

Application Status and Development Trend of Artificial Intelligence in Manufacturing Industry

Yuxin Hu¹, Lu Zhang², Jiangong Liu¹, Yong Li¹

1.Hebei Taihang Machinery Industry Co., Ltd. Shijiazhuang 052160, Hebei, China;

2.S&T Department, Hebei GEO University, Shijiazhuang 050031, Hebei, China

Abstract: Artificial intelligence technology can be applied in production line automation, robot control, intelligent logistics and other aspects, which can greatly improve production efficiency, and promote manufacturing enterprises to complete production tasks more quickly and accurately, improve production efficiency and production capacity. Therefore, the application of artificial intelligence in the manufacturing industry as a starting point, in-depth study of the application of artificial intelligence in the manufacturing industry problems. The results show that there are security risks and liabilities as well as cost and return on investment issues in the application of AI in manufacturing. On this basis, the development trend of artificial intelligence in manufacturing industry is further looked forward, in order to provide useful reference for the healthy and efficient development of manufacturing industry.

Keywords: Artificial intelligence; Manufacturing; Intelligent production

As the core industry of China's real economy^[1], manufacturing industry is an important power point to achieve a new level of real economy, and is also one of the main drivers of economic growth. On the one hand, the development of the manufacturing industry has promoted the production of various products and services, created a large number of jobs, increased national income and GDP, and promoted sustained economic growth. On the other hand, the development level of manufacturing industry directly affects the national industrial competitiveness^[2]. Countries with a strong manufacturing base can offer higher quality products and more competitive prices, thus better winning international market share. However, with the continuous progress of science and technology, a variety of new technologies continue to emerge, the traditional manufacturing industry needs to continue to upgrade and transform technology, otherwise it will face the danger of being eliminated. In this context, artificial intelligence technology, through data analysis and algorithmic models, helps to improve the quality of manufacturing products and optimize the production process, reducing the generation of defective products. In addition, artificial intelligence technology can be applied in production line automation, robot control, intelligent logistics and other aspects, which can greatly improve production efficiency. By realizing intelligent production, manufacturing enterprises can complete production tasks more quickly and accurately, and improve production efficiency and production capacity. Therefore, understanding and applying the latest application status and development trends of artificial intelligence technology can help manufacturing enterprises improve production efficiency, reduce costs, and improve product quality, so as to maintain market competitiveness.

1. Application status of artificial intelligence in manufacturing industry

1.1 Intelligent Production Optimization

Traditional manufacturing production usually adopts manual operation or simple automation equipment, and production efficiency is limited. Manual operation may cause fatigue and high error rate, resulting in low production efficiency. At the same time, simple automation equipment is also less efficient in adapting to complex production needs and changes. Artificial intelligence can improve production efficiency by analyzing data and optimizing production processes. Accordingly, in order to promote the smooth transformation of manufacturing production, the application and research of artificial intelligence in the production stage have been continuously developed, manifested as automated production line technology and sensor technology.

The automated production line originated from Ford Motor Company, which uses the principle of assembly line to divide the automobile manufacturing process into several individual processes, and each worker is responsible for completing one of the specific tasks, which greatly improves the production efficiency. Further, with the continuous development of artificial technology, the combination of automated production lines and AI helps enterprises realize the automation and process optimization of the production process, reduce manual operation, reduce production cycle and production cost, improve production efficiency, and achieve large-scale production^[3]. Automated production lines can achieve a high degree of standardization and precise control of the production process, reduce human interference, improve product quality and consistency, reduce the rate of defective products, and increase product reliability and stability.

1.2 Intelligent Transportation Management

The traditional transportation mode of manufacturing industry may have problems such as unreasonable route planning and improper choice of transportation mode, resulting in low transportation efficiency and high transportation cost. Artificial intelligence can improve supply chain management by optimizing logistics planning, reducing transportation costs, and improving delivery efficiency^[4]. For now, the most prominent technologies in intelligent transportation management in the manufacturing industry include AGV unmanned handling technology and automatic sorting systems.

AGV unmanned handling technology was originally applied to automated production lines in the automotive manufacturing industry. With the development of automation technology, AGV technology is gradually applied to the logistics industry for cargo handling, warehousing management and other fields. AGV can automatically move goods in factories, warehouses and other environments, replacing manual handling, improving operational efficiency and reducing labor costs. In addition, the AGV can achieve autonomous navigation and obstacle avoidance functions through sensors and navigation technology, which can accurately and efficiently complete the handling task and improve the handling accuracy and safety. Agvs can also be automatically executed according to the set path and tasks, and can work 24 hours a day, improving the efficiency and flexibility of logistics transportation.

