

Research Article

Application and Thinking of Artificial Intelligence in Electrical Automation

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With the vigorous development of China's market economy, a new generation of artificial intelligence technology has also developed rapidly, which has strongly promoted the optimization and improvement of China's electrical automation control system. The use of artificial intelligence technology in power automation systems mainly has the following two advantages: it can reduce the manufacturing time of power products, thereby increasing the number of workers manufacturing power products and promoting enterprises to conduct larger-scale machine manufacturing, thereby improving the comprehensive economic benefits of enterprise machine manufacturing, but also improve the quality of manufactured products of electric power products. Since the machine control of artificial intelligence is more efficient than manual manufacturing, it reduces the manufacturing problems caused by the subjective factors of manufacturing workers to a certain extent and thus improves the qualification rate of machine production. Electrical engineering plays an important role in China's urban development, and automatic control is an important part of electrical engineering, which can have a direct impact on the quality of electrical engineering. Therefore, in order to promote the healthy development of cities in China, this paper studies the application of artificial intelligence technology in electrical engineering automation by analyzing relevant data, in order to provide a reliable basis for relevant personnel to carry out their work.

1. Introduction

Now, people have been able to see electrical automation control systems and robots in many enterprise manufacturing workshops. This equipment [1, 2] has become the main driving force to promote the socialized manufacturing of enterprises at this stage, which can reduce the production cost and improve the manufacturing efficiency of the enterprise. Electric automation control and robots are a reinnovation of conventional production methods, which in turn promotes a deeper reform of enterprise manufacturing and thus forms a benign chemical manufacturing reaction system. Fully integrating industrial AI and electrified chemical automatic control can not only make the overall chemical manufacturing production line of the enterprise more continuous and efficient but also reduce labor costs to a certain extent and thus achieve good results.

Under the condition of informatization, the organic combination of information technology and industrial automation and improving the production efficiency of factories are not only an important trend of China's industrial development but also an important goal of China's industrial development in the new era. Artificial intelligence technology is an important milestone in the development of information technology. The application of artificial intelligence technology in electrical engineering automation control can effectively improve the data analysis, calculation, and processing capacity in factory electrical automation control, so as to effectively improve the production efficiency of factory electrical automation. Compared with the traditional control mode, the application of artificial intelligence technology in the field of electrical engineering automation control can solve some problems that cannot be solved by traditional control technology, which makes the factory electrical auto-

mation control more and more efficient and convenient. Based on the analysis of the characteristics of artificial intelligence technology, this paper analyzes and introduces the application of artificial intelligence technology in factory electrical automation control.

In the traditional electrical control work, the basic work is controlled and managed by manpower. Due to the large number of electrical system equipment and complex and difficult management and control and because there are many problems that are difficult to control and solve, the operation errors of technicians often occur. Therefore, the manual operation ability in the traditional technology directly affects the control ability of the electrical engineering automation system. Once there is an operation error, the whole electrical engineering will be seriously affected, which will prolong the construction period, not only losing a lot of economic costs but also affecting the work efficiency of the automation control system. In the electrical control work, the application of artificial intelligence technology effectively avoids the risks caused by previous staff operation errors, ensures the efficient implementation of the whole project, and avoids improper operation. At the same time, it also improves the work efficiency, ensures the efficient and stable operation state of the electrical system, and realizes the efficient operation of the automatic control system of electrical engineering. Artificial intelligence realizes the effective control and management of electrical automation. Combined with the fuzzy set theory of the intelligent system, it adopts the control and management mode of fuzzy language and fuzzy reasoning, which can provide the basic management mode for the system, ensure the stable operation of electrical engineering automation system, and provide the main development direction for the progress of engineering automation. One of the processes for the application of artificial intelligence in electrical engineering automation is shown in Figure 1.

2. The Evolution of AI in Electrified Manufacturing

Simple and fast product design ideas are the main advantages of AI. If people apply AI thinking to electrified product design, they can well avoid the drawbacks of conventional product design [3]. In the conventional industrial electrification control design, the control object modeling is the key to realize the control function, but because the actual work process will be controlled by the external environment, there is often a problem of mechanical failure in mass production. In addition, due to the different fixed data types of control object modeling, the difficulty of engineering design is further increased. Compared with the conventional electrical manual control, the engineering design of AI technology is relatively simple [4]. Only the relevant practitioners are required to program the robot, which can reduce the difficulty of AI product design and improve the overall convenience of work.

