APPLICATIONS OF AI IN AGRICULTURE

- by Shafiya Noor Ul Ain

RESEARCH PAPERS

PAPER 1: Understanding the potential applications of AI in agriculture sector.

- by Mohd Javid, Abid Haleem, Ibrahim Haleem Khan.

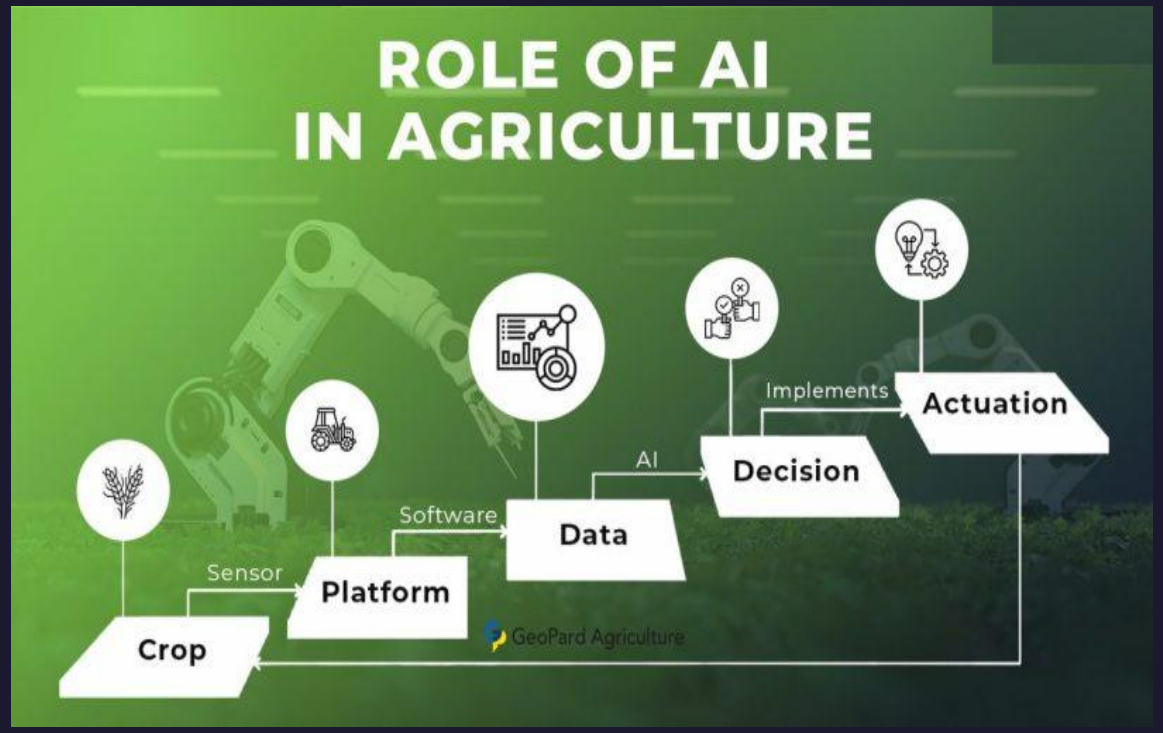
The paper explores how artificial intelligence (AI) is transforming agriculture by improving decision-making and operational efficiency. AI helps farmers monitor soil and crop health, select ideal planting times, and choose optimal seeds based on weather conditions. It integrates data from sensors and forecasting systems to manage pests, forecast weather, and recommend nutrient applications, enhancing crop quality and yields with fewer resources. AI-powered health monitoring systems and advanced analytics reduce waste, speed up time to market, and support better supply-chain management. Overall, AI aids sustainable and precise farming by enabling data-driven, efficient agricultural practices.

PAPER 2: AI in agriculture: applications, approaches and advertises across pre-harvesting, harvesting and post-harvesting.
- by Nidhi Upadhyay and Anuja Bhargava.

The paper reviews how AI is applied throughout agricultural stages — from pre-harvest planning to harvesting and post-harvest processes — to enhance productivity and sustainability. It discusses machine learning, computer vision, and data analytics for crop monitoring, disease and pest detection, yield prediction, automated harvesting, and quality assessment. The authors also examine challenges like data quality, infrastructure limitations, algorithmic biases, and adoption barriers in real-world farming environments. The study highlights AI's potential to optimize resource use, reduce losses, and support data-driven decision-making, while noting the need for robust, scalable solutions and interdisciplinary research.

PAPER 3: Implementation of AI in agriculture.
- by Shivangi Sharma, Kirti Verma and Palak hardaha.

Sharma and Verma examine how artificial intelligence (AI) is transforming traditional farming through automation and smart technologies. They outline how AI applications—such as machine learning, sensors, robotics, drones, and computer vision—are being used for tasks like irrigation control, weeding, spraying, crop monitoring, and soil water sensing to increase efficiency and reduce resource use. These AI-enabled systems help conserve water, minimize pesticide and herbicide use, preserve soil fertility, and enhance crop quality and yields. The authors also discuss combining AI with other technologies to address agricultural challenges and improve automation in farming practices.



