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Identification and Classification of Disease for Tomato Plant using IP and CNN

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Abstract:- **Tomato Leaf disease Identification is basically a system application which uses IP (Image Processing) and CNN (Convolution Neural Network) techniques. Image processing is very important part of the system which includes image acquisition and image conversion. The convolution neural network is use for classification. To train the model for the CNN architecture, data is collected from the authenticated online source. 4000 samples leaf images of four classes, including the healthy leaf images are used to train the model. At the end the result shows some tomato plant diseases such as Late Blight, Yellow Leaf Curl and Bacterial Spot are detected.**

Keywords:- *Image Processing, Convolution Neural Network, Late Blight, Yellow Leaf Curl, Bacterial Spot.*

I. INTRODUCTION

Agriculture has much more importance than simply a means to nourish ever growing populations. However, plant diseases are threatening the livelihood of this important source. Due to the plant diseases there are major economic losses in agriculture and forestry. Therefore, early detection and identification of plant diseases plays the utmost important role to take timely Measures. There are several ways to detect plant pathologies. Some diseases are not identify at the early stage. They need some time to identify the disease. In these cases, it is necessary to perform sophisticated analysis, usually by means of powerful microscopes. In some cases, the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans.

The aim of this research is to develop a user friendly system for the farmers that will help farmers in finding out diseases of tomato plant without bringing an expert to the field. We are providing remedies of tomato plant diseases to the user. For this purpose we first get the image from user then perform feature extraction on that image. For extracting the features we use conversion of image and resize the image. The convolution neural network is use for classifying the diseases. The system can uses one image databases which contain 4000 images, 70% of the data is use for training the model and 30% of data is use for testing the model.

II. RELATED LITERATURE

This section of Literature Survey eventually reveals some facts of Tomato Plant Disease Identification System based on the analysis of many authors work as follows:

Debashis Ghosh [1], aimed to develop a mobile vision based plant leaf recognition system which monitor crop diseases having different patterns. It classifies its suitable class which can be used to help the botanical students in their research work. The feature factor used in the system planned by the author in this work has enormous computation cost. The quality of captured image is affected by the shadow and season.

S. Bani-Ahmad [2], proposed an improved solution for classification of leaf diseases by using algorithms like k-means and neural networks. Otsu's method are used in segmentation to mark green pixels and then the boundary pixels are removed. In proposed work clustering and classification of diseases is done.

S. Arivazagan [3], proposes to develop a system that automatically finding the solutions for plant leaf disease by analyzing the texture of leaf. At the initial stage diseases are analyzed. The identification rate is short which needs to be optimized to avoid the misclassification of the variable symptoms of the plant disease.

III. PROPOSED ARCHITECTURE

We develop a system which helps the farmers to identify the tomato plant diseases. We are using Image Processing for extracting the features and Convolution Neural Network for classification of the tomato plant disease. For that purpose we are using the dataset of total 4000 images of tomato plant leaf. These 4000 images are classified in four categories as follows: 1.Late Blight Disease 2.Yellow Leaf Curl Disease 3.Bacterial Spot Disease 4.Healthy. Each category of disease contain 1000 images.

For classification of images we are using convolution neural network. For this first we have to train the model then test the accuracy of that model by testing the model. So 70% of data is use for training the model and 30% of data is use for testing the model. The main objective of this system is to identification of tomato plant disease and provide remedies for that disease.

Fig 1:- Image Dataset

❖ *Methodologies:*

A. Image Processing for Feature Extraction:

First process after getting the image from camera or any other source is to process the image for feature extraction. We get the image of different resolution so first we need to resize the image of 50 by 50 pixel. Then conversion from RGB to HIS model and flood fill algorithm is use for feature extraction.

➢ *Conversion from RGB to HIS model:*

Basically the input image is in format of RGB model. The RGB model, which encodes by their intensity of color of Red, Green, and Blue. Each color red, green and blue defines their intensity of color by an integer value between 0 to 255. The HSI model, which encodes colors according to their **H**ue, **S**aturation, and **I**ntensity. The HIS model is used by some graphics software and image monitoring system alongside the RGB Model.

➢ *Flood Fill Algorithm:*

For segmentation purposed flood fill algorithm is very important. Flood fill algorithm is also called region growing algorithm. At a first view, it looks very simple algorithm to implement but it has very interesting implementation for segmenting the image. Flood fill algorithm finds the same color area from starting point to last point with same color. Flood fill algorithm includes 4 or 8 direction of neighbors that check for condition to same area color and perform the operation recursively for neighbors in case they passed that condition.

B. CNN for Disease Classification:

The classification of disease is depend on the model that we are created by training the 70% of the data. The accuracy of the model is depend on the size of database, higher the size of database higher the accuracy of the model. There are total seven layers present in this convolution neural network. First layer is input layer and the last layer is output layer. There are total five hidden layers present in this convolution neural network. The output layer has four neuron present in it for classification of the disease. Each neuron represent the unique disease of tomato plant. Such as one neuron for Late Blight Disease and others neurons for different diseases. In this model we are using the learning rate of 1e-3 that is 1*(10 to the power -3) for training the model. After finding the tomato plant diseases, system provides the remedies of this disease.