2.1. AI Is a Breakthrough to Conventional Electrification. Compared with conventional Chinese power management systems, AI electrical control has the following three advan-

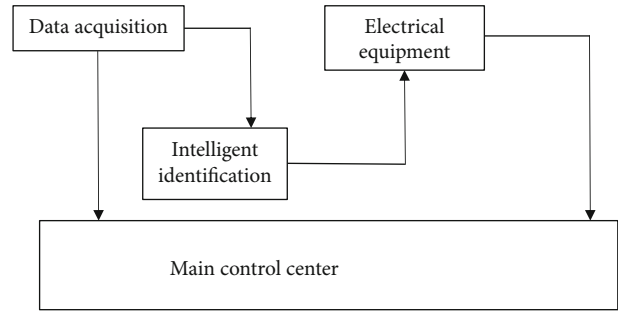


FIGURE 1: Application of artificial intelligence in electrical engineering automation.

tages: AI systems not only have great information acquisition capabilities but also have great transmission capabilities, and the time utilization rate of information processing and processing is very high, and the transmission effect of the signal is good, as shown in Figure 2.

With the development of China's economy and society, the cost of labor production has also shown an increasing trend. Correspondingly, due to the extensive application of intelligent technology in electrical automation control, the ratio between personnel and mechanical equipment in production can be reduced to a certain extent, and thus, production costs can be reduced to a certain extent. Since the AI manufacturing process is more sustainable and can also reduce errors caused by the subjective reasons of manufacturing workers to a certain extent, AI technology also has more cost effectiveness in electrified control system products. One of the physical diagrams of the application of AI in electrified manufacturing is shown in Figure 3.

2.2. The Benefits of AI in Electrification. The computer is equivalent to the brain of AI, so in the actual manufacturing process, the relevant electronic manufacturing personnel only need to input the corresponding program to the robot, and then, the AI can adjust the corresponding action of the machine. It is worth mentioning that AI also has strong logic analysis capabilities. It can automatically organize and decompose all signals that appear in production during the manufacturing process, so as to predict possible production failures and make timely adjustments, to ensure the stability and continuity of the entire manufacturing, thereby improving the efficiency of the manufacturing process.

The new generation of AI has great logic [5, 6]. It can predict possible product problems in time by decomposing key signals, thereby improving product stability. In addition, because the computer has great convenience, it can reduce the production pressure of enterprise employees to a certain extent, thereby improving the production efficiency of the enterprise. In addition, because AI itself has certain computer data processing capabilities as the basis, it can also more accurately control the working angle, orientation, and pressure of mechanical equipment, thereby improving the production standard of products.

