Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 04 (JULY-AUG, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Role of Artificial Intelligence in Food Security

(Khushboo Kumari[1], Ayushi Kashyap[2] and *Arti Kumari[3])
[1]Department of Food Science and Technology, Assam Agricultural University, Jorhat, Assam
[2]College of Horticulture, Assam Agricultural University, Nalbari, Assam
[3]Krishi Vigyan Kendra Nalanda, Bihar Agricultural university, Sabour
*Corresponding Author's email: artikumari14002@gmail.com

Abstract
The world is facing numerous challenges such as climate change, pandemics, wars, growing population and supply chain disruptions. Amidst the growing challenges, feeding the ever-growing population remain the greatest concern. To address these challenges, agricultural sector needs to be more agile and efficient. Food security can be achieved by enhancing crop productivity and reducing post-harvest losses. The technological advancement such as artificial agriculture offers a range of tech-based solutions including access to agricultural inputs, quality testing, market connecting platforms, digital finance and precision farming. AI-based post-harvest management reduces the food loss and ensures safe delivery of food products to the end users. Thus, AI-based tools are new additions in the sustainable crop production system.

Introduction
Artificial Intelligence (AI), the science of today and the future generation is a field in which computer uses its software's and database which can tolerate diverse and integration procedures without losing its validity with intelligence and helps problem solving. They execute complex tasks in simplest possible ways. The main goal of Artificial intelligence is perception, learning and reasoning. Nowadays different AI tools are commonly used such as Chat GPT, Chat BOT, Grammarly, Descript, DALL -E 2, Mem, Fireflies, Reclaim, Genei and many more.

Agriculture, from preparation of land to distribution of food to the consumers is great sector of concern because production status of India according to third advance estimate released by central government in 2023 is 330.5 million tones (Press Information Bureau, Govt. of India, 2023), the global hunger index rank of India is 111th globally with a score of 28.7 in 2023 (Appendix C, 2023 Global Hunger Index[4].). India is the top most country in production of agricultural goods but based on its hunger index there is a large gap between the production and consumption rate and this raises the concern toward food security in India. According to world food summit, Food security is the access to sufficient nutritious and safe food that meets the populations dietary need and food preferences for an active and healthy life (FAO, Food security programme). The global population is projected to reach 10 billion by 2050, thereby imposing threat to food security. To address the challenges of food shortage, crop productivity needs to be enhanced from limited land which can be achieved by embracing technological advancements and innovative practices. Until last decade, Artificial intelligence in agriculture seemed weird combination. However, in recent years, introduction of AI in agriculture have seen revolutionizing effects. AI can solve many challenges and

reduce the disadvantages of conventional farming systems. The use of AI in agriculture and food sector has been discussed briefly in this chapter.

Dimensions of food security

Food availability: It is the availability of sufficient quantity of food of appropriate quality supplied through domestic production or imports. Availability of quality food is an area of concern as post-harvest loss of crops in India is very high. For availability of food, processing is very important and it requires equipments and skilled manpower at farm level.

Food access: It refers to access of individuals to adequate resources to obtain appropriate food for nutritious diet. Goods should be accessible from farm level to the consumers, as it will reduce middle man, prize fluctuation and exploitation of farmers or consumers. The farmers should reach each and every consumer directly maybe not through physical channel but trough online platforms and they should be aware of the market prize value.

Utilization: Utilization of food through appropriate diet, clean water, sanitation and healthcare to reach a state of nutritional well-being where all physiological needs are met. These are the roles of non-food inputs in food security. For proper utilization of food, hygiene, sanitation, appropriate quantity of additives while processing and packaging is essential to ensure delivery of safe food to the consumers.

Stability: To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk loose access to food as a consequence of sudden shock such as economic or climatic crisis or cyclical events such as seasonal food insecurity. The concept of stability is referred to both availability and access to food in food security. And for this proper storage facility with minimal wastage is essential.

