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EARLY DISEASE DETECTION IN TOMATO PLANTS USING NEURAL NETWORK

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ABSTRACT

Agriculture is one field which has a high impact on life and economic status of human beings. Improper management leads to loss in agricultural products. This process is to detect plant disease using the deep neural network, the alternative of conventional neural networks. This can easily detect the disease of plant leaves. First user can upload the image of the plant and it will upload the image on the screen. Then analyse the image by pressing the button. The disease can analyse and show the status of a plant that is healthy or unhealthy. The disease can be detected in the image of plant leaves. Due to the improvement and development in technology where devices are smart enough to recognize and detect plant diseases. Recognizing illness can prompt faster treatment in order to lessen the negative impacts on harvest. This process focuses upon plant disease detection using an image processing approach. This work utilizes an open dataset of 5000 pictures of unhealthy and solid plants, where convolution systems and semi-supervised techniques are used to characterize crop species and detect the sickness status of 4 distinct classes. The convolutional neural network algorithm is used to train the images of the plant and detect the disease from the image. Then it will predict the detection model of the plant leaf images in the form of accuracy.

1. INTRODUCTION

The aim of this paper is to help the farmers to protect his farm from any kind of pests and disease attacks and eliminate them without disturbing the decorum of the soil and untouched parts of other plants. Mostly in India, farmers use manual monitoring and some apps which have huge database limitations and are only bound to the detection part. Since, Prevention is better than cure, this paper aims at detection of attacks of pests/diseases in future thereby making farmers to prevent such attacks. The Network is trained using the images taken in the natural environment and achieved 99.32% classification ability. This shows the ability of CNN to extract important features in the natural environment which is required for plant disease classification. Image classification, Image Categories, Feature Extraction, and Training Data is carried out. The whole development of the algorithm is done in a Python tool. The algorithm is implemented with training data and

classification of given image dataset. The test input image is compared with the trained data for detection and prediction analysis. From the results, it is clear that the model provides reliable results.

2. LITERATURE REVIEW

In this study [1], Evaluated the performance of simple two layers CNN (as a baseline), AlexNet (with 5 convolutional layers), VGGNet (with 13 convolutional layers) and GoogleNet (with 9 convolutional layers). The accuracy are as follows, Baseline - 84.58, AlexNet - 91.52, GoogleNet - 89.68 and VGGNet - 95.24

In this study [2], Compared 5 Deep Learning Models such as Resnet50, Xception, ShuffleNet, MobileNet, DenseNet_Xception. The accuracy are as follows, DenseNet_Xception - 97.10, Xception - 93.17, Resnet50 - 86.56, MobileNet - 80.11, ShuffleNet - 83.68

In this study [3], Labeled 3 classes, Background, Healthy and Cucumber Mosaic. Used 5 cluster K-means clustering and Quadratic SVM is used for Image Segmentation and Classification. A high percentage of 90.9% accuracy is obtained for both classification of background images and the healthy part of the plant. However only, 57.1% accuracy was obtained for classification of cucumber mosaic.

In this study [4], Survey has been conducted to compare disease detection and classification techniques in Machine learning. We studied Support Vector Machine (SVM), Artificial Neural Network (ANN), K- Nearest Neighbor, Fuzzy C-Means Classifier and Convolutional Neural Network. SVM classifier is used by many authors for classification of diseases when compared with other classifiers. The result shows that CNN classifiers detect more diseases with high accuracy.

This study [5], presents a Convolutional Neural Network (CNN) model and Learning Vector Quantization (LVQ) algorithm-based method for tomato leaf disease detection and classification. The dataset contains 500 images of tomato leaves with four symptoms of diseases. One of the main challenges in disease detection and classification for this study is that the leaves with different diseases are very similar to each other. Therefore, this similarity can cause some leaves to be folded into wrong classes.

In this study [6], comprising 35,000 images of healthy plant leaves and infected with the diseases, the researchers were able to train deep learning models (CNN) to detect and

recognize plant diseases and the absence of these diseases. The trained model has achieved an accuracy rate of 96.5% and the system was able to register up to 100% accuracy in detecting and recognizing the plant variety and the type of diseases the plant was infected with.