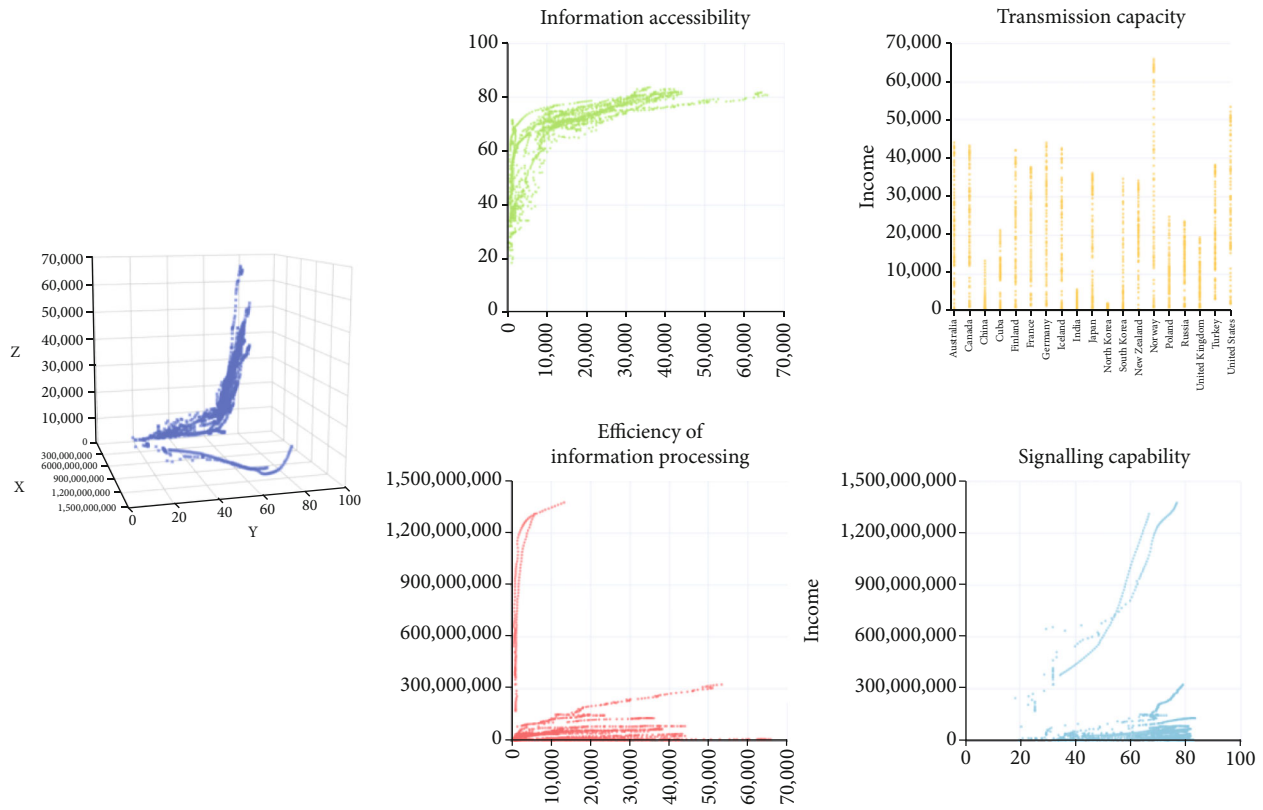


FIGURE 2: Superiority of artificially intelligent electrical control.

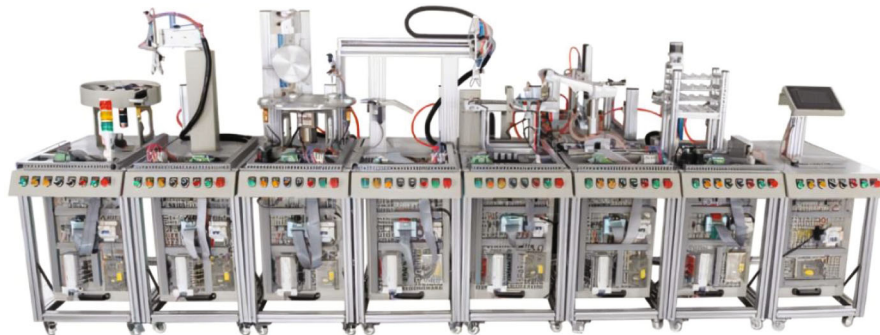


FIGURE 3: AI application in electrified manufacturing.

3. Application of AI in Electrical Automation

The rapid development of computer technology has caused an impact on the conventional electrification management system and thus formed a new type of time-sensitive AI model. Using AI technology, the monitoring of target equipment and its intelligent analysis can be well carried out and it can also be used to classify complex information systems. AI technology can not only realize quantitative analysis through mathematical models but also realize qualitative analysis using the control theory, so as to better integrate qualitative analysis and quantitative analysis, so as to achieve real management intelligence. AI technology methods generally include the expert control system, neural network control system, fuzzy management, and its comprehensive

intelligent management technology. Among them, the technical methods of modern intelligent control systems are usually based on various computer algorithms, including the ant colony algorithm, immune computing, and genetic algorithm. Here, the two systems are briefly analyzed first.

3.1. Control System. The neural network [7] controller has strong bionic characteristics; it is a network controller designed based on the working principle of biological neurons. Neural network controllers are usually composed of hierarchical organization structures and simple adaptive devices, and based on this, large-scale network connections can be realized, and thus, the control of the entire device and its related signals can be enhanced. In a network controller, the signal transmission method of all neurons is

usually in a nonlinear fashion, what humans call a “black box model.”