Role of Artificial intelligence (AI) in Agriculture

I. **For weather forecasting:** By predicting the weather condition through weather forecasting, farmers can predict which type of crop can be grown and when sowing of seeds can be done.

II. **Monitoring soil and crop health:** Several AI based applications helps to identify the soil and plant health or any plant disease by photograph screening through their smart phone and also give solutions to deal with it.

One such example is Plantix, a German based start-up.

III. **Precision and analytic farming:** AI tools helps to analyze crop sustainability, farm evaluation like disease, pests, poor nutrition by using different data such as wind speed, temperature, humidity, solar radiation in combination with machine learning, algorithms and images through different means such as satellite, drones.

Several AI companies are developing different robots to perform multiple tasks at farm level such as, they are trained to control weeds and harvest crops at faster rate as compared to humans, through machine learning, algorithms and historical data sets. One such pioneer working in this field is Blue river technology (it uses robotics and computer software or algorithms for agriculture).

Artificial intelligence and food security

I. **Post harvest management:** AI screening system for individual crops by using algorithms and imaging are used to detect the harvesting stage of the crop because different crops have different stages of harvesting. For example in climacteric or non-climacteric fruits they have different harvesting stages. Deep learning helps in food grading based on physical factors (shape, size, colour, spoiled, infected etc).

II. **Food processing:** Under a food chain, different AI tools such as cyber-physical twin used to monitor food quality (like; sensory, chemical, economical and environmental quality) during food handling, transportation and before and after packaging.

Biosensors are used to detect pesticides residue, harmful microbes, water bodies contaminated by heavy metal. Different methods such as spectral method, sensor fusion, block-chain based digital traceability, vibration artificial intelligence-based tool, radial based multiple linear regression and many more methods/ tools/ softwares used to analyse adulteration of foods.

III. **Marketing and food consumption:** Evolutionary market learning helps in food distribution supply chain and reduces prize as it cut off the middle man by helping farmers to directly access the market prize of goods and online platform to reach larger number of consumers through e-commerce platforms by using current or historical data and algorithms through their smart phones. Smart phone scanning helps to access dietary parameters, tracking food consumption pattern, consumers demand. Also, it aids in food preparation, cooking parameters and identifies whether the food is fully cooked or uncooked based on its colour. Different developed nation uses robots in stores for distribution of food, one of the great examples of AI in food sector.

Challenges in use of AI in agriculture

- Reaching AI technologies to farmers is difficult in agricultural system due to lack of awareness and also the complexity of Indian agricultural system.
- To train the AI models different database is lacking.
- Cost of different AI systems (softwares/ hardwares) is very high.
- Data security is concerning issue as cyber crime rates are increasing day by day and less awareness towards this will lead to exploitation of both farmers and consumers.

Conclusion

Artificial intelligence (AI) helps in automation of farming system, provides information to the farmers about market and helps them to reach the consumers. It also helps in improving the production of crops by analyzing soil health, plant health, weather condition etc. It plays a great role in food security by minimizing post-harvest loses, helps food analysis, improve food quality, ensures proper packaging and distribution of food and its safe reach to the consumers. It reduces time, resources and man power and helps to improve quality, yield, overall output and maintain food security chain efficiently.

References

1. Anonymous (2022). Redefining agriculture through artificial intelligence: Predicting the unpredictable, Pricewaterhouse Coopers Private Limited, FICCI.
2. Innocent K, Munyaradzi R, Lyndah C (2023). Artificial intelligence in agrifood sectors, Journal of Agriculture and Food Research 11: 34.
3. Anonymous (2008). An Introduction to the Basic Concepts of Food Security, EC- FAO Food Security Programme, Food Security Information for Action Practical Guides.
4. Anonymous (2023). 2000,2008, 2015 and 2023 Global Hunger Index Scores, and changes since 2015, Appendix C, 2023 Global Hunger Index. Available at: https://www. globalhungerindex.org/india.html
5. Anonymous (2023). Press Information Bureau, Government of India, Tamil Nadu.