

Preface

Agriculture is one of the most fundamental human occupation. As long as we have pursued it, we have tried to master it. Better techniques produce greater yields. This, in turn, kept humans happier and healthier – and helped birth modern society as we know it. However, there is only one hitch in this success story. As our farming capacity has expanded, usage of resources such as land, fertilizer, and water has grown exponentially. Environmental pressures from modern farming techniques have stressed our natural landscapes. Still, by some estimates, worldwide food production will need to increase by 70% by 2050 to keep up with global demand. With an increase in global population, it falls to technology to make farming processes more efficient and keep up with the growing demand. Fortunately, the combination of more data from the Internet of agricultural things and new machine learning capabilities can contribute a crucial part.

Machine learning and the Internet of things (IoT) play a very promising role in the agricultural industry; some of the examples are an artificial intelligence-programmed drone to monitor the field, IoT-designed automated crop watering system, and sensors embedded in the field to monitor temperature and humidity. Agriculture industry is the largest in the world, but when it comes to innovation, there is a lot more to explore. IoT devices can be used to analyze the status of crops. For instance, with soil sensors, farmers can detect any irregular conditions such as high acidity and efficiently tackle these issues to improve their yield. The data gathered from sensors allows us to apply analytics and get the insight that can aid decisions around harvesting.

In this book, we try to explore the impacts of machine learning and IoT in the agriculture sector and to point out the challenges faced by the agroindustry which can be solved by both machine learning and IoT.

Chapter 1 initially introduces the IoT architecture and the various protocols used to perform the data exchange between connected devices, and later discusses what machine learning is and their various categories.

Chapter 2 focuses on a long-term strategy by incorporating research and innovation for a sustainable agricultural system based on technologies such as the IoT and machine learning that play a significant role to advance sustainable farming and food nutrition.

Chapter 3 provides a detailed description of machine learning and its relationship with IoT, and also different applications of IoT where machine learning helped to make the intelligent system and the futuristic scope of IoT and machine learning and how these two technologies help in different areas such as smart city, smart human, and smart farming.

Chapter 4 highlights recent state-of-the-art work done with IoT and machine learning in the agriculture field and the challenges of respective technologies in this sector.

Chapter 5 highlights an overview of the modern technologies deployed to agriculture and proposes an abstract of the present and possible applications, and elaborates on the challenges and suitable explanations and execution.

Chapter 6 discusses Kaa, an IoT-based platform for smart farming that makes farmers reply instantly toward developing issues and modifications in encompassing conditions as well as examine their benefits.

Chapter 7 focuses on the benefits and technologies required for implementing smart farming.

Chapter 8 discusses various tools and techniques for smart farming using IoT that will significantly increase the farming outcome.

Chapter 9 aims at giving a detailed understanding of the IoT-based smart farming ecosystem and each of its elements with real-world use cases and illustrations.

Chapter 10 presents a novel smart farming enabled IoT-based agriculture toolkit Kisan-e-Mitra for soil quality analysis, testing, and recommendation.

Chapter 11 presents a discursive literature survey on the applications of artificial intelligence techniques in plant disease detection.

In Chapter 12, the convolutional neural network (CNN) model is used on 2,000 images to identify the wheat rust disease in an unseen leaf image.

Chapter 13 tries to introduce briefly the relevant concepts of plant disease detection and to explore how image-based plant disease detection technology can provide early detection of plant diseases.

Chapter 14 presents a review of the research works in rainfall forecasting using machine learning techniques with special emphasis on India.

Chapter 15 focuses on early disease recognition which requires higher resolution images.

Chapter 16 aims to exhibit deep learning capabilities to detect plant disease using images.

Chapter 17 explains how deep learning can be used for plant disease detection.

Chapter 18 includes an explanation about CNNs, their fundamental building blocks, and the details of different modern CNN architectures such as LeNet-5 and AlexNet.

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