1.3 Smart Market Demand Forecast

The manufacturing industry may be limited by the low accuracy of the model when building the intelligent market demand forecasting model. Some forecasting models may not capture the complexity and changing trend of market demand well, resulting in a large deviation from the actual situation. In this context, AI technologies can support manufacturing market needs by collecting and analyzing data, especially in the form of digital twins.

Digital twin technology was originally developed to meet the needs of product design, production and maintenance in the engineering field. Through digital twin technology, manufacturing enterprises can combine actual physical systems or products with artificial intelligence technology to achieve digital simulation and management of the entire product life cycle, so as to better understand product performance, behavior and status. This is conducive to manufacturing enterprises to optimize the design scheme, improve production efficiency, reduce maintenance costs, and achieve intelligent production and management. Further, with the continuous progress of science and technology and the acceleration of artificial intelligence development. Digital twin technology is not only applicable to traditional manufacturing, but also in aerospace, automotive, energy, logistics and other fields have been applied.

2. Problems in the application of artificial intelligence in the manufacturing industry

2.1 Security Risks and Liability Issues

The security risks and liability issues of AI systems are one of the important challenges facing the manufacturing industry. On the one hand, data privacy and security issues. In the application of artificial intelligence in the manufacturing industry, a large amount of data will be generated, which may be leaked or abused, resulting in serious threats to enterprise trade secrets and user privacy, resulting in security risks and liability issues. On the other hand, technical failure and error prediction problems. Artificial intelligence systems are not infallible, and there is the possibility of technical failure. The wrong prediction or operation error of artificial intelligence system will affect the manufacturing production process and product quality, resulting in security risks and liability problems in the application of artificial intelligence in the manufacturing industry.

2.2 Cost and Return on Investment

The introduction of AI technology requires a large amount of capital and resources, including the cost of hardware equipment, software development, staff training, etc., and manufacturing enterprises need to weigh the relationship between investment and expected return to ensure the benefits of AI application. First, personnel training and recruitment costs. In order to effectively apply

AI technologies, companies need to train employees or recruit professionals with relevant skills. This comes with additional costs and may require ongoing investment to keep staff skills up to date and up to date, resulting in costs. Second, there is uncertainty about the return on investment cycle. The application of artificial intelligence technology can improve production efficiency and optimize production processes to a certain extent, but its actual income and return on investment cycle are highly uncertain. The return on business investment can take a long time to materialize, which is not conducive to financial planning and leads to investment reporting issues when smart technologies are introduced in manufacturing.

3. The development trend of artificial intelligence application in manufacturing industry

3.1 Data-Driven Decision-Making

Manufacturing enterprises will generate a huge amount of data in the production process, including sensor data on the production line, equipment operation data, product quality data, to achieve massive data generation and accumulation, creating the basic conditions for the use of artificial intelligence for data-driven decision-making. On this basis, with the development of the Internet of Things and sensor technology, a large amount of data is stored and accumulated, so that manufacturing enterprises can obtain more valuable information through reasonable analysis and use of these data, seize market opportunities, and improve enterprise competitiveness. In addition, manufacturing enterprises can make data-driven decisions through artificial intelligence, which can respond to changes in market demand and production environment more quickly and accurately, and improve enterprise competitiveness and flexibility. In summary, whether out of realistic conditions or corporate interests, data decision-making will be one of the development trends of artificial intelligence in the manufacturing field.

3.2 Collaborative Robots and Smart Factories

On the one hand, with the aging population and labor shortage, the manufacturing industry needs to reduce its dependence on human resources, and the application of collaborative robots can make up for the shortage of labor and improve production efficiency. Collaborative robots and smart factories combined with artificial intelligence technology can realize the automation and intelligence of production processes, achieve unmanned production and alleviate labor shortage while improving production efficiency, which is the future development trend of artificial intelligence application in manufacturing industry. On the other hand, the continuous development of artificial intelligence makes the use of collaborative robots and smart factories gradually reduce the cost and improve the performance. This has prompted manufacturing companies to face a “price ceiling” reduction squeeze, forcing companies to invest heavily in using collaborative robots and smart factories to achieve scale production to resolve the crisis. Therefore, collaborative robots and smart factories will be the future development trend of artificial intelligence applications in manufacturing.

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