Leaf Blight Detection using Image Processing and Support Vector Machine

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Abstract— Agriculture sector comprises of 70% of our economy. Thus it is very important for the advancement of technology in the field of agriculture. This in turn will help in sustainable agriculture and health monitoring of the plants in equal intervals. The aim of this project is to using image processing and machine learning for disease detection in order to increase the crop yield production. This in turn will help solve the plight of the farmer. Image processing plays a vital role in the recognition of the diseased and healthy leaves. Machine learning techniques like support vector machine is used for classifying the type of leaf disease and give necessary aid to the plant for recovering from the disease and help inexperienced farmers as well as experienced farmers for faster and accurate detection of the leaf diseases. It also gives the affected region of the leaf disease. Thus allowing the farmers to calculate the fate of the plant.

Keywords: Leaf Disease, Image Processing, Vector Machine

I. INTRODUCTION

India's primary sector involves agriculture. India's GDP is majorly dependent on the agricultural sector. It is of utmost importance to make sure that all the agriculture related problems are solved thereby not allowing it to hamper the economy of the country. Major plights in the agriculture sector include diseases which occur in various parts of the plants. This in turn leads to the low crop yield production. In order to increase the crop yield production, it is necessary for the early detection of the diseases which may occur in any part of the plant like leaves, fruits, stems. There are various kinds of disease which may occur which includes bacterial, viral or fungal disease. The proposed system will help in early detection of the diseases in leaves. Thus, getting aid for it as early as possible in an efficient, fast and economical manner.

II. SYSTEM DESIGN

The system design consists of the following steps

1) Capturing of leaf images
2) Image Pre-processing
3) Image Segmentation
4) Feature Extraction
5) Classification of leaves
6) Detection of leaves

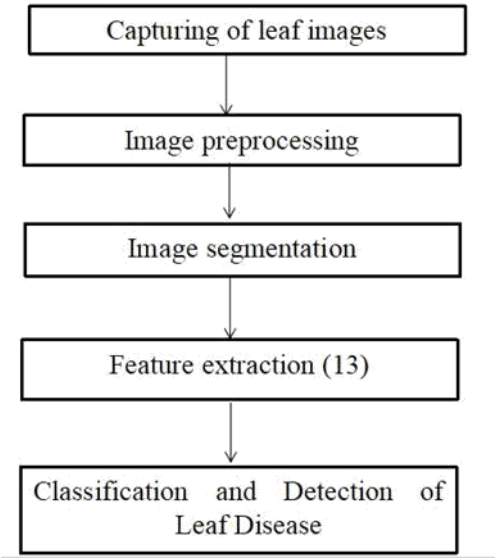

Fig. 1: System Design

A. *Capturing of Leaf Images*

The first step is to capture the leaf images from public domain. The images captured are kept in standard form that is .png,.jpeg,.jpg.The captured images are then divided as healthy leaves and diseased leaves. In the project, the infected leave diseases include alternaria lternata, anthracnose, bacterial blight.

B. *Image Preprocessing*

Image preprocessing involves removal of any noise in the image. This helps in clearer differentiation and gives bold changes if any that occur in a leaf. The noise and extortion removed are like enhance of the contrast, resizing of the images, picture intensity is enhanced, converted to grayscale image for better quality and clarity. Thresholding is done using otsu's method which converts the intensity image to binary image. Image's histogram is used to compute the mean of the distribution and then scaled to a normalized value between 0 and 1.

C. *Image Segmentation*

Image segmentation is the segmentation of the desired leaves into various segments in order to get the desired region of interest. It includes the diseased area for a diseased leaf or the healthy area for a healthy leaf. In this project we have done image segmentation using K-mean clustering algorithm where the segmentation is done by dividing into 3 clusters and selecting one of them to get the desired features. The K-mean clustering algorithm involves

1) The data set is divided into K number of clusters and data points need to be assigned to each of these clusters randomly.

2) For each data point, the distance from data point to each cluster is computed using Euclidean distance The Euclidean distance is given as follows:
Euclidean Distance=√ ((x1-x2)² + (y1 -y2)²) where (x1, y1) & (x2, y2)
3) The data point which is nearer to the cluster to which it belongs to should be left as it is.
4) The data point which is not close to the cluster to which it belongs to should be then shifted to the nearby cluster.
5) Repeat all the above steps and once the clusters are constant, clustering process needs to be stopped.

