

# Chapter 13

## Applications of Artificial Intelligence for Smart Agriculture

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### ABSTRACT

*Smart cities is the latest buzzword towards bringing innovation, technology, and intelligence for meeting the demand of ever-growing population. Technologies like internet of things (IoT), artificial intelligence (AI), edge computing, big data, wireless communication are the main building blocks for smart city project initiatives. Now with the upcoming of latest technologies like IoT-enabled sensors, drones, and autonomous robots, they have their application in agriculture along with AI towards smart agriculture. In addition to traditional farming called outdoor farming, a lot of insights have gone with the advent of IoT technologies and artificial intelligence in indoor farming like hydroponics, aeroponics. Now along with IoT, artificial intelligence, big data, and analytics for smart city management towards smart agriculture, there is big trend towards fog/edge, which extends the cloud computing towards bandwidth, latency reduction. This chapter focuses on artificial intelligence in IoT-edge for smart agriculture.*

### 1. INTRODUCTION

Smart cities (<http://smartcities.gov.in/content/innerpage/what-is-smart-city.php>) is the latest buzzword towards bringing innovation, technology and intelligence for meeting the demand of ever-growing population. This has been the hot debate in both developing and developed nations of the world. Lot of Project proposal or initiatives are being developed for making cities smarter, greener and safer for citizens. Technologies like Internet of things (IoT), Artificial Intelligence (AI), Edge Computing, Big Data, Wireless communication are the main building block for smart city project initiatives. Along with IoT Sensors and wireless communication technologies like WiFi, 4G, 5G, Zigbee Technologies, these data need to be analysed for taking intelligent decisions. Along with all these technologies, communication

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and Artificial Intelligence, Big Data technology also has its role to play in smart city for managing the voluminous amount of data collected from IoT sensors in Cloud for future analysis and decision making.

Now a question would arise as how agriculture is connected to smart city application. Agriculture traditionally has been countryside legacy and not urban side. Usage of technologies in agriculture has not been focus for generations.

Now with the upcoming of latest technologies like IoT enabled sensors, drones and autonomous robots, they have their application in agriculture along with AI towards smart agriculture. These technological innovations have lot of applications in traditional farming pertaining to seeding, irrigation, crop health and many more. Also, these technologies based on IoT would benefit the farmers in reduction in wastage and enhancing the productivity (Ahmad et al, 2019; Heman et al, 2019; Wahidur et al, 2020; Raheela et al, 2016; Marques et al, 2019; Shekar et al, 2017)

In addition to traditional farming called outdoor farming, lot of insights have gone with the advent of IoT Technologies and Artificial Intelligence in indoor farming like hydroponics, aeroponics which are done by general public within their home terrace or room (Mehra et al, 2018; Ludwig and Fernandes, 2013; Khudoyberdiev et al, 2020; Bambang et al., 2019). There is no need of big farmland for doing agriculture nowadays. Now along with IoT, Artificial Intelligence, Big Data and Analytics for smart city Management towards smart agriculture, there is big trend towards Fog/Edge Computing (Bonomi et al, 2014; García-Pérez and Merino, 2017; Tang et al, 2017; Elbamy et al, 2017; Veeramanikandan and Sankaranarayanan, 2019; <https://www.cisco.com/c/en/us/solutions/enterprise-networks/edgecomputing.html>) which extends the cloud computing. The number of users using IoT has increased and also bandwidth needed for transmitting huge amount of data for analysis in the cloud employing Artificial Intelligence and Big Data tools can lead to lot of challenges which are latency, network connectivity, bandwidth consumption. So, a technology Edge/Fog computing solves the above-mentioned challenges in IoT for smart city management

This chapter would focus on Artificial Intelligence in IoT-Edge for smart agriculture. So before delving into the main focus of the chapter, we would look into work carried by different researchers in the area of IoT and Artificial Intelligence in Agricultural sector – indoor and outdoor farming towards smart city

## **2. LITERATURE REVIEW**

In this section, we would look into detail the various work carried out by different researches employing IoT technologies and Artificial Intelligence towards smart Agriculture enabling smart city.

### **2.1 IoT in Smart Agriculture**

In this research work (Ahmad et al, 2019), IoT technology been employed towards monitoring remotely for controlling the indoor climate conditions via LED parameters like spectrums, photoperiod and intensity towards increasing yields and reducing turnaround time. As a case study, the growth of *Brassica chinensis* been studied under different wavelengths of light source. This has influenced the performance and phytochemical characteristics of plant growth. Pulse treatment methodology was used in treating four different light treatments. Data that was captured for performing analysis of plants were leaf count, height, dry weight and chlorophyll a & b. Toward monitoring the environmental parameters of plant experimentally, an intelligent embedded system was developed towards automating the LED control.

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