Research on Application of Artificial Intelligence Technology in Intelligent Manufacturing

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***ABSTRACT.** At China Nineteenth National Congress of the Communist Party, General Secretary Xi Clearly Pointed out That We Should Accelerate the Development of China's Manufacturing Industry, Strive to Build China into an Advanced Manufacturing Powerhouse, and Further Promote the Integration of Information Technology and Industrial Manufacturing. Thus, China's Manufacturing Industry Will Be Featured with Smart Information, Informatization and Digitization. in This Article, the Basic Content of Artificial Intelligence Technology and Intelligent Manufacturing is Firstly Elaborated. on This Basis, the Specific Application of Artificial Intelligence Technology in Intelligent Manufacturing is Clarified. This Part Mainly Uses Machine Vision and 4d Printing Technology as Examples. the Main Purpose of This Article is to Accelerate the Development and Application of Intelligent Manufacturing Technology and Industry under the Guidance of Artificial Intelligence Technology.*

***KEYWORDS:** Artificial intelligence, Intelligent manufacturing, Machine vision, 4d printing*

1. Introduction

For a long time in the past, the continuous development of human society was mainly due to the improvement of productivity brought about by industrial progress. The advancement of industrialization mainly relied on the effective systems improvement such as automation, digitization and information technology, which greatly increased the economies of scale. However, the productivity level of human society has only increased by a few percentage points, according to the statistical survey released by the OECD. On this situation, people began to think about new ways to greatly increase social productivity. Under the demand of economic scale development, intelligent manufacturing becoming the driving force of a manufacturing technology has become a hot issue in all sectors of society.

2. Artificial Intelligence and Intelligent Manufacturing

2.1 Artificial Intelligence

Artificial intelligence is abbreviated as AI, which is the intelligence expressed by human-made machines. Artificial intelligence technology refers to the technology that humans present human intelligence through computer programs. The core problem of its main research is to construct some basic abilities such as learning, communication, perception, operating equipment and using tools, which are similar to or beyond humans. Recalling the development process of artificial intelligence, it has mainly experienced three stages of birth, formation and development. Turing, a pioneer researcher of artificial intelligence, proposed the mathematical model of the Turing machine, an ideal computer in the 1930s, and then proposed The important argument of "machines can think".[1] Since then, artificial intelligence has made many achievements in machine learning, theorem proofs, and expert systems. Subsequently, many countries have conducted research on artificial intelligence, and artificial intelligence technology has entered the development stage since then. Up to now, the main research and application areas of artificial intelligence technology include the following aspects: machine learning, programming, expert systems, neural networks, pattern recognition, machine vision, intelligent retrieval and other aspects.

2.2 Intelligent Manufacturing

The Chinese government has proposed a *Made in China 2025* strategic plan. Since its introduction, *Made in*

China 2025 has attracted widespread attention at home and abroad. The strategy further clarifies that smart manufacturing is the main direction of our country and realizes China's manufacturing transforming into a manufacturing powerhouse. Intelligent manufacturing is a strong requirement for the transformation and upgrading of China's manufacturing industry; it can also provide important development opportunities for the leap-forward development of China's manufacturing industry. Our government divides China's manufacturing industry into three stages. In the first 10 years, we strive to enter the second matrix; in the second decade, we strive to enter the forefront of the second matrix; and in the third decade, we will catch up with the United States and become a global manufacturing industry. The Regulations further establish the basic principles for China to become the second strongest country in the manufacturing industry: focusing on talent, environmentally friendly development, innovation-driven, taking a new industrialization development path, focusing on improving the quality of manufacturing, and continuously improving economic benefits, which is constantly the main goal of accelerating the information technology and manufacturing integration.[2] The main contents of smart manufacturing are: to promote the upgrading of basic industries, to accelerate the adjustment of manufacturing structure, to accelerate the construction of high-quality brands, and to establish manufacturing and production services. The main development areas of smart manufacturing are: biomedicine, marine engineering equipment, CNC machine tools, aerospace equipment, power equipment, agricultural machinery, new energy vehicles, etc.

