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ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ НА ПРОИЗВОДСТВЕННОЙ АРЕНЕ: ИННОВАЦИИ, ВЫЗОВЫ И ПЕРСПЕКТИВЫ

Дементьев С. Ю.
ФГБОУ ВО "СИБИРСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ НАУКИ И ТЕХНОЛОГИЙ ИМЕНИ АКАДЕМИКА М.Ф. РЕШЕТНЕВА", Красноярск, Россия (660037,город Красноярск, пр-кт Им.Газеты "Красноярский Рабочий", д. 31), e-mail: super.wark@mail.ru

Статья исследует влияние искусственного интеллекта (ИИ) на современные производственные процессы. Рассматриваются инновационные подходы к внедрению ИИ, вызовы, с которыми сталкиваются организации, и перспективы дальнейшего развития. Авторы рассматривают ключевые технологии, примеры успешного применения ИИ в производстве, а также обсуждают вопросы этики и безопасности.

Ключевые слова: Искусственный интеллект, производство, инновации, вызовы, перспективы, технологии, этика, безопасность.

ARTIFICIAL INTELLIGENCE IN THE MANUFACTURING ARENA: INNOVATIONS, CHALLENGES AND PROSPECTS

Dementev S. Y.
RESHETNEV SIBERIAN STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY, Krasnoyarsk, Russia (660037, Krasnoyarsk, Newspaper "Krasnoyarsk Worker" Ave., 31), e-mail: super.wark@mail.ru

This article explores the impact of artificial intelligence (AI) on contemporary manufacturing processes. It examines innovative approaches to AI implementation, challenges faced by organizations, and prospects for further development. The authors delve into key technologies, provide examples of successful AI applications in manufacturing, and discuss ethical and security considerations.

Keywords: Artificial intelligence, production, innovation, challenges, prospects, technology, ethics, safety.

With the advent of Artificial Intelligence (AI), the industry is undergoing a period of significant transformation, moving from traditional production methods to the digital era, where intelligent systems become an integral part of the production process. Artificial intelligence, as a key component of Industry 4.0, provides organizations with unique opportunities to increase efficiency, flexibility and innovation.

The history of industry shows a continuous pursuit of improvement. While the first industrial revolution brought mechanization and the second mass production, the third brought automation and the use of electronics. Artificial intelligence fits into this evolutionary path, providing new opportunities for optimizing production processes [1].

Artificial intelligence in manufacturing represents a new level of analysis, learning and decision-making skills. This includes the system's ability not only to perform predefined tasks, but also to learn from experience, improve itself, and adapt to changing conditions.

Innovation in Manufacturing Using Artificial Intelligence:

1. Process automation;
2. Predictive Maintenance;
3. Robotic systems.

Artificial intelligence allows you to automate a wide range of production tasks, ranging from monotonous and routine to complex and labor-intensive. This improves efficiency and accuracy in task completion, and frees up human resources for more creative and strategic tasks [2].

Here are some specific examples of successful automation of production processes using artificial intelligence:

1. Assembly lines in the automotive industry. Many factories in the automotive industry are implementing artificial intelligence systems to automate assembly processes. Robots with built-in machine learning algorithms are able to recognize and install parts, make decisions about necessary adjustments, and perform tasks with high speed and accuracy.

2. Product quality control. Artificial intelligence systems can automatically scan products using optical sensors and cameras, identify defects and sort products based on predefined quality standards. This increases the efficiency of quality control and reduces the risk of producing low-quality products.

3. Optimization of production processes. Artificial intelligence can analyze data about production processes and optimize parameters taking into account various variables. For example, systems can regulate temperature and pressure in real time, ensuring optimal conditions for production.

4. Equipment Life Prediction. Using machine learning algorithms, AI can analyze equipment health data and predict possible failures or malfunctions, allowing proactive maintenance measures to be taken and downtime avoided.

Predictive maintenance using artificial intelligence is a key aspect of production optimization. The implementation of monitoring and data analysis systems makes it possible to predict possible failures and problems in the operation of equipment, providing the opportunity for timely interventions and preventing unplanned shutdowns [3].

Examples of successful predictive maintenance:

1. Equipment condition monitoring. AI systems can continuously collect data on equipment performance, including parameters such as temperature, vibration, and wear levels. Data analysis algorithms can detect anomalies and predict the likelihood of equipment failure.

2. Optimization of maintenance. Analyzing equipment condition data helps optimize your maintenance schedule. Instead of regular preventative maintenance, you can move to a more effective practice by conducting maintenance based on the actual condition of the equipment.

3. Reduced costs. Predictive maintenance reduces maintenance costs by ensuring that work is carried out only when actually necessary. It also increases resource efficiency, reducing downtime and lost productivity.

