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Popular Article

# ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN AGRICULTURE

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Agriculture sector is continuously being leveraged with technologies and tools. These technologies and tools perform various agricultural related tasks and accomplish them with great efficiency and precision ultimately saving a lot of time and back breaking labour. It is also true that agriculture sector all across the globe is under severe pressure to produce more with fewer resources. At the same time, it is also facing challenges of limited land, labour shortages, climate change, degradation of natural resources, low yields and many other related ones. At this time when the global population is on the rise and is expected to reach 10 billion by 2050, the food shortages can be addressed by two ways. Firstly, by using more land for large-scale farming and secondly by using technology to enhance productivity on existing farmland. This has led to various innovative developments in farming. An important technological intervention that is revolutionizing agriculture sector in the present era and that has the potential to enhance productivity is the Artificial Intelligence (AI) and Machine Learning (ML). We often hear people using AI and

ML interchangeably, but both are different. However, both are closely related.

**AI vs ML:** Artificial intelligence (AI) is the branch of science that deals with the development of machines to mimic human intelligence. Machine learning (ML) is a sub-domain of AI where the machine can learn automatically from data without being explicitly programmed. AI and ML techniques have the capacity to optimize resource utilization by analyzing agricultural data. It has changed the present-day face of farming by predicting various input parameters and forecasting post-harvest life of a crop. The simplest way to understand how AI and ML relate to each other is that AI is the broader concept of enabling a machine or system to sense, reason, act, or adapt like a human and ML is an application of AI that allows machines to extract knowledge from data and learn from it autonomously. One helpful way to remember the difference between machine learning and artificial intelligence is to imagine them as umbrella categories. Artificial intelligence is the overarching term that covers a wide variety of specific approaches and algorithms.



Machine learning sits under that umbrella, but so do other major subfields, such as deep learning, robotics, expert systems, and natural language processing. While artificial intelligence encompasses the idea of a machine that can mimic human intelligence, machine learning does not. Machine learning aims to teach a machine how to perform a specific task and provide accurate results by identifying patterns. AI allows a machine to simulate human intelligence to solve problems. The goal is to develop an intelligent system that can perform complex tasks like a human. AI has a wide scope of applications and uses technologies in a system so that it mimics human decision-making. It works with all types of data: structured, semi-structured, and unstructured and AI systems use logic and decision trees to learn, reason, and self-correct. Machine Learning (ML) on the other hand allows a machine to learn autonomously from past data. The goal is to build machines that can learn from data to increase the accuracy of the output. We train machines with data to perform specific tasks and deliver accurate results. Machine learning has a limited scope of applications and uses self-learning algorithms to produce predictive models. It can only use structured and semi-structured data and ML systems rely on statistical models to learn and can self-correct when provided with new data.

**AI & ML in Agriculture:** Since 1950 when the word 'Artificial Intelligence' was coined by John Mc Carthy, AI has travelled a long way being exploited in one or the other way to serve the mankind in the best possible way. Agriculture is both a major industry as well as foundation of the economy. In agriculture sector AI & ML can play a vital and pivotal role in various aspects of crop production and well as in

livestock. As mentioned earlier, Artificial intelligence is a sort of machine learning where we try to induce a sense of perception, learning, reasoning and understanding in machines or robots. Now various companies have developed agricultural robots which can handle all the essential agriculture related operations like harvesting crops at a higher volume and faster pace than human laborers. In this regard the crop and soil Monitoring is done with the help of sensors and by leveraging computer vision and deep-learning algorithms to process data captured by drones and/or software-based technology to monitor crop and soil health. In predictive agricultural analytics, various artificial intelligence and machine learning tools are being used to predict the optimal time to sow seeds, get alerts on risks from pest attacks, and more. Various machine learning models are being developed to track and predict various environmental impacts on crop yield such as weather changes. Many companies have also now come up with Supply Chain Efficiencies. These Companies are using real-time data analytics on data-streams coming from multiple sources to build an efficient and smart supply chain.

Today weed management is an important aspect for healthy crops and consequently obtaining higher crop yields. An estimated 250 species of weeds have become resistance to herbicides. A research study conducted by the Weed Science Society of America on the impact of uncontrolled weeds on corn and soybean crops, reported an annual loss of \$43 billion to farmers. The ability to control weeds is a top priority for farmers and an ongoing challenge as weeds have become more herbicide resistant. The companies have now come up with automation and robotics to help



farmers find more efficient ways to protect their crops from weeds. Blue River Technology has developed a robot called 'See and Spray' which reportedly leverages computer vision to monitor and precisely spray weeds on cotton plants. This precision spraying has helped prevent herbicide resistance. According to its website, the company claims that its precision technology eliminates 80 percent of the volume of chemicals normally sprayed on crops and can reduce herbicide expenditure by 90 percent. In a country like United States where it has been estimated that over 1 billion pounds of pesticides are used annually, reduction of herbicide expenditure through the use of robotics matter a lot. To reduce the challenges in labour force, automation is also emerging as an important tool to address this issue. The industry is also projected to experience a 6 percent decline in agricultural workers from 2014 to 2024. Harvest CROO Robotics has developed a robot to help strawberry farmers pick and pack their crops. Lack of laborers has reportedly led to millions of dollars of revenue losses in key farming regions such as California and Arizona. In the Hillsborough County, Florida region which has been described as the "nation's winter strawberry capital," between 10,000 and 11,000 acres of strawberries are typically harvested in a season. Harvest CROO Robotics claims that its robot can harvest 8 acres in a single day and replace 30 human laborers.

Time of sowing is very critical component in ensuring a better yield. Towards this, the International Centre for Research on Semi Arid Tropics 'ICRISAT' has in collaboration with Microsoft has developed an Artificial intelligence Sowing App powered by Microsoft Cortana Intelligence Suite including Machine

Learning and Power BI. This app sends sowing advisories to participating farmers on the optimal date to sow. It uses artificial intelligence to inform the farmers in selected district of Hyderabad about the right sowing date which is very critical to ensure that farmers harvest a good crop. When the farmers are informed about the right date of sowing, it prevents them from loss which they would have incurred due to costs of seeds, as well as the fertilizer applications. This information about timely sowing has already resulted in 30 per cent increase in yield of the farmers receiving the messages. The most interesting thing is that this is very much affordable. Farmer do not have to install any sensors in their fields or incur any capital expenditure. They need to only have a smart feature phone capable of receiving text messages.

Similarly Machine Learning (ML) is used in early warning systems that alert farmers about potential outbreaks. It can also be used to develop models for predicting the spread of pests and diseases. Machine learning can help farmers identify areas of degradation and map out management plans to improve soil health. Drone or satellite photos may be analyzed by deep learning algorithms to track crop health and spot any problems. These models enable prompt action by early illness, pest, or nutritional deficiency detection. Machine learning also helps farmers make informed management decisions on what to grow towards matching the crop to the existing market's demands.

To conclude, one can say that AI and ML bring with them powerful benefits for agriculture sector. New possibilities constantly emerge as the amount of data grows in size and complexity. It will result in automated and intelligent systems



coming up and helping to automate tasks, unlock value and generate actionable insights to achieve better outcomes. Both these have the massive potential to disrupt every part of the agriculture industry in the next 100 years.