Fuzzy control [8, 9] includes access terminals, monitoring equipment, access and output ports, mechanisms, controlled objects, and inspection systems. The basic principle of fuzzy control is shown in Figure 4.

The following is a brief description of the fuzzy control system and inspection equipment: the fuzzy control system is the computer of the fuzzy controller. It is generally based on the theory of a certain normative reasoning language and then carries out refined management, fuzzy decision, and fuzzy quantitative management. Measuring equipment has the function of electrical signal, it mainly converts electrical signal into digital signal, and electrical signal generally involves pressure, temperature, speed, and so on. The measuring equipment is the key part of the fuzzy system and plays a key role in ensuring the reliability and accuracy of the whole system. Figure 5 shows the power system simulation and 3D visualization processing using AI management.

3.2. Optimize Product Design. The design process of electrical production has great uncontrollability. Due to the influence of many factors in the actual manufacturing process, resulting in a large backlog of electrical appliance production, manufacturers must adjust the corresponding production lines. This will cause great losses to the overall manufacturing company. However, as AI technology gradually penetrates into electrified product control, manufacturers will be able to optimize the AI technology model by professional staff to better meet the market environment and people’s needs, which can greatly shorten the time required for electrical products. Manufacturing cycle, increasing total manufacturing efficiency and cost-effectiveness. At the same time, due to the great operability and accuracy of the new generation of AI settings, it can better monitor the production qualification rate of electrical products and thus achieve good manufacturing economic benefits.

At present, in the work flow of the electrical automation control system, the electrical automation control system often breaks down due to robot movements, mechanical equipment failures, and other problems, thus affecting the normal production. Using AI [10, 11] directly in the electrical automation control system makes the electrical engineering and its intelligent fault diagnosis process produce complex changes, thus transforming it into a genetic algorithm or using the nonlinear relationship to directly apply AI technology to electrical automation. In the genetic algorithm [12, 13] of the control system, the precise performance of the genetic algorithm is improved, so that the electrical automation control system can make intelligent judgments. The application of a new generation of AI information technology in the industrial electrical automation control system will greatly improve the engine’s obstacle handling efficiency, thereby enhancing industrial capabilities. Therefore, in the process of transformer fault inspection, if only the conventional fault gas analysis method is used, the exhaust gas of the transformer is collected, and then, the gas is statistically analyzed. Reasonable handling measures [13–15], in

this whole set of detection process, often have to spend a lot of technical personnel’s spirit and working time, and the application of AI technology can be used in electrical automation control systems to intuitively analyze the entire system. If there is a fault, then, according to the analysis method of AI technology, we can quickly find out the reasonable treatment measures, so that the detection speed and efficiency are greatly improved.

When carrying out AI technology design work, when engineering designers lack rich technology, knowledge, and valuable work experience, the designed AI system often cannot adapt to the actual work needs at all. In the conventional electronic technology design work, the method of combining experiment and experience is often adopted, while the design work of electrical equipment is a highly specialized and complex engineering field. The work of equipment is also quite complicated, so the management of equipment at work requires employees to have a lot of professional knowledge reserves. When AI information technology is used in the intelligent control of equipment, because the computer is used as the work carried out by the human brain, people must perform system programming while performing computing actions on the computer, so as to jointly complete the intelligent work of the equipment, and then, the computing power of the electrical automation control system can be greatly enhanced. In the application design process of AI technology, it has also begun to gradually move from the conventional manual design method to the new generation of the AI product design method. At present, the design of CAD engineering [15] has been applied and people can design a completely finished product in a short time through it, so as to effectively simulate the effect of the finished product, so that the design of the product can be completed efficiently, thus ensuring the quality of the finished product. Therefore, through the extensive use of AI technology in electrical automation control systems, the accuracy of industrial production technology can be greatly improved.

3.3. Optimizing Electrical Automation Equipment. For the conventional industrial electronic automation control system, it must be equipped with special electronic automation design and control personnel and also has a high demand for personnel quality, so the production cost of personnel is also high. In the conventional industrial electronic control system, manufacturing companies should also allocate the corresponding specialized personnel and some factories even adopt the management mode of apprenticeship for corresponding work, but in the process, some productive technical errors are inevitable. Effectively infiltrating AI technology into intelligent equipment such as production electricity can greatly reduce the overall cost. Manufacturers can also hire special staff to program the robot, so as to more effectively improve the precision and accuracy of the operation of electrified products, thereby improving the manufacturing efficiency of the whole machine, reducing the cost of production, and achieving good economic benefits.