PAPER 4: Digital applications and AI in agriculture toward next generation plant phenotyping.
- by Pasquale Tripodi, Nicola Nicastro and Catello Pane.

Tripodi and Nicastro review how digital technologies and AI are shaping modern agriculture, especially in plant phenotyping for next-generation crop research. They highlight the use of advanced sensors, imaging systems, and non-invasive data collection to capture complex plant and environmental traits in both controlled and field conditions. AI and machine learning play a crucial role in managing and analyzing these high-dimensional datasets, enabling precise trait detection and improved decision-making. The authors also emphasize integrating phenomics with other biological sciences and fostering collaboration to overcome data challenges and accelerate breeding efficiency.

PAPER 5: AI in agriculture sector management: A critical analysis. - by Deepali Rani Sahoo.

The paper examines how artificial intelligence (AI), together with blockchain and the Internet of Things (IoT), can enhance sustainable management in agriculture and related sectors. It highlights AI's ability to streamline resource use, boost system efficiency, and optimize energy and water management through data-driven decision-making. Blockchain is discussed for improving supply chain transparency, while IoT enhances real-time monitoring and control. The study also addresses challenges like high costs, technical complexity, data privacy concerns, and equitable access. It advocates multidisciplinary research, collaboration among stakeholders, ethical data governance, and sustainable implementation strategies to leverage these technologies for long-term agricultural and environmental sustainability.

PAPER 6: AI in applications in agriculture 4.0
- by Guilherme Augusto Silva and Atilla Graciano da Silva.

The paper explores how AI drives Agriculture 4.0 by leveraging digital data from sensors and devices to develop applications in computer vision, acoustic event detection, and data processing that support agricultural decision-making. These AI systems help monitor, understand, and predict key production attributes to enhance sustainability and food security. The authors review practical AI scenarios, discussing the technologies' advantages, limitations, and implementation challenges, such as data availability and system scalability. They also highlight future opportunities, including deeper integration of AI across the agricultural value chain and efforts to overcome barriers to adoption.

PAPER 7: AI in agriculture: A literature survey - by Gauravmoy Banerjee and Uditendu Sarkar

The paper presents a comprehensive literature survey of artificial intelligence (AI) applications in agriculture, reviewing around 100 key studies from 1983 to 2017. It explores how AI techniques—especially expert systems, artificial neural networks, and fuzzy logic—have been used to address core agricultural challenges like crop management, pest and disease detection, irrigation control, and soil and yield prediction. The survey highlights AI's role in transforming traditional farming by enabling knowledge-based decision support and handling complex, uncertain agricultural data. It underscores the historical development and multidimensional growth of AI-driven agro-intelligent systems over several decades.

PAPER 8: Applications of generative AI for optimizing research in the agricultural business sector.
- by Mayla Daiane Correa Molinari and Katia Cristiane Brumatti Goncalves.

The chapter examines how generative artificial intelligence (GenAI) is reshaping agricultural business research by enhancing data-driven insights and operational efficiency. GenAI supports tasks such as crop yield prediction, disease detection, breeding programs, and resource management by generating realistic data and processing complex datasets. Integrated with remote sensing, Internet of Things (IoT), and edge computing, it enables real-time decision-making and boosts agribusiness sustainability. The authors also highlight GenAI's roles in environmental monitoring, carbon footprint reduction, and supply-chain optimization. Despite its promise, challenges like model interpretability, data privacy, and infrastructure gaps remain, with future prospects centered on deeper integration and sustainable agriculture advancement.

PAPER 9: Revolutionising Agri-Energy: A comprehensive survey on the applications of AI in agriculture-energy internet.
- by Xueqian Fu, Wei Ye, Xin Li.

The paper surveys how artificial intelligence (AI) technologies are integrated into the **Agricultural Energy Internet (AEI)**—a system linking agriculture with smart energy networks to optimize production and energy use. It reviews AI methods such as reinforcement learning, deep learning, and generative models for improving energy forecasting, intelligent management, and optimisation of agricultural and energy processes. Applications span crop cultivation, fisheries, disease detection, yield prediction, and resource management. The study also discusses future prospects like AI-enhanced synergistic control of coupled agriculture-energy systems and carbon-tracking technologies to support sustainable rural electrification and efficiency.

PAPER 10: AI in food processing: current status and future prospects. - by Thingujam Bidyalakshmi and Bikram Jyothi

The paper reviews how artificial intelligence (AI) is transforming food processing within the agriculture and food supply chain, enhancing productivity, efficiency, and product quality. It examines AI technologies—such as machine learning, computer vision, robotics, and data analytics—that automate and optimize unit operations from raw material handling to finished product inspection. AI improves process control, reduces waste, accelerates production, and supports quality assurance and traceability. The authors also discuss challenges in implementation and emphasize continued research and ethical adoption to fully realize AI's potential in food processing, meeting increasing global food demand sustainably.

THANK YOU