

Artificial Intelligence-The Future of Agriculture

Reshma Bahuleyan
SGT University
Gurugram, Haryana

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The agriculture and food sectors are facing multiple challenges as the global populations projected to grow from 7.6 billion to 9.6 billion by 2050 (UN DESA, 2019) so as there will be a significant increase in the demand for food. At the same time with the increasing population & industrialisation, the availability of natural resources such as fresh water and productive arable land is increasingly constrained. Rapid urbanisation is having important implications for patterns of food production and consumption. So how can we overcome this crisis in future?

Digital innovations and technologies may be part of the solution. The application of digital technologies such as blockchain, the Internet of things, AI (Artificial Intelligence) is being widely used in different sectors in developed countries like the USA to access information, inputs, market, finance and training. These technologies are creating new opportunities to integrate smallholders in a digitally-driven agri-food system. The digital transformation and its influence on our day to day life are huge. The perfect storm of a wide range of technologies such as artificial intelligence is changing the world and lives of people.

Agriculture may be the ancient and most important occupation, but the digital revolution in Indian agriculture is no exception. India has made rapid steps in the service sectors, yet, agriculture contributes 16 per cent to the countries GDP and 49 per cent of the rural household as means of livelihood. RAISE 2020 gave a platform to explore the opportunities of AI in agriculture. "I see a big role for AI in empowering agriculture, health care, education, creating next-generation urban infrastructure, addressing urban issues," Prime minister Modi said while inaugurating the Responsible AI for social empowerment summit (RAISE). The artificial intelligence-based Agri-tech applications are set to unleash the value



in agriculture, especially in wake of recent farm reforms that have opened doors to private sector investment in agriculture, TNIE reported.

There was a boost in the export of agricultural commodities by \$39.4 billion in 2019-20, with the investment in supply chain and post-harvest packaging and storage. This growth in agricultural productivity and outcome can be further increased by these AI-based advanced technologies. This advancement of technologies in the field of agriculture enables farmers to overcome many challenges. The use of technology in agriculture will improve the farmer's access to markets, inputs, data, advisory, credit and insurance.

Application of AI In Agriculture

The Agriculture industry is turning to Artificial Intelligence to help yield healthier, disease and pest free crops, monitoring soil health and growing conditions, organizing the data for farmers and improve a wide range of agriculture-related tasks in the entire food supply chain. Cognitive computing is emerging as a disruptive technology that allows analysing and correlating about the weather conditions, type of seed to sow, sowing time, probability of risk of disease-pest infestations, year to year outcomes, market trends, consumer needs and the final analysis facilitating farmers to make decisions on increasing the output. Farmers benefit not only by the on-farm application of AI but also in improving varieties and fertility products.

Soil And Crop Monitoring System: The application of AI help the farmers to determine the soil quality and the crop to sow. The soil type and nutrition play a crucial role in the determination of the type of crop and the quality of the crop. The interference of human and various environmental factors lead to the degradation of soil quality. A German-based tech startup PEAT developed an AI-based application called Plantix that can identify nutrient deficiencies in the soil as well as pest-disease by which farmers can also get an idea about the fertilizer usage to improve the harvest quality. This app uses image recognition based technology. Farmers receive the images of the field and crop in photos and short videos where he can analyse the conditions of his field which his smartphone. This app also provides soil restoration techniques with tips for the farmers. This sets an excellent example for the AI application in agriculture. AI application in India is advancing nowadays. The idea of



developing an AI-powered crop yield prediction model to provide real-time advisory and updates for the farmers. This enables the farmers to increase productivity and avoid agricultural input wastage.

•**AI-Enabled System To Detect Pest:** Pest is the worst enemies of farmers. It is very crucial to detect the pest attack beforehand to take appropriate measures to control them to avoid loss. AI system uses satellite images and compares them with historical data using the AI algorithm to detect the pest infestation in the field and the type of pest that has landed. It sends alerts and messages to the farmer to their smartphones, so that they can take required preventive measures and suitable control measures.

