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SVM Based Plant Diseases Detection using Image Processing

Bharath Kumar R[1], Balakrishna K[2], Shreyas M S[3], Sonu S[4], Anirudh H[5] and Abhishek B J[6]

[1]Dept of CSE, MIT,Mysore, Karnataka, India
[2]Dept of ECE, MIT,Mysore, Karnataka, India
[3,4,5&6]Dept of CSE, MIT,Mysore, Karnataka, India

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***Abstract*:** Plants are affected by a disease which leads to the variation in the growth stages of it's and finally affects the throughput from it. Identification of the plant leaves diseases id the key role in preventing the losses in farming, where it's a challenging to detect multi plant diseases. Here four major diseases affected by the plant are selected like Alternaria Alternata, Anthracnose, Bacterial Blight and Cercospora Leaf Spot and also addition with the healthy leaves using image processing technologies. The algorithm consist of a image pre-processing, image segmentation, feature extraction and finally with classification method.

Keywords *– Image processing, Segmentation, Feature Extraction, Support Vector Machine, Gray-Level Cooccurrence Matrix (GLCM).*

I. INTRODUCTION

The Plant diseases have turned into a big problem as it can cause significant reduction in both quality and quantity of agricultural products. 70% of the Indian population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. But the cultivation of these crops for optimum yield and quality produce is highly technical. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly. Many authors have worked on the development methods for the automatic detection and classification of leaf diseases based on high resolution multispectral and stereo images.

There are two main characteristics of plant disease detection machine-learning methods that must be achieved, they are: speed and accuracy [1]. There is need for developing technique such as automatic plant disease detection and classification using leaf image processing techniques. This will prove useful technique for farmers and will alert them at the right time before spreading of the disease over large area. Solution is composed of four main phases; in the first phase we create a color transformation structure for the RGB leaf image and then, we apply color space transformation for the color transformation structure. Then image is segmented using the K-means clustering technique. In the second phase, unnecessary part (green area) within leaf area is removed. In third phase we calculate the texture features for the segmented infected object. Finally, in the fourth phase the extracted features are passed through a pre-trained neural network [2].

II. LITERATURE SURVEY

Zulkifli Bin Husin et al, in their paper [3], they captured the chilli plant leaf image and processed to determine the health status of the chilli plant. Their technique is ensuring that the chemicals should apply to the diseased chilli plant only. They
used the MATLAB for the feature extraction and image recognition. In this paper pre-processing is done using the Fourier filtering, edge detection and morphological operations. Computer vision extends the image processing paradigm for object classification. Here digital camera is used for the image capturing and LABVIEW software tool to build the GUI.

The segmentation of leaf image is important while extracting the feature from that image. Mrunalini R. Badnakhe, Prashant R. Deshmukh compare the Otsu threshold and the k-means clustering algorithm used for infected leaf analysis in [4]. They have concluded that the extracted values of the features are less for k-means clustering. The clarity of k-means clustering is more accurate than other method.

Prakash et al., [5] worked on disease detection and classification in plant leaf using image processing technique. Images are collected using a high-resolution camera for better efficiency and applied an image processing technique to extract the features for further analysis. Image pre-processing filter is used to remove noise in the images and CIELAB is applied to define color space conversion. The texture analysis has been done with a feature computation of

contrast, energy, homogeneity and correlation. Finally, the extracted features are given to the pre-trained neural network for classification of disease using BPNN, SVM and KNN followed by optimal parameter selection.

III. PROPOSED METHODOLOGY

The four major diseases affected by the plant selected here are Alternaria Alternata, Anthracnose, Bacterial Blight and Cercospora Leaf Spot and also addition with the healthy leaves. Plant diseases control accomplished a desired aim only with well timed detection of diseases and perfect identification of causative agents. In that majorly diseases seen on the leaves of a plant, then it will spread to different part of the plant. So here first need to identify the diseases and then need to feed the proper dosage of medicine treatment to cure the diseases. The image processing method helps to identify and classify the diseases automatically, efficiently, fast and accurately [?]. The general steps in identification of the diseases will be carried as shown in Figure 1.

