ABSTRACT

Food security is a main apprehension in a modern society. Plant disease is critically disturbing the yield of agricultural crops and it is a massive threat to food security. Early identification of plant disease can reduce the influence of disease on crop yield. Agriculture has become much more than just a means to nourish continually increasing populations. Plants have become an important source of energy, and also plays an important role to solve global warming issue. There are numerous diseases that distress plants with the hidden to cause disturbing economical, social and ecological losses. Therefore, detecting diseases in a precise and timely way is of the most significance task. In tropical countries like India, incomes of agricultural crops are enormously affected by several plant diseases. Early identification of these diseases can be valuable to eliminate the effect of disease on crop yield. Empirical techniques of identification is time consuming and lengthy. It is remarkable that most of the plant dieses produce different symptoms on the surface of the leaves. Most diseases, though, generate some kind of appearance in the visible range. In the vast majority of the cases, the diagnosis, or at least a first guess about the disease, is performed visually by humans. Symptoms developed generally on every organ of a plant. However, symptoms developed on a foliage creates great effect on electromagnetic spectrum, that's why it is easy to detect the disease by foliar symptoms. These symptoms can be identified using various digital image analysis techniques. Image analysis techniques can be useful to resolve this problem. A relationship between digital numbers in various pixels can be identified from the image. Pixel wise classification techniques can be applied to identify disease symptoms on the leaves of plant. The overall process involves various stages namely, image acquisition, image segmentation, feature selection / extraction, and classification.

This study incorporates a model that Classifies a Mung (Vigna mungo L.) leaf to check whether it is healthy or infected with a disease with the aid of Machine Learning and Deep Learning algorithms. For this work, researcher used a self-created dataset of Mung leaf. The leaf samples have been collected from the South Gujarat Region. The images have been captured from Navsari Agriculture University, Gujarat and other crop fields of nearer villages. Images has been captured using various smart phones like Mi Note 8 Pro which has 64MP camera and Oppo A5 13MP camera. The dataset is created in a three different environments namely controlled environment, uncontrolled environment and combined environment, where

a controlled environment is a data item (image) that comprises only a single subject (leaf) and a white background. In an uncontrolled environment, an image contains the Mung leaf, background noise like stems, ground, other Mung leaves, etc. In combined environment images of both the controlled and uncontrolled environments are merged together. Seven different classifiers namely Support Vector Machine (SVM), KNN (K – Nearest Neighbor), AdaBoost (Adaptive Boosting), GaussianNB (Gaussian Naive Bayes), DTC (Decision Tree Classifier), LogisticRegression and Custom CNNs with different architectures have been trained and compared to each other.

Researcher aims at detecting 3 mung leaf disease categories and a healthy leaf category. The model extracts complex features of various diseases. Early detection will help farmers to improve their productivity. The main objective was to automate Mung Leaf disease identification using advanced machine learning and deep learning approaches and image data. Among all the classifiers the custom CNN achieved performs well and achieved highest accuracy in all the three environments. Custom CNN achieves 99.24% of training and 95.05% of testing accuracy in controlled environment. In uncontrolled environment custom CNN achieves 99.69% training and 87.88% of testing accuracy. In combined environment custom CNN achieves 98.81% of training and 90.68% of testing accuracy. The results shows high potentiality of machine vision for recognition of diseased leaves. An interface is developed where user can input and image. Here are user can select image from either single leaf (controlled environment), photo captured from the field itself (uncontrolled environment). Image given as input by interface will be given to model for classification whether it is healthy or having disease and if it is affected by disease then which disease the leaf has i.e. amongst the three Cercospora Leaf Spot, Powdery Mildew, and Yellow Mosaic Virus. Interface is just a medium to interact with model, and model works as an engine that does classification in background.