In the process of realizing intelligent production, due to the relatively cumbersome operation of the conventional

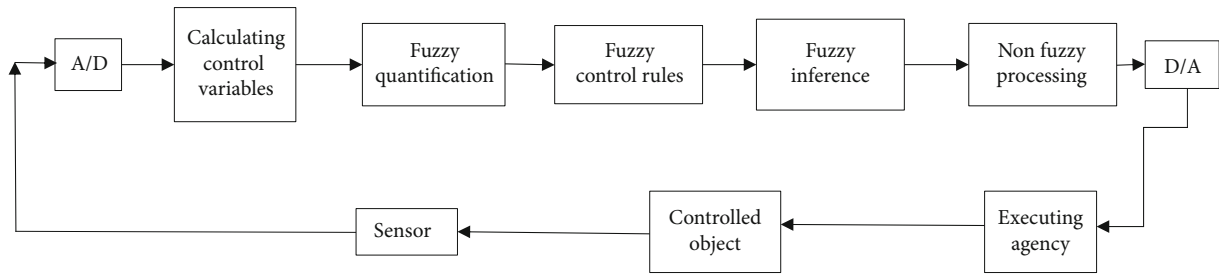


FIGURE 4: Flow chart of the basic principles of fuzzy control.



FIGURE 5: AI-based 3D power system simulation.

electrical automation control system, the application of the intelligent control system has put forward a great professional demand for personnel and it is also very easy to cause the system to produce artificial intelligence during the operation process. Problems, preventing the entire intelligent control system from operating normally. The introduction of AI technology has effectively solved this situation, and the operation complexity has also been greatly reduced, so that the conventional electrical automation control system can effectively operate intelligently in a true sense. The introduction of AI technology enables more efficient remote operation, effectively optimizes the system, and greatly shortens the workflow of the control system. In the process of information system operation, the use of AI technology can better identify system faults, more effectively obtain data information about the normal operation of information systems, and realize the collection and classification of data information resources, so as to facilitate rapid and accurate search to a reasonable solution to the problem.

3.4. Effective Troubleshooting. The conventional electrical management system does not have intelligent technology, so in the actual industrial production process, experienced maintenance workers can complete the inspection of relevant components on the production line and use these methods to eliminate corresponding faults. This troubleshooting method mainly has the following two defects: the repair worker's troubleshooting work is inefficient, but it may also lead to greater economic losses due to the repair

worker's wrong judgment; the repair worker is in the process of repairing. It often prolongs the overall manufacturing time of the factory and therefore increases the production cost of factory manufacturing in a disguised form. The introduction of AI technology into the control system of electrified production is like configuring a layered and systematic mechanical nerve for this production line and through related AI modules, including fuzzy controllers. The mechanical problems are collected, so that the manufacturing personnel can find the corresponding problematic machinery through the unique fault codes of the machinery, thereby improving the work efficiency of troubleshooting. It is worth mentioning that industrial AI also has the function of automatic adjustment, that is to say, it can timely adjust the machine manufacturing model connected with it by collecting corresponding data information and making appropriate classification, so as to better reduce the failures that occur in the factory, thereby improving the overall manufacturing efficiency of the factory. The most important AI technology system applied at this stage is fuzzy control, which is accomplished by adjusting the transformation relationship between AC and DC voltages in a timely manner.

3.5. Consolidate the Daily Operation and Maintenance of Electrical Systems. AI [12, 14] is relatively simple compared to conventional automatic operations. In the work flow of electrical systems, some operations still require electric workers to complete manual operations but such situations are on the one hand endangering power. The working personnel are healthy, so it is very troublesome in the long-term operation process. At the same time, during the work process, a small amount of exhaust gas that is harmful to the body is also generated due to the electricity. On the one hand, it is to improve the labor cost of the power industry, but at the same time, it cannot guarantee the accuracy of its work, which consumes a lot of manpower and money, but at the same time, it also lays a solid foundation for establishing a good image for the power industry. AI technology is a milestone in the development of electrical systems. AI technology makes the development of the power industry more and more specialized and at the same time promotes the development of the power industry to become better and better. In the near future, AI technology will be widely used in all aspects of the power industry, not just electrical systems.