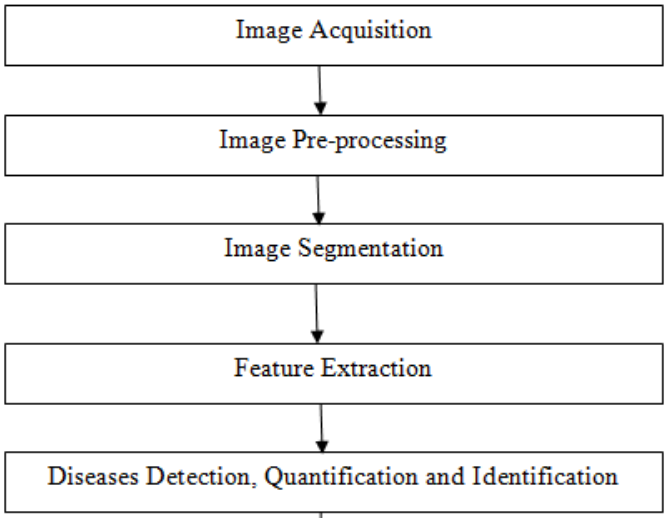

Figure 1: Basic steps in detection of diseases.

Image Acquisition: The images of the plant leaf are captured through the camera. This image is in RGB (Red, Green And Blue) form. Color transformation structure for the RGB leaf image is created and then, a device-independent color space transformation for the color transformation structure is applied Segmentation subdivides an image into its constituent regions or objects. The level to which the subdivision is carried depends on the problem being solved. That is, segmentation should stop when the object of interest in an application have been isolated. For example:, in the automated inspection of electronic assemblies, interest lies in analyzing images of the products with the objective of determining the presence or absence of specific anomalies, such as missing components or broken connection paths. There is no point in carrying segmentation past the level of detail required to identify those elements. Segmentation algorithms for monochrome images generally are based on one of two basic properties of image intensity values: discontinuity and similarity.

Image Pre-processing: Noise gets added during acquisition of leaf images. So we use different types of filtering techniques to remove noise. We create device independent color space transformation structure. Thus we create the color transformation structure that defines the color space conversion. The next step is that we apply device-independent color space transformation, which converts the color values in the image to color space specified in the color transformation structure. The color transformation structure specifies various parameters of transformation. A device independent color space is the one where the resultant color depends on the equipment used to produce it. For example the color produced using pixel with a given RGB values will be altered as brightness and contrast on display device used. Thus the RGB system is a color space that is dependent. To improve the precision of the disease detection and classification process, a device independent color space is required. In device independent color space, the coordinates used to specify the color will produce the same color regardless of the device used to take the pictures. CIE L*a*b is a device independent color space in which a & b components carry color information.

Image segmentation (k-means clustering): Image segmentation is the process used to simplify the representation of an image into something that is more meaningful and easier to analyze. *K-means* clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. *K-means* clustering aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster.

Then the Green colored pixels based on the specified threshold value that is computed for these values. The pixels with zeros red, green, blue components as well as pixels on the boundaries of infected cluster are completely removed. This is helpful as it gives more accurate disease classification and significantly reduces the processing time. Infected cluster is converted from RGB to HSI color format.

GLCM: The 11 features are extracted from the GLCM, Gray level Co-occurrence matrix (GLCM) is generated for each pixel map for H & S images of infected cluster.

The support vector machine (SVM) is a type of classifier that is originally a binary Classification method developed by Vapnik and colleagues at Bell laboratories.

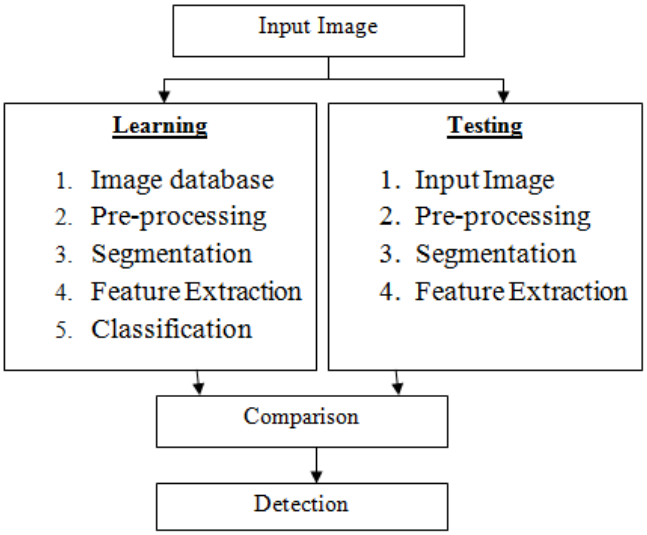

Figure 2: Proposed Method of Algorithm.

