JUST AGRICULTURE
multidisciplinary e-Newsletter

Artificial Intelligence in Agriculture

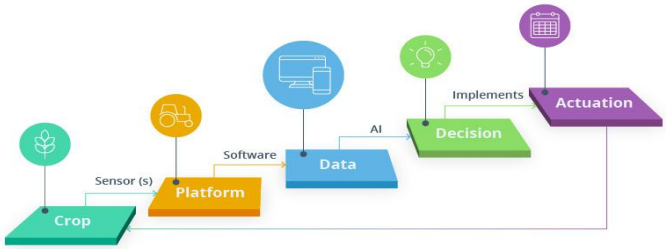
Pooja Gangwar
Assistant Professor, Ganna Utpadak Mahavidayalya, Baheri (Bareilly), Uttar Pradesh

ARTICLE ID: 103

Agriculture is crucial for every nation's economic sector. Everyone is directly and indirectly dependent on agricultural products for everyday needs. The demand for food is rising along with the global population on a daily basis. At this point, the farmers' traditional techniques are insufficient to meet the demand. Some novel automation techniques are required to fulfil the current demand globally for agriculture produce. Artificial intelligence is playing a very important role in the agriculture sector for transforming the agriculture industry. AI has the potential to change traditional agriculture by increasing efficiency of time, labor, and resources, enhancing environmental sustainability, providing accuracy in monitoring and data analysis for better agriculture results. AI useful in agriculture from seed to seed has improving crop production, protection, harvests, processing and marketing. Numerous Hi-tech computers based devices and agri-bots have already been introduced to determine various crucial parameters for improved agriculture. In this article, we will discuss how Artificial Intelligence is revolutionizing agriculture by employing more efficient methods along with the difficulties in AI adoption.

Artificial intelligence

Artificial intelligence is a tool that mimics human intelligence and ability processes by machines, advanced computer systems, robots and digital equipments. AI has many uses, including natural language processing (NLP) to understand spoken human language, computer vision to view analog-to-digital conversions like video, and speech recognition and expert systems to mimic judgement.



The role of AI in the agriculture information management cycle

JUST AGRICULTURE
multidisciplinary e-Newsletter

The three cognitive abilities of learning, thinking, and self-correction are the foundation of AI encoding, which every action and outcome rely. In recent years, the fastest-growing industries have included those in banking, healthcare, retail, pharmaceutical research, intelligent process automation, marketing and Agriculture.

Why AI in Farm is Necessary?

To overcome from obstacles in traditional agriculture we have need to use some innovative techniques. The difficulties in cultivation are as follows when using conventional methods:

- **Labour challenges:** It will be challenging to use enough labour for farm practices due to expensive labour costs. This issue immediately affects the income and output of the agricultural sector.
- **Weather factors**: Using conventional methods, we are unable to predict sudden weather changes that have a negative impact on our agriculture and cause difficulties with sowing, harvesting, and spraying.
- **Decision making**: When it comes to improved agriculture, traditionally we haven't been able to make wise decisions regarding the timing of sowing, crop variety selection based on field characteristics, irrigation timing, soil nutrient deficiency, spraying area, or dosage calculation.
- **Accuracy in data collection and analysis**: It is impossible to gather accurate data on insect pests, diseases, and weeds without the use of cutting-edge technologies. We can decrease the amount and applications of pesticides by using accurate data for better crop production.

Use of AI in Agriculture

Farmers would face numerous challenges, just as they would with traditional agricultural methods. AI is being widely used in this sector to address these challenges. Artificial intelligence has become a game-changing technology in agriculture. AI benefits farmers in a variety of ways, which are detailed below.

Environmental protection:

AI allows for more efficient ways to produce, harvest and sell crop products, as well as a focus on inspecting defective crops and improving agricultural practices for eco-friendly crop production. AI provides us with more accurate data about insect pest infestations,

JUST AGRICULTURE
multidisciplinary e-Newsletter

diseases and weeds, as well as various management methods. AI methods based on robotics, computer vision, and machine learning could assist farmers in spraying chemicals only where the pests are, reducing the use of chemical substances sprayed on the entire area. Environmental protection through pesticide reduction is a major functional advantage of AI technology. Therefore, AI technology assists framers in pest control and pesticide residue reduction.

Weather and price forecasting:

Weather plays an important part in agricultural decision making and planning. Artificial intelligence technology may allow farmers to obtain meteorological data, which would be helpful for timely sowing, harvesting, spraying and other agronomic practices; increasing crop yield and profits by decreasing crop danger. Weather predictions can also help with pest management; taking precautions by adopting practices on time, reduces input costs and yield loss. Farmers can use price forecasting to get a clearer idea of crop prices in the coming weeks, allowing them to maximize profit.