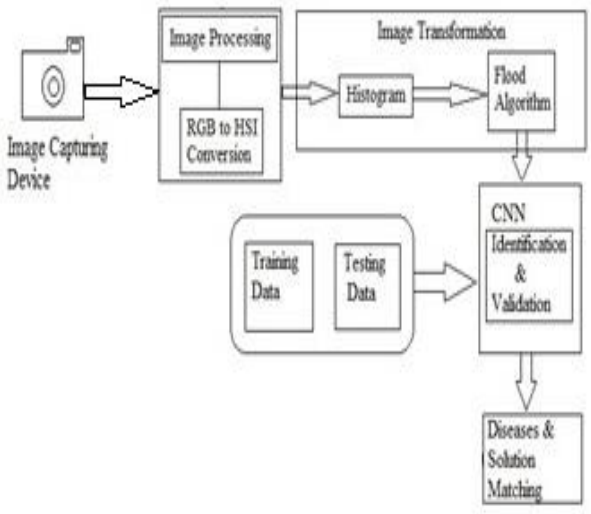

Fig 2:- System Architectural Diagram

IV. EXPERIMENTATION AND RESULTS

The dataset is divided 70% for the training and 30% for testing. Different models with different architectures and learning rate are tested. ReLu activation function is used since researches have shown that ReLU result in faster training. The result obtained is shown below.

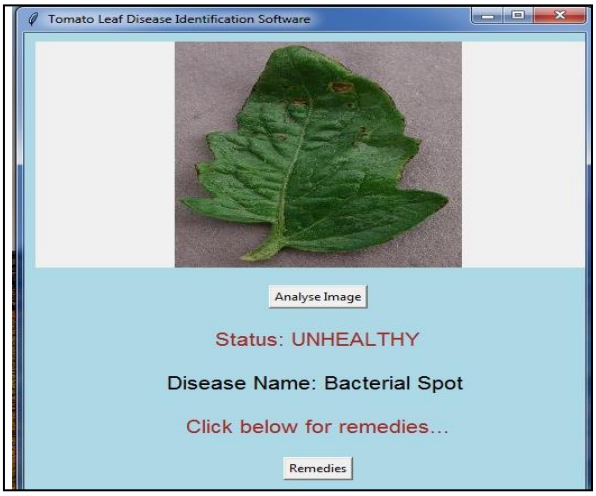

Fig 3:- System GUI for Identification of Disease

Fig 3 shows the 'Status' of the leaf as HEALTHY or UNHEALTHY. If the plant is UNHEALTHY, then the name of disease is specified. Knowing the disease is not enough, so remedies for the disease is provided. To get the remedies the button as 'Remedies' is shown in the above figure. By pressing this button a process of searching appropriate decease remedies carried out simply by switching to block of matched index value out from analysis algorithm.

Thus after detecting the disease, remedies for the disease is displayed on the resulting screen provided in the following Fig 4.

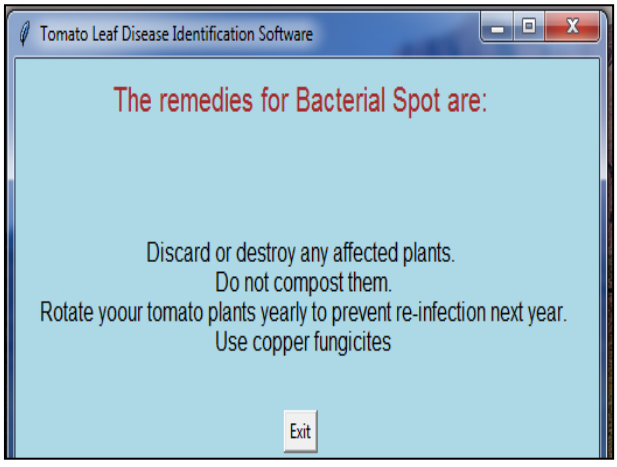

Fig 4:- System GUI for Remedies of Disease

The remedies are useful to avoid the disease, so the plant will be Healthy.

V. CONCLUSION

The system is capable of detecting the disease at the earlier stage as soon as it occurs on the leaf. Hence saving the loss and reducing the dependency on the expert to a certain extent is possible. It can provide the help for a person having less knowledge about the disease. The system periodically monitors the cultivated field. Tomato plant diseases are detected in early stage by using Image Processing and CNN techniques. Convolution Neural Network techniques are used to train the model which helps to identify the diseases. The remedies are provided to the farmer to control the disease.

VI. FUTURE SCOPE

This research has been considered only for three diseases and further it can be extended for various diseases. In future it can be extended to find the percentage of the infection in accordance with the area affected. In future the system may be implemented by adding extra services like nearby government stores, price list for the pesticides, nearby open market and many more.

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