Robotic systems powered by artificial intelligence are becoming an integral part of modern manufacturing, providing unique opportunities for flexibility and efficiency.

Examples of the use of robotic systems with artificial intelligence:

1. Collaboration between robots and people. Robots equipped with AI can interact with human workers on the production line. For example, they can help move heavy loads and perform monotonous tasks, freeing up human labor for more complex and creative tasks.

2. Flexibility of production processes. Robots with artificial intelligence are able to adapt to changes in the production environment. For example, they can quickly adapt to perform new tasks or work in collaboration with other robots to efficiently solve complex problems.

3. High-quality and precise operations. AI-controlled robots have high precision and the ability to perform complex operations. For example, they can carry out precision operations in microelectronics assembly or ensure a high standard of quality in manufacturing.

4. Self-learning and optimization. Robots can use machine learning to optimize their actions according to changing conditions. For example, they can learn to avoid obstacles, optimize movement paths, and adapt to new tasks.

These examples highlight how robotic systems supported by artificial intelligence not only automate production processes, but also provide the flexibility, efficiency and precision required by modern industry [4].

Challenges in Artificial Intelligence Integration:

1. Data security;
2. Model training.

With the increasing use of artificial intelligence in manufacturing, ensuring data security becomes a critical aspect. The use of blockchain technologies and cryptographic methods helps guarantee the confidentiality and integrity of data.

Examples of data security measures:

1. Data encryption. Use encryption mechanisms to protect sensitive data in real time. This may include encrypting data transfers between devices, as well as encrypting data stored on servers.

2. Blockchain in the supply chain. Using blockchain technology to ensure transparency and immutability of data in the supply chain. This reduces the risk of fake data and ensures accurate information from the manufacturer to the consumer.

3. Multi-level authentication. Implementation of multi-level authentication systems to prevent unauthorized access to production management systems and databases.

4. Security audit. Conduct regular security audits to identify potential vulnerabilities and ensure compliance with security standards.

These measures help create strong data security, which is important for maintaining trust and successfully integrating artificial intelligence into production processes.

One of the key challenges is the need for large amounts of data to effectively train artificial intelligence models. In some industries, it can be difficult to provide access to enough diverse data to train systems.

In the field of training artificial intelligence models, manufacturing enterprises are actively using machine learning methods to improve the efficiency and accuracy of processes. An example would be Optimization of production parameters. Many businesses use machine learning algorithms to analyze production process data and optimize parameters such as temperature, pressure and speed. Machine learning models can predict optimal settings for equipment, resulting in increased performance and reduced energy costs.

This example highlights how AI-powered model training plays a key role in optimizing manufacturing processes, helping to utilize resources more efficiently and reduce costs.

With the development of artificial intelligence technologies in manufacturing, it is expected that operational efficiency will continue to improve, more intelligent control systems will be created, and market competitiveness will increase. Prospects include expanding the use of AI in new industries, deeper integration with other Industry 4.0 technologies, and further development of algorithms and learning methods [5].

Development prospects:

1. Development of Natural Language Processing Technology (NLP). Artificial intelligence trained in NLP can improve communication in the manufacturing environment. Robots and systems can understand and generate text, facilitating interaction with human workers and simplifying management processes.
2. Integrating the Internet of Things (IoT) and AI. IoT systems that collect data from equipment can interact with artificial intelligence to more accurately monitor and control production processes. Life forecasting, energy optimization and predictive maintenance become more accurate and efficient.
3. Development of Robotics and Collaborative Robots: Robots equipped with artificial intelligence are becoming more flexible and able to collaborate with humans on production lines. This leads to increased efficiency and safety at work.

In conclusion, it is worth noting that the implementation of artificial intelligence in manufacturing requires a careful balance between technical innovation and human factor management. This also highlights the need to develop effective workforce training strategies and create regulatory frameworks for the use of AI in the manufacturing environment.

In conclusion, the development and application of artificial intelligence in industry offers tremendous promise for improving production processes. Approaches such as automation, predictive maintenance and model training are becoming key drivers for optimization and efficiency gains.

Future opportunities include deeper integration of technologies such as natural language processing to create systems that are more intuitive and easy to manage. Advances in robotics and seamless collaboration between robots and humans provide unique opportunities to create flexible, high-performance manufacturing environments.

With specific examples of future developments such as IoT integration and the use of natural language processing technology, improvements in resource management, forecasting, and workplace safety can be expected.

Thus, artificial intelligence in the manufacturing arena not only provides innovative solutions to current challenges, but also opens up new prospects for the development of more efficient, sustainable and intelligent manufacturing systems.

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