Chapter 4
Detection and Classification of Leaf Disease Using Deep Neural Network

Meeradevi
M.S. Ramaiah Institute of Technology, India

Monica R. Mundada
M.S. Ramaiah Institute of Technology, India

Shilpa M.
M.S. Ramaiah Institute of Technology, India

ABSTRACT

Modern technologies have improved their application in field of agriculture in order to improve production. Plant diseases are harmful to plant growth, which leads to reduced quality and quantity of crop. Early identification of plant disease will reduce the loss of the crop productivity. So, it is necessary to identify and diagnose the disease at an early stage before it spreads to the entire field. In this chapter, the proposed model uses VGG16 with attention mechanism for leaf disease classification. This model makes use of convolution neural network which consist of convolution block, max pool layer, and fully connected layer with softmax as an activation function. The proposed approach integrates CNN with attention mechanism to focus more on the diseased part of leaf and increase the classification accuracy. The proposed model design is a novel deep learning model to perform the fine tuning in the classification of nine different type of tomato plant disease.

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INTRODUCTION

Unpredictable climate change, without any proper irrigation technique, lack of knowledge in using modern technologies and use of pesticides have caused an imbalance in farming which has caused improper cultivation and unhealthy crops thereby threatening food security. Plant pathogens will lead to crop loss. Due to animals, weeds, pathogens it is estimated to reduce agricultural production between 20% to 40% globally. Agriculture is one the main sources of income in India it struggles to support rapidly growing population. It is estimated that in India smallholder farmers will generate around 80 percent of agricultural production and due to pests and plant disease there is more than 50 percent of yield loss. Plant diseases reduce the quality and production of food crops. To overcome this we need large verified dataset of images which includes healthy and diseased leaf images of all type of crop plants. Using this dataset develop an accurate image classifier which classifies the type of disease at initial stage. Such dataset was not available until recent and smaller dataset will not give accurate classification. So, PlantVillage project was initiated to benefit farmers with early disease detection and started collecting thousands of images of all types of crops. This chapter focuses on automatic plant disease detection as a topic of discussion. The study demonstrates the technical feasibility of deep learning to enable automatic tomato plant disease detection through tomato leaf images. The dataset consist of both diseased and healthy leaf images. In this chapter, deep convolution neural network is used to categorize the plant leaf as healthy or diseased. Various diseases of tomato leaf is identified like tomato_mosaic, lateblight, yellow curved, septoria Leaf Spot, healthy, bacterial spot with total 21071 images . These diseases can be identified at initial stage using CNN and farmers can use any infection control tools to stop spreading disease to other plants and also solve pest problems while minimizing the risks of human and environment. Some of the challenges identified are as follows.

- Quality of the leaf image
- Larger dataset
- Image denoising
- Segmenting exact spot of disease in leaf
- Splitting the training and testing samples from original images
- Feature extraction like color, size, texture and shape from image
- Recognizing different type of disease from plant leaves

Leaf diseases are threat to the crop production and farmer's economy reduces immensely with increase in spread of crop disease. Conventional methods of detecting crop diseases require a great deal of knowledge and expertise. Further,