4. Conclusion

AI fills the power automatic control system with wings and, it fills the production process with nerves and puts eyes on the power management, thereby making the entire power production process more efficient, sustainable, and timely. Thereby, the cost of the enterprise is reduced while the production efficiency is improved and a good output economic benefit is obtained.

This paper mainly focuses on the application of artificial intelligence in electrical engineering automation. Firstly, it summarizes the application importance of artificial intelligence technology in electrical automation and then highlights the application value of artificial intelligence through real-time monitoring of the equipment operation status, strengthening the electrical control process design, optimizing fault diagnosis, etc., so as to ensure the steady improvement of the electrical engineering automation level and promote the electrical engineering industry to a new height and depth.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

- [1] D. P. Anderson, "Public computing: reconnecting people to science," in *Conference on shared knowledge and the web*, vol. 6, pp. 4–10, Madrid, Spain: Residencia de Estudiantes, 2003.
- [2] W. D. Nordhaus, "The Progress of Computing," 2001, <http://arxiv.org/abs/285168>.
- [3] V. Natarajan, S. Gurumurthi, and A. Sivasubramaniam, "Is conventional power management+ prefetching=DRPM for server disks," in *Eighth Workshop on Computer Architecture Evaluation using Commercial Workloads (CAECW-8)*, San Francisco, CA, USA, 2005.
- [4] P. Singh and J. S. Lather, "Power management and control of a grid-independent DC microgrid with hybrid energy storage system," *Sustainable Energy Technologies and Assessments*, vol. 43, p. 100924, 2021.
- [5] C. Zhang and Y. Lu, "Study on artificial intelligence: the state of the art and future prospects," *Journal of Industrial Information Integration*, vol. 23, p. 100224, 2021.
- [6] M. Cui and D. Y. Zhang, "Artificial intelligence and computational pathology," *Laboratory Investigation*, vol. 101, no. 4, pp. 412–422, 2021.
- [7] J. Jiang, M. Chen, and J. A. Fan, "Deep neural networks for the evaluation and design of photonic devices," *Nature Reviews Materials*, vol. 6, no. 8, pp. 679–700, 2021.
- [8] D. Kontogiannis, D. Bargiotas, and A. Daskalopulu, "Fuzzy control system for smart energy management in residential buildings based on environmental data," *Energies*, vol. 14, no. 3, p. 752, 2021.
- [9] B. Moaveni, F. Rashidi Fathabadi, and A. Molavi, "Fuzzy control system design for wheel slip prevention and tracking of desired speed profile in electric trains," *Asian Journal of Control*, vol. 24, no. 1, pp. 388–400, 2022.
- [10] S. D. Bala, M. K. K. Rony, K. Islam et al., "Weather and Covid-19 outbreak correlation in Dhaka district Bangladesh," *Science Progress and Research (SPR)*, vol. 1, no. 4, pp. 171–175, 2021.
- [11] I. Siraj and P. S. Bharti, "3D printing process: a review of recent research," *Surface Plasmon Resonance*, vol. 1, no. 3, pp. 127–137, 2021.
- [12] P. M. Amisha, M. Pathania, and V. K. Rathaur, "Overview of artificial intelligence in medicine," *Journal of Family Medicine and Primary Care*, vol. 8, no. 7, pp. 2328–2331, 2019.
- [13] V. Sugumaran, Z. Xu, P. Shankar, and H. Zhou, *Application of Intelligent Systems in Multi-Modal Information Analytics*, Springer, 2019.
- [14] K. W. Johnson, J. Torres Soto, B. S. Glicksberg et al., "Artificial intelligence in cardiology," *Journal of the American College of Cardiology*, vol. 71, no. 23, pp. 2668–2679, 2018.
- [15] G. Kaur and S. S. Garima, "Functional matrix hypothesis: a review of literature," *Surface Plasmon Resonance*, vol. 1, no. 2, pp. 33–42, 2021.