3. PROPOSED METHODOLOGY

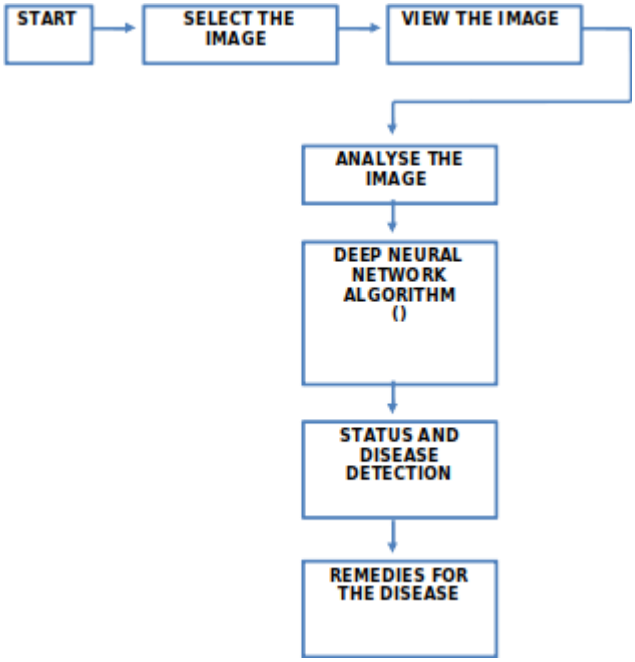
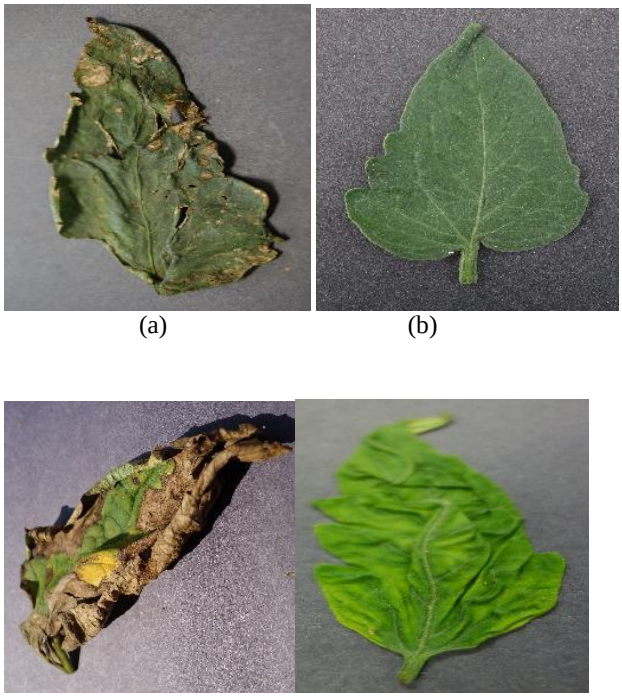


Fig 3.1: Data Flow Diagram

This study employed design science to establish and assess a strategy that uses qualitative and quantitative data to produce innovations and define concepts, practices, technological capabilities, and products. The design model for this study is shown in Figure 3.1.

3.1 Data Selection and Loading

In this project, the tomato plant disease dataset is used for disease detection. The dataset contains the image of three types of diseased leaves and healthy leaves. Each set contains 1000 images. Among which, 90% of the images are used for creating the training model and 10% is used for testing.



(a) (b)

(c) (d)

Fig 3.2: (a) Bacterial Spot (b) Healthy (c) Late Blight (d) Yellow Leaf Curl Virus

3.2 Data Pre-processing

Data Pre-processing is used to verify the images in the dataset. The images are verified based on the colour, size, patterns and shape. This process can verify whether the image is good or it is blurry. The clarity of the image can be verified here.

