of people's life and production. For
high-density and high-precision electronic components, AI utilization in the control process of electronic equipment greatly improves the control efficiency and precision. Therefore, in the field of electrical automation control, the utilization of AI tech is more and more in-depth, which effectively guarantees the automation level of electrical equipment and facilities.

In order to further enhance the stability and reliability of the electric automation control system and meet the work demands under the background of intelligence, we should draw up a perfect plan in the process of applying AI tech in electric automation control, follow the working principle of modernization and advanced nature, and coordinate the relationship between all aspects of work. In short, the progress of AI tech and the organic integration of electrical automation control can effectively ensure the smooth production and life, with its unique advantages. Therefore, it is of great practical value to study the utilization of AI tech in electrical automation control.

2. AI automation control theory

2.1. Automation control theory
With the development of computer with powerful computing power and the continuous improvement of aerospace tech, the modern control theory represented by optimal control has stepped on the stage of history. Electrical automation control theory mainly includes several aspects as shown in Figure 1. The optimal control is the optimal control for a given performance index. Stochastic control is mainly used to solve the control problem under noise interference. Adaptive control is used to change the parameters or structure of automatic control to ensure the control quality. Robust control is mainly used to improve the stability of control system. Predictive control is to predict the future output based on historical info and realize rolling optimization. Internal model control (IMC) is a kind of controller designed with the idea of inverse system.

![Figure 1. Main contents of electrical automation control theory.](image)

2.2. Development of automatic control theory
For MIMO linear systems, Pontriagin's maximum principle, Behrman's dynamic programming and Kalman's linear filtering and estimation theory are the basis of automatic control theory. The state space description method is a system mathematical model, which is used to solve the control problem of complex system [5]. At present, the traditional theory of electrical automation control is facing the challenges of uncertain model, highly nonlinear and complex task requirements. In addition, many complex production processes and control objectives that are difficult to achieve can be operated by skilled operators, technicians and experts to obtain satisfactory control effect. However, there are large human disturbances in these processes, so it is necessary to make full use of AI tech and fusion control theory to solve the control problems of complex systems.

2.3. AI intelligent control theory
AI intelligent control is based on the development and combination of artificial intelligence, control theory and computer science. Through the organic integration of several aspects as shown in Figure 2, the development of AI intelligent control will be promoted. Secondly, through AI tech to simulate and realize human intelligence, and then realize or partially realize the automation of mental work. The
machine simulates human intelligence from the external function through symbolic reasoning including logic and numerical value. From the perspective of bionics, the human brain model is established by establishing the relationship between neuron model and neuron. Intelligent behavior is a process of continuous evolution based on the mode of perception behavior, which shows the behavior characteristics of self-learning, self-adaptive, optimization and tuning in control.

**Figure 2.** Integration elements of AI intelligent control.

2.4. AI's intelligent hierarchical control

The level of AI intelligent electrical control includes organization level, coordination level and execution level. Among them, at the organizational level, high-level decision-making, such as perceiving environment and pursuing goals, can be studied by using the method of artificial intelligence [6]. At the coordination level, the discrete event dynamic system is mainly studied by operational research. At the executive level, the basic automation level oriented to equipment parameters can be designed with the method of conventional control theory. AI automation control is a process in which intelligent machines achieve their goals independently. In structured or unstructured, familiar or unfamiliar environments, AI automation control can perform tasks specified by human beings autonomously or interactively with human beings.

3. Electrical automation control based on AI tech

3.1. AI concept of electrical automation control

AI electrical automation control is intelligent simulation of intuitive reasoning and trial and error by machine. Secondly, in the process of analysis and design of electrical automation control system, the intelligent control system is realized. In this process, electrical automation control can be realized independently without too much manual intervention. AI electrical automation control includes typical characteristics of learning ability, adaptability, fault tolerance, robustness, organizational functionality, real-time, human-computer cooperation, etc., as shown in Table 1 below.

| Function features | Detailed descriptions                                      |
|-------------------|------------------------------------------------------------|
| Learning ability  | Improve performance based on environmental info            |
| Adaptability      | Adapt to changes in object, and operating environment       |
| Fault tolerance   | Fault self-diagnosis, shielding and self-recovery           |
| Robustness        | Insensitive to interference                                |
| Organizational    | Self-organization and self-coordination of complex tasks   |
| Real time         | Good real time response                                   |
| Machine cooperate | Friendly human-computer interaction                         |

3.2. AI intelligent electrical automation control structure

AI intelligent electrical automation control system has the functions of memory, learning, info processing, formal language, heuristic reasoning, etc., and describes the dynamic feedback of the
system. AI intelligent electrical automation control includes expert control, CNN control system, fuzzy control system, learning control system and other branches. The knowledge representation and knowledge reasoning tech of AI tech are used to simulate the complex electrical automation control problems solved by domain experts. Artificial neural network control, built neural network control or neural control.

In the neural network control system, its utilization in electrical automation control is mainly based on the model of various control structures as the object model, as the controller, in the control system to play the function of optimization calculation, through the combination with other intelligent control, and provide non parametric object model and reasoning model.

3.3. AI fuzzy electrical automation control system
The basic idea of AI fuzzy electrical automation control is to use machines to simulate human control of the system. Fuzzy control uses fuzzy set theory to transform the natural language of human control strategy into the control algorithm described by algorithm language acceptable to computer. The control system consists of three parts: fuzzification, fuzzy reasoning and precision. In the fuzzy control level, the system info is fuzzified; in the fuzzy reasoning level, the fuzzy control quantity is obtained through fuzzy rule reasoning; in the precise level, the fuzzy control quantity is converted into the accurate quantity, and the final control value is output. The system architecture is shown in Figure 3 below.

![Figure 3. AI electrical control system architecture.](image)

3.4. Utilization of AI in electrical automation control
The specific utilization of AI in electrical automation control mainly includes electrical equipment control system, fault diagnosis expert system, daily operation system and electrical control system. Among them, the utilization in the electrical control level is to ensure the safe operation of the system and improve the working efficiency of the system. The utilization of neural network in electrical fault diagnosis is to use neural network reasonably to deal with electrical fault. Secondly, the specific utilization in daily operation is mainly to avoid errors, so as to effectively improve the quality and efficiency of electrical operation.

In addition, in the utilization level of electrical control, promote the reform and improvement of system tech, and accelerate the development speed of electrical industry. In the utilization level of automation equipment, it can improve the operation efficiency of electrical automation equipment, conduct better research and analysis, and improve the operation efficiency while reducing the cost.

4. Conclusion
In summary, AI tech under the blessing of electrical automation equipment is infiltrating into various fields to ensure the stable development of people's life and production. For high-density and high-precision electronic components, AI is applied in the control process of electronic equipment, which greatly improves the control efficiency and accuracy. Through the research of AI automatic control theory, this paper analyzes the AI intelligent electrical control level and its control level. Through the
analysis of electrical automation control based on AI tech, the concept of AI electrical automation control, the structure of AI intelligent electrical automation control and the specific utilization strategy of AI in electrical automation control are studied.

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