3. The Application of Artificial Intelligence Technology in Smart Manufacturing

The scientific and technological revolution has transformed human society from an industrialized society to an informationized society, and also transformed manufacturing into an information-driven manufacturing industry. The establishment of an information-based manufacturing system is to better adapt to the complex market environment and diversification. Market demand, effectively process a large number of complex information, and further enhance the flexibility and sensitivity of the manufacturing system. Under this situation, people began to explore the application path of artificial intelligence in manufacturing. What role will technology play in China's manufacturing? It is generally recognized that the research and development of artificial intelligence will reduce the production of manufacturing. Cost, improving product quality in manufacturing, and improving production efficiency and promoting the national economy are of great significance.

3.1 Application of Machine Vision in Intelligent Manufacturing

With the informatization construction of manufacturing industry, intelligent manufacturing technology has increasingly become a key technology to promote manufacturing automation and informatization. The most basic work in the manufacturing system of intelligent manufacturing is the collection and collation of information. Information construction can be intelligent. The decision of the manufacturing system provides a strong basis. Machine vision technology has gradually gained popularity in intelligent manufacturing due to its powerful flexibility. The main purpose of machine vision technology is to perform visual inspection. This technology is mainly used to acquire, identify, detect, analyze and process images. The main advantage of machine vision in intelligent manufacturing is that it does not require contact with the detected object. To achieve detection, this detection method is widely used in detection due to its reliability and safety. Machine vision technology can acquire and process infrared, ultrasonic and microwave through sensors in a timely manner, which can be said to be an extension of human vision to a certain extent. In the entire large system of intelligent manufacturing, machine vision is mainly used in the following aspects: the objects need to be positioned; some workflows in traditional manufacturing have widely used intelligent robots; there are different positions of robots and parts in the application of intelligent robots.[3] The problem of docking, which makes it difficult for the robot to process according to the original program, and the emergence of machine vision technology can solve this problem well; the dimensions need to be measured; machine vision technology uses image processing; optical imaging and computer imaging technology actively detect object information and highly match the three-dimensional characteristics of objects, thereby effectively enhancing the accuracy and efficiency of measurement.

3.2 Application of 4d Printing Technology in Intelligent Manufacturing

4D printing technology is an extension and upgrade of 3D printing technology. This technology is a revolutionary technology developed by MIT and Stratasys Co., Ltd. to accelerate the molding of materials. Its main operating method is to use 4D printing technology to be designed and embedded in the deformed product, and the product assembly is carried out under the support of specific conditions. The use of 4D printing

technology can create new and more intelligent things. Applying it to smart manufacturing is bound to bring a good economy benefit. The first is the application of 4D technology in the manufacture of military weapons. The process of using 4D printing technology to produce weapon equipment is to deploy and shape on the basis of semi-finished product manufacturing, and then use recycling and redeployment. The weapon products produced by this technology can be used at any time. We should optimize the settings according to the environment and the target of the attack, so as to effectively improve the military combat performance. The intelligent materials of the smart weapon equipment can effectively sense the changes of the external light, freely change colors according to different environments, and enhance the concealment and security of military combatants. At the same time, the intelligent material automatically adjusts the thickness and breathability of the combat uniform according to the temperature change, and activates the bulletproof function according to the external force of the equipment. 4D printing technology has also been further applied in micro military robots. Micro robots are mainly used in reconnaissance in military battlefields. 4D printing technology provides certain technical support for the manufacture and movement of micro robots. The precise design of materials will Further enhance the flexibility of micro robots.

4. Conclusion

In summary, China's manufacturing industry has mainly experienced four development stages: the mechanization stage of Industry 1.0, the electrification stage of Industry 2.0, the information stage of Industry 3.0, and the intelligent stage of Industry 4.0. Germany and the United States respectively proposed Industry 4.0 and industrial Internet construction, while China proposed the concept of "Made in China 2025". Promoting industrial intelligent manufacturing is the main goal of China's industrial development. Artificial intelligence technology provides important technical support for China's industrial intelligent manufacturing. The large-scale application of 4D printing technology in the military field is a good example, and so it is to the innovative research of machine vision technology in intelligent manufacturing.

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