3.3 Feature Extraction

Feature Scaling is a method used to standardize the range of independent variables or features of data. In data processing, it is also known as data normalization and is generally performed during the data pre-processing step. It is a step of data pre-processing which is applied to independent variables or features of data. It basically helps with the data within a particular range. Sometimes it also helps in speeding up the calculations in an algorithm.

3.4 Analyse Image using CNN

In neural networks, Convolutional Neural Network (ConvNets or CNNs) is one of the main categories to do image recognition, image classifications. CNN image classification takes an input image, processes it and classifies it under certain categories. Convolution is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a filter or a kernel. The next layer Maxpooling, it selects the maximum element of the image covered by the filter. It forms an extracted image with the most prominent features of the image. From these extracted features a trained model is created.

3.5 Predict the Disease

To predict the disease the trained model is imported. The test image is passed to the CNN and the features of it are extracted. The image formed using the extracted features is compared with the imported trained model. A predict function is used to provide the output from the comparison.

4. RESULT

The proposed system is successfully implemented to train and test the model. With no overfitting, the accuracy of the test set is 98.4% and the loss is 1.6%. This model predicts the disease type and added to that, it also provides the remedies for the disease. This model can benefit the farmers by assisting them to find the disease type by themselves without any expert opinions. Also, it eases the disease prediction when compared to the traditional method of predicting the disease. This model has produced high accuracy too.

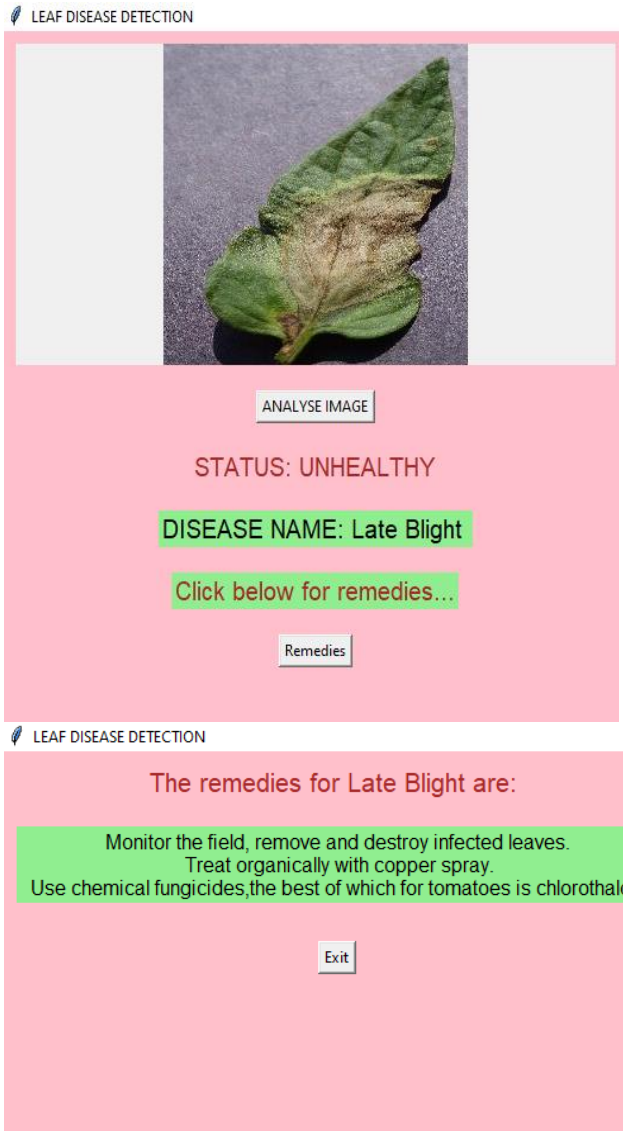


Fig 4.1: Results

5. CONCLUSION AND FUTURE SCOPE

The proposed system is successfully implemented to train and test the model. With no overfitting, the accuracy rate on the test set is 98.4%. In the future, this model can be developed as a real-time monitoring system which can be more effective in the field of agriculture.

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