Detection of insect-pests and disease:

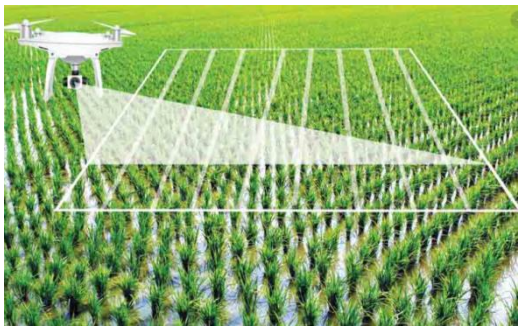
AI methods are able to monitor insect pests and diseases, and are helpful in identifying pests as well as areas that are impacted by them. We can now identify plant diseases and pests using image recognition technology based on deep learning. This technique builds models that can "keep an eye" on plant health by using image classification, detection, and segmentation methods. By using AI techniques monitoring, detection and management of insect pests and plant disease are made easier and eco-friendly. After using AI-based techniques, there is a noticeable decrease in the quantity and number of pesticide applications; able to accurately recognize and count a large number of insects. AI computer vision has a bright future for tracking the condition of our food systems. In addition to lowering labor inefficiencies, it also does so without compromising the accuracy of the data.

Definition of plant diseases and pests detection problem

JUST AGRICULTURE
multidisciplinary e-Newsletter

Soil health monitoring:

Today, good soil health is essential to meet the increasing demand for food. However, using conventional methods, we are unable to determine the specific soil properties for each crop. Artificial intelligence (AI) and machine learning (ML) technologies have made it possible to track soil characteristics in farms, such as quality, fertility, microorganism and nutrient deficiency, as well as flora pattern, either through image capture with a camera recognition tool or by using a deep learning-based tool. Visual perception AI can analyze and interpret this data much quicker than humans in order to monitor crop health, make accurate yield predictions, and identify crop malnutrition. AI models can alert farmers to particular problem areas so they can respond right away.



Analyzing crop health by drones

Innovation in harvesting methods:

Crop harvesting requires a lot of work and effort. AI based computer vision model is helpful in observing and estimating crop growth maturity without having to hire more people. A variety of agribots have already been developed to automate harvesting; decrease losses, costs, environmental effect, and food waste. AI-powered tools outperform human agricultural workers in terms of speed, difficulty, and accuracy. A significant portion of that work is now being handled by AI with ease and remarkable efficiency.

Intelligent spraying

By using UAVs equipped with computer vision AI, ecofriendly pest management is possible as required amount of pesticides or fertilizers to be sprayed uniformly in target spraying area. With real-time recognition of target spraying areas, UAV sprayers can work with extreme accuracy in terms of the area and amount to be sprayed. As a result, we can lessen animal toxicity, natural resource contamination, and pesticide residue in crops. Virginia Tech has developed a smart spray system based on servo motor controlled sprayers that use computer vision to recognize

JUST AGRICULTURE
multidisciplinary e-Newsletter

weeds, analyzes the size, shape, and color of each pesky plant in order to deliver exact amounts of herbicide.

Livestock health monitoring

We can't neglect the importance of animals in our agriculture system and they tend to need a bit more tracking than plants. Cattle Eye is an excellent illustration of an AI-first agricultural company. Management of cowshed made easier by using cameras and drones (UAVs) for data collection. Tracking animal health and behavior, identifying unusual behavior and monitoring important activities such as giving birth are all made possible with ease and accuracy by using overhead cameras and computer vision algorithms. Remote tracking and observation of cattle can be useful for quickly spotting issues and informing farmers about the health of their livestock and their access to food and water.

Benefits and Challenges of AI in agriculture

Advantages

- Farmers can make better choices and conduct more effective farming with the help of eco-friendly AI techniques. Additionally, it enables farmers to determine the precise regions that require pesticide application, fertilization, and irrigation, helping them to avoid overusing resources and chemicals on their crops.
- AI assists farmers in overcoming key agricultural challenges such as market demand analysis, price forecasting, and determining optimal periods for sowing and harvesting crops based on weather forecasting.
- Farming machinery with AI capabilities enables producers to produce more crops with less effort and expense. With AI and automation, farms can complete tasks without hiring more workers. Some examples include driverless tractors, intelligent irrigation and fertilising systems, smart spraying, vertical farming software, and AI-based harvesting robots.
- The use of advanced AI-based technologies has other benefits on the agri-food supply chain, such as cutting employee training costs, reducing the time required to solve problems, reducing the amount of human errors, lowering human intervention, and providing automated good, accurate, and robust decision-making at the right time at a low cost.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Challenges of AI adoption in Agriculture

Although there is a lot of potential here, there are still some obstacles.

- The majority of farmers around the world are unfamiliar with the use of AI-enabled tools and solutions.
- Adopting AI and innovative technologies in agriculture for underdeveloped nations can be difficult.
- The threat of unemployment is the biggest social challenge; in reality, robots and intelligent machines could take over most of the repetitive jobs and tasks; as a result, human involvement is decreasing, which will pose a serious challenge to employment standards.
- Another example of a technological challenge is the fact that robots can only perform the tasks for which they have been designed or programmed, and if those tasks are altered, they often fail or produce useless results.
- The high expense of these applications, which may increase prices and input costs, is a further problem. These methods are also useless for small-scale farms or rural areas.