The Separable Case: Fully Linearly Separable For a binary classification problem with input space X and binary class Y where y Ɛ {-1, 1}. There may exist many separating hyper-planes that correctly classify the data. The goal of SVM is selecting between them the one that maximizes the distance between the separating hyper-planes. The goal of SVM is to search for the optimal.

$$w \cdot x + b = 0 \qquad (1)$$

where w is normal to the hyperplane. Since SVM search for the separating hyperplane with largest margin. This can be formulated as follows:

$$y_i (x_i \cdot w + b) - 1 \geq 0 \; \alpha \; I \qquad (2)$$

Not Fully Linearly Separable: In order to extend the SVM methodology to handle data that is not fully linearly separable, we relax the constraint 2 slightly to allow for misclassified points as follow:

$$y_i (x_i \cdot w + b) - 1 \geq 0 + Ɛ \; \alpha \; I \qquad (3)$$

IV. CONCLUSION

In these experiments, plant diseased is detected and is also classified. The histogram matching is based on the color feature and the edge detection technique. The color features extraction are applied on samples that are contained the diseased leaf of the plant. The training process includes the training of these samples by using layers separation technique which separates the layers of RGB image into red, green, and blue layers and edge detection technique which detecting edges of the layered images. The SVM based classifiers classifies for the specific diseases for the plant leaves in generic.

V. RESULT

The Figure 3 shows the snap shot for the working model.

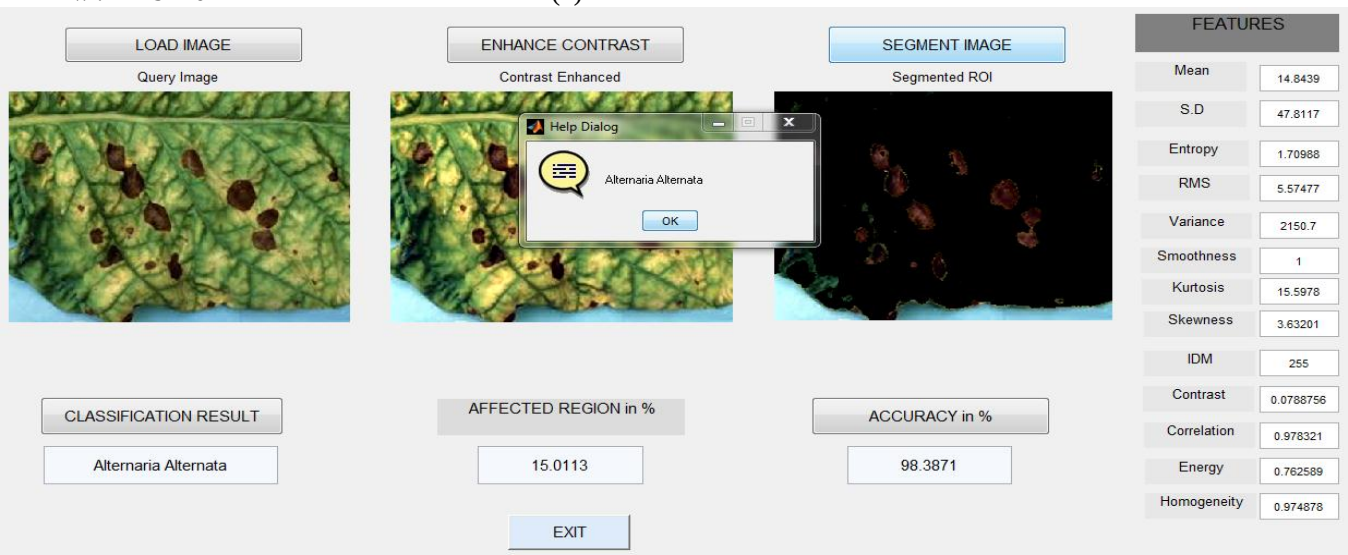

Figure 1: Snapshot of a working model

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