•**Supply Chain Efficiencies:** The AI and elated technologies are used in various stage of the Agri supply chain to ensure efficiency and effective transactions.

Transition discovery: Real-time data analysis on multiple sources and data from buyer/producer marketplaces and transporters feeds their automatic transaction discovery algorithm to attain high margin transactions.

Quality maintenance: Computer vision and AI-based automatic grading and sorting maintain quality products and the value of commodities. This boosts the export of products and retains international standards of products. It also helps to check the mal practises in different levels of the Agri supply chain.

•**Agricultural Robotics:** Agriculture sectors remain labour intensive and are the source of employment however there are areas where robots already come into use in agriculture. AI has emerged as a tool for monitoring, optimizing the yield and thereby AI companies are developing robots that can perform multiple tasks in the farming field. They are used in areas where intensive attention and precision is required or areas where labour cannot perform as per the hi-tech requirements. Robotics are mainly used in Nurseries for seed, plotting, care for the plants. It is utilized in the dairy industries for animal monitoring, milking and feeding machines. In the fisheries sector, it is employed for automated feeders and pond aeration. These machines recognise cropping patterns and undertake target spraying of fertilizers and pesticides, the precision allowing to limit the application to target plants. These robots are capable to fight agricultural labour challenges. They perform similar to face recognition in



smartphones where the crop pattern triggers the precision application. Harvesting robots and driverless tractors are using AI technology.

•**Price forecasting:** There are times when farmers are forced to sell their products to the middle man due to the lack of knowledge about markets. India also suffers from inadequate participation of agriculture produce marketing organisations. Often farmers encounter various challenges in marketing their products due to lack of knowledge. AI-based models use historical data sowing data, weather patterns, production yield and other relevant data and it uses remote sensing data from geostationary satellite images to predict crop yield at every stage of farming processes. The resulting output from the model includes the arrival date and crop volumes enabling the government and farmers to forecast the price three months prior to harvest for major crop market.

•**AI sowing app by Microsoft:** With the collaboration between Microsoft and non-profit agricultural organisation The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad successfully developed an AI-sowing app. The app is powered by Microsoft Cortana Intelligence Suite and Power Business Intelligence. With the help of Cortana Intelligence technology, the data are converted to readily actionable forms. Using this technology the app can forecast weather and data on crop yield and rainfall to accurately predict and advise local farmers on when they should sow or plant seeds. Farmers receive advisory assistance as text messages on their phones. By assistance, farmers receive necessary information related to planting time, weed management, fertilizer application and harvesting.

AI supports farm management decisions through the machine and digital learning processes. Human Intelligence can take longer time to comprehend, analyse, and formulate solutions to all the farm management decisions and react to all uncertainties agriculture is subjected to. The government of India is aiming to improve the quality of life of farmers and management decisions by the use of these technologies. Various national schemes like Pradhan Mantri Fasal Yojana is using remote sensing, AI, and modelling tools to lessen the claim settlement times. India with vast culture, traditional agricultural practises, soil and climate and topography contribute a vast opportunity for the data scientist to create AI-based solutions not just for the country but for the world too.

Challenges of AI in Agriculture

While we are excited about the possibilities and opportunities of AI in agriculture, we cannot help but look at the conditions and limitations in Indian Agriculture. In India, farmers own small landholdings and we can't expect them to invest in such technologies which are expensive. Although mobile phones and the internet improved access to ICT for people around the world still Internet connections remain limited in rural areas. Literacy and the education system plays an important role in digital technology knowledge dissemination. The literacy rate that remains low in rural areas is a major setback, which becomes a barrier to access such advanced digital technologies.

Lack of e-literacy and digital skills can create drawback in modern markets. It is necessary to educate about digital technologies and its applications in schools and colleges. Government should adopt strategies for digital agriculture by combining IT infrastructure along with social, economic and policy changes. The creation of sustainable models that provide solutions to small scale farmers can have a huge impact on the digital agriculture transformation process. We can look forward to the future of AI in agriculture.