APPLICATIONS OF AI IN AGRICULTURE AND INDUSTRY

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Abstract

This article aims to present the current applications of Artificial Intelligence (AI) in agriculture and industry and the potential for further advancements. AI is a branch of computer science that deals with the development of intelligent machines or computer programs that can perform tasks that would typically require human intelligence, such as perception, reasoning, learning, and decision-making. Artificial Intelligence (AI) is a rapidly expanding field that has the potential to revolutionise various industries, including agriculture and manufacturing. AI is already used in agriculture to create smart farming practices that help farmers manage resources effectively, optimise crop yields, and reduce waste. Similarly, AI has various applications, such as predictive maintenance, supply chain management, quality control, and automation in the manufacturing industry. In the coming years, Artificial Intelligence has the potential to help address some of the biggest challenges in agriculture and industry, such as climate change, food security, and supply chain disruptions.

Keywords: precision agriculture, quality control, LiveStock Monitoring, predictive maintenance, artificial intelligence

Industry, the production of goods and services using machinery and technology, emerged in the late 18th and early 19th centuries with the rise of mechanisation and factory-based production. The Industrial Revolution transformed society, enabling the mass production of goods and leading to significant advances in transportation, communication, and infrastructure.

Agriculture and industry have played significant roles in human history, contributing to the development of civilisations and shaping the world as we know it today. They continue to be vital in global economies, with agriculture providing food and raw materials for industry and industry producing goods and services supporting modern society. The two sectors are increasingly interconnected, with advances in technology and automation driving innovation and efficiency in agriculture and industry.

During the Industrial Revolution in the 19th century, machines were implemented as a solution for replacing or reducing human labour (Paras M. *et al*, 2018). In the last decades of the 20th century, with rapid advancements in information technology, this vision evolved and gave birth to the idea of creating machines and computer systems capable of emulating human intelligence - thus giving rise to the concept of artificial intelligence (AI). Today, we can see how AI is growing and advancing rapidly, with new developments and breakthroughs being made every day. As technology evolves and improves, AI becomes more sophisticated and capable of performing increasingly complex tasks.

AI has the potential to make industry and agriculture more efficient, sustainable, and profitable while also reducing waste and environmental impact. It can also be used to develop predictive models that help farmers, and industrial operators make more informed decisions about planting, harvesting, and other processes.

MATERIAL AND METHOD

Although the global population is growing, the available agricultural land is not increasing at the same rate. Additionally, the trend of urbanisation is causing agricultural land to become increasingly scarce, meaning farmers need to produce more with fewer resources. As the disposable income of consumers increases, demand for high-quality and eco-friendly food products is also on the rise.

In this context, farmers face the pressure of producing enough healthy food to meet the needs of the growing population. Therefore, it is vital for farmers to find new ways to increase production and improve efficiency in order to feed more people with limited resources. One of the main connections between agriculture and industry is that agriculture provides the raw materials used in many industrial

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processes. Also, the industrial sector supports agriculture by providing equipment and machinery for planting, harvesting, and processing agricultural products.

The interconnection between agriculture and industry is symbiotic, with each sector supporting and relying on the other to meet the needs of society. The challenges faced by one industry can have an impact on the other.

This is where technology comes into play, and artificial intelligence (AI) can be the solution that farmers need to increase their production and meet the growing demand. AI can help farmers more efficiently monitor crop health, prevent damage from extreme weather conditions, optimise resource utilisation, and quickly identify issues during production. Ultimately, AI can help farmers produce healthier and more sustainable food, thereby contributing to meeting the food needs of a growing population. In this way, the industry has enough raw materials to function and to produce in relatively good conditions.

Artificial intelligence could solve these above challenges by providing next-generation solutions.

RESULTS AND DISCUSSIONS

AI has numerous applications in agriculture and industry. AI is being used for precision farming, crop monitoring and prediction, soil analysis, livestock management, and more.

The agriculture and industry sectors had to adapt to the discoveries and innovations that emerged in the automation field as technology became increasingly important in the production process (Jha et al, 2019). The benefits of automation include increased efficiency, reduced costs, improved quality, and enhanced safety. By automating tasks, companies can streamline processes, reduce errors and waste, and improve productivity.

All the companies presented below use automation to a greater or lesser extent with the help of AI to improve their operations and processes.

Precision agriculture (DeLay D. et al, 2022) is an approach that employs technology and data analytics to enhance farming efficiency and sustainability. It involves real-time data gathering, analysis, and application to optimise crop management decisions. This technique leverages technologies like GPS, drones, sensors, and machine learning algorithms to achieve higher productivity with fewer resources.

Company Blue River Technology's See & Spray precision (VishnusaiR T.J., 2021; Yeshe A. et al, 2022) spraying system uses computer vision and machine learning to target weeds, reducing herbicide use and improving crop yields. It can also be used for precise fertilisation and seeding, optimising agricultural productivity.

Another company called Harvest CROO Robotics (De Preter et al, 2018) has created a robot specifically designed to aid farmers in the time-consuming process of harvesting and packing strawberries.

