

# Chapter 3

## Disease Identification in Plant Leaf Using Deep Convolutional Neural Networks

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### ABSTRACT

*Early detection of disease in the plant leads to an early treatment and reduction in the economic loss considerably. Recent development has introduced deep learning based convolutional neural network for detecting the diseases in the images accurately using image classification techniques. In the chapter, CNN is supplied with the input image. In each convolutional layer of CNN, features are extracted and are transferred to the next pooling layer. Finally, all the features which are extracted from convolution layers are concatenated and formed as input to the fully-connected layer of state-of-the-art architecture and then output class will be predicted by the model. The model is evaluated for three different datasets such as grape, pepper, and peach leaves. It is observed from the experimental results that the accuracy of the model obtained for grape, pepper, peach datasets are 74%, 69%, 84%, respectively.*

### INTRODUCTION

#### Motivation

Agriculture plays an important role in the global economy. Latest technologies have provided human society the facility to harvest adequate food to meet the requirement of more than 7 billion people. On the other hand, food safe keeping remains in danger by a number of factors such as change in climate, the decline in pollinators, plant diseases and others. Among these factors plant diseases are not only a threat to food security at the international level but can also have dreadful effect on small scale cultivators whose subsistence depends on safe and sound crops. Smallholder agriculturist bring about more than

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80 percent of the agricultural production in the evolving world. Farmers are facing more than 50% of yield loss because of pests and disease. Hence identification of plant disease and do the needful in time is one of the most primitive and vital activity in agricultural field. Fungi and micro-organisms are the major origin for plant disease. The metabolism of micro – organisms are unfit to predict at early stage because a few diseases do not show any symptoms during early stage and are expressed only at the final stage. These types of diseases are causing major reduction in the yield.

### **Traditional Methodologies**

In order to reduce crop loss due to disease several attempts have been developed from the olden days. Ancient way of widespread application of pesticides have in the past decade increasingly been supplemented by integrated pest management (IPM) approaches. Usage of chemicals such as bactericides, fungicides, and nematicides to control plant diseases can cause the development of long-term resistance of the pathogens, severely reducing the ability of the soil to fight back and produce adverse effects in the agro-ecosystem. Hence diagnosing a disease properly at its first appearance and provided appropriate remedial action is an important process for efficient disease management. In most of the cases diagnoses is performed visually by observing the symptoms through naked eye by the farmers or person from by agricultural extension organizations or other institutions, such as local plant clinics. Due to the enormous cultivated Crops and their existing phytopathological problems, even experienced agricultural experts and plant pathologists may often decline to victoriously diagnose specific diseases and are therefore led to misguided conclusions and concern solutions.

### **Interrelating Technologies With Agriculture**

An automated systems are invented nowadays to support farmers for determining plant diseases by the plant's appearance and visual symptoms. This could provides an immense service to the beginners in the gardening process and also trained professionals can be used as a confirmation system in disease diagnostics. The process of precise plant protection has been enhanced and expanded by the opportunities provided via advancement in the computer vision. In recent years computer vision applications are widely used in the field of agriculture which provides better accuracy compared to other historical methods.

Trustworthiness of the disease diagnosis can be enriched by employing data analysis through innovative technologies such as Artificial Intelligence (AI). Machine learning the subarea of AI. Machine learning is a field of research that formally focuses on the theory, performance, and properties of learning systems and algorithms. It is a highly interdisciplinary field building upon ideas from many different kinds of fields such as artificial intelligence, optimization theory, information theory, statistics, cognitive science, optimal control, and many other disciplines of science, engineering, and mathematics. Because of its implementation in a wide range of applications, machine learning has covered almost every scientific domain, which has brought great impact on the science and society. It has been used on a variety of problems, including recommendation engines, recognition systems, informatics and data mining, agriculture and autonomous control systems. There are several machine learning algorithms such as Support Vector Machine (SVM), Artificial Neural Network (ANN) and Deep Neural Network are used to extract hidden patterns from large volume of data and also the meta heuristics algorithms are employed to optimize the performance of these machine learning algorithms.

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