Chapter 11
Deep Learning Solutions for Agricultural and Farming Activities

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ABSTRACT

The continuously growing population throughout globe demands an ample food supply, which is one of foremost challenge of smart agriculture. Timely and precise identification of weeds, insects, and diseases in plants are necessary for increased crop yield to satisfy demand for sufficient food supply. With fewer experts in this field, there is a need to develop an automated system for predicting yield, detection of weeds, insects, and diseases in plants. In addition to plants, livestock such as cattle, pigs, and chickens also contribute as major food. Hence, livestock demands precision methods for reducing the mortality rate of livestock by identifying diseases in livestock. Deep learning is one of the upcoming technologies that when combined with image processing promises smart agriculture to be a reality. Various applications of DL for smart agriculture are covered.

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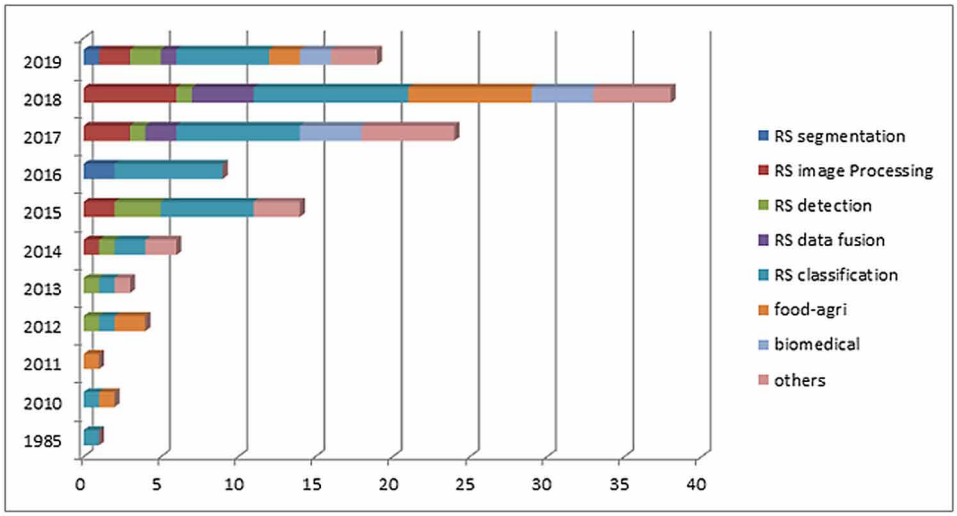
INTRODUCTION

With the ever-increasing global population, smart agriculture emphasizes (i) enhancing agricultural productivity and quality of food and (ii) safeguarding the natural ecosystem. It is comprised of automation of the identification of plant diseases, yield prediction, weed detection, insect detection, crop identification, and livestock management using modern techniques, such as cloud-based services, machine learning (ML), Internet of things (IoT), image processing, big data analytics, and many more. Smart agriculture promotes automated farming and the collection of field data using various means, including cameras, micro-controllers, actuators, and others. The data is analysed by IoT or machine learning to deliver useful information for decision making. Traditional machine learning needs to extract the domain features of input image data followed by classification. Feature extraction expects domain expertise as a prerequisite. Furthermore, traditional machine learning methods are not robust enough to handle high volumes of high-dimensional data. Both of these issues are handled by Deep Learning (DL). DL is widely used for automating various aspects of smart agriculture for two major reasons: it can handle huge amounts of data and does feature engineering on input images on its own (Zhu, 2018; Tseng, 2018). The popularity of this technique and its applicability over the years can be seen in Figure 1, which provides information on papers published in 1985 and between 2010 and 2019 on the application of Deep Learning to different techniques.

Figure 1. Papers published on different applications of deep learning, by year



The next section covers Deep Learning and its advantages and disadvantages, followed by a brief explanation of commonly used DL algorithms: CNN, RNN, LSTM, and GRU. Finally, the authors elaborate on Deep Learning-based agriculture applications and present the conclusions of the study.