Drones called UAVs (Unmanned Aerial Vehicles) use Artificial Intelligence. By analysing large amounts of data related to the environment and crop details, Precision Agriculture assists farmers in making critical decisions at the appropriate time (Velusamy P. et al, 2021)

Livestock Monitoring involves utilising modern technology such as sensors, cameras, and GPS to gather data about the well-being, conduct, and whereabouts of livestock. This information is evaluated to obtain insights into animal health, productivity, and welfare. Early detection of sick animals, enhanced feeding management, avoidance of overgrazing, and overall improvement in farming efficiency and profitability are among the benefits of livestock monitoring.

A company that uses Livestock monitoring is Allflex (Indira D., Suresh J., 2020) which offers electronic identification tags and activity monitors. DeLaval (Garcia E. et al, 2014) also provides smart farming solutions like activity and milk sensors. Cainthus uses AI-powered software to track individual animal health and behaviour (Neethirajan S., Kemp B., 2021), Quantified AG offers wearable sensors and computer vision cameras (Siberski–Cooper C. J. et al, 2022), and Connecterra uses wearable sensors and AI-powered software for real-time monitoring (ting Liu T. et al, 2020). Overall, these companies use advanced technology to collect and analyse data, enabling farmers to make informed decisions about herd management and optimise animal health and productivity.

Quality control is a process implemented in agriculture and industry to ensure that products meet the required quality standards. Companies from various industries, such as Automotive, Food and Beverage, Healthcare, and more, use AI-powered quality control systems to identify impurities in beverages and aliments and defects in car parts.

Agriculture companies started to use AI and machine learning to monitor crop health and detect diseases, and provide livestock monitoring solutions that use computer vision to analyse animal behaviour and health. Using Artificial Intelligence in quality control can help ensure that products comply with regulatory requirements, meet customer expectations, and are safe for consumption.

Predictive maintenance is a modern maintenance approach that employs advanced technologies like AI and machine learning to forecast potential equipment failures. By analysing equipment performance data like temperature, vibration, and sound, predictive maintenance algorithms can predict and alert technicians to perform maintenance before any serious issue occurs. This technique differs from traditional maintenance methods like preventive or reactive maintenance, which are done on a fixed schedule or after a failure occurs. Predictive maintenance helps companies to minimise downtime, improve equipment efficiency, and save costs by extending the lifespan of the equipment.

Several companies provide predictive maintenance solutions using AI and machine learning algorithms. Companies use AI and machine learning algorithms to offer software solutions in the predictive maintenance industry. These solutions cater to various industries, such as manufacturing, energy, transportation, healthcare, and more. Some companies provide AI-powered software solutions for predictive maintenance to several well-known clients in the energy and manufacturing sectors. Others specialise in offering predictive maintenance solutions to specific industries, such as manufacturing. For example, Falkonry (Redchuk A., Walas Mateo F., 2022) offers predictive maintenance solutions for energy and manufacturing industries. All companies use AI and machine learning algorithms to analyse data from various sources to identify potential equipment failures and provide maintenance recommendations.

Artificial Intelligence (AI) is playing an increasingly important role in Supply Chain Management (SCM) as it helps businesses optimise their operations. With the ability to automate tasks and analyse data, AI provides insights that assist organisations in making informed decisions. Using AI, businesses can optimise inventory levels, forecast demand, and streamline logistics. For example, by analysing sales data, AI can predict future product demand, reducing waste and optimising inventory levels. AI can also improve shipping routes and delivery, reducing transportation costs and boosting customer satisfaction.

Additionally and complementary, Blockchain technology (Nayal K., 2021) further enhances SCM by creating an unalterable record of every transaction in the supply chain, enabling stakeholders to monitor the movement of products and authenticate their origins.

Looking to the future, we can expect AI and blockchain technology to continue transforming every possible industry in numerous ways.

AI is poised to transform all sectors, including agriculture and industry. AI can potentially optimise crop yields and reduce crop losses by identifying and responding to crop diseases and pests more quickly. Similarly, in industry, AI-powered robots and machines can perform dangerous or tedious tasks, and AI can optimise supply chain management, leading to faster delivery times and increased profitability. As technology advances, we expect to see further innovation and growth in these industries, and AI will play a critical role in this transformation.

CONCLUSIONS

The future of AI in agriculture and industry is bright. AI-powered tools are already helping farmers and manufacturers increase efficiency, reduce costs, and improve sustainability. The rapid advancement of technology is creating new opportunities for implementing AI in various industries, including agriculture and the industry sector. It is highly probable that we will witness even more innovative and exciting AI applications as technology continues to evolve.

While AI is poised to revolutionise agriculture and industry, it is essential to recognise that AI tools are only as effective as their implementation. In other words, AI can only provide value if it is tailored to meet specific business requirements and combined with human expertise. Moreover, it is necessary to approach AI with transparency, fairness, and responsibility, given its potential to impact individuals, organisations, and entire industries. A balanced and ethical approach to AI will ensure that it drives positive change and does not perpetuate any harmful consequences.

ACKNOWLEGMENTS

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