D. Feature Extraction

After the segmentation, feature extraction needs to be done. The easier way the evaluate the entire leaf is to divide the leaf according to their features components. We can use features from gray-level co-occurrence matrix.
Includes: entropy, energy, skewness, smoothness, kurtis, homogenity, RMS, IDM, mean, variance, standard deviation. These components are then used to find out the percentage of affected region.

No	Features	Formula
1	Contrast	$\sum_i \sum_j \lvert i-j \rvert^2 p(i,j,d,\theta)$
2	Correlation	$\sum_{i,j} \frac{(i-\mu_i)(j-\mu_j)p(i,j)}{\sigma_i \sigma_j}$
3	Energy	$\sum_i \sum_j p(i,j,d,\theta)^2$
4	Homogeneity	$\sum_i \sum_j p(i,j,d,\theta)/(1+\lvert i-j \rvert)$

Table 1: Feature Extraction Formula

E. Classification

Support vector machine are supervised learning models with associated algorithms that analyze data used for classification and regression analysis. Some of the problems of pattern recognition like texture classification make use of SVM.SVM is basically binary classifier which determines the hyper plane in dividing two classes. The boundary is maximized between the hyper plane and the two classes. The marginal distance is maximized between different classes by SVM. Different kernels are used to divide the classes. The samples that are nearest to the margin will be selected in det0ermining the hyper plane are called as support vectors. In this project we have made use of multi class SVM as there more than two possibilities in real life. Here when there is large training data, voting strategy is used where the testing point is supposed to have the largest vote. The voting strategy is called MAX-WIN strategy.

III. RESULT AND ANALYSIS

The result of the different inputs applied are as follows:

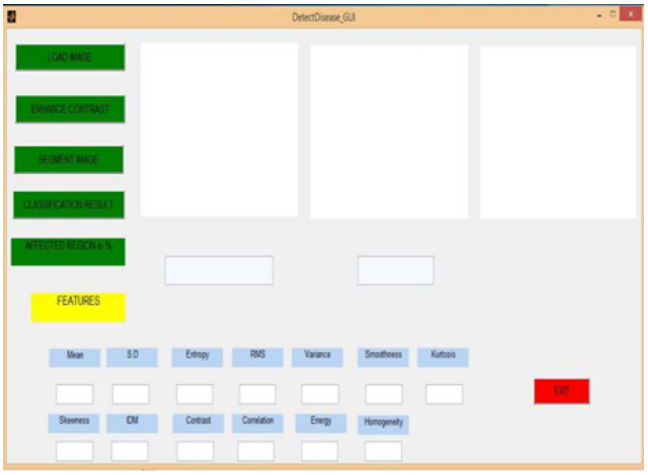

Fig. 2: GUI of the Layout

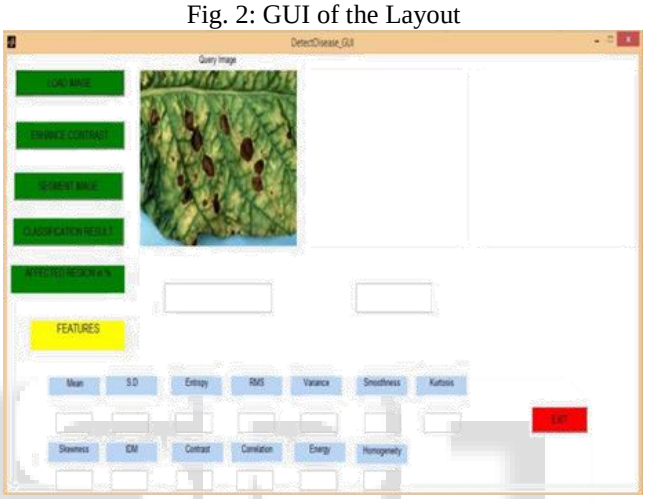

Fig. 3: Image is uploaded

Description: GUIs provide point-and-click control of software applications, eliminating the need to learn a language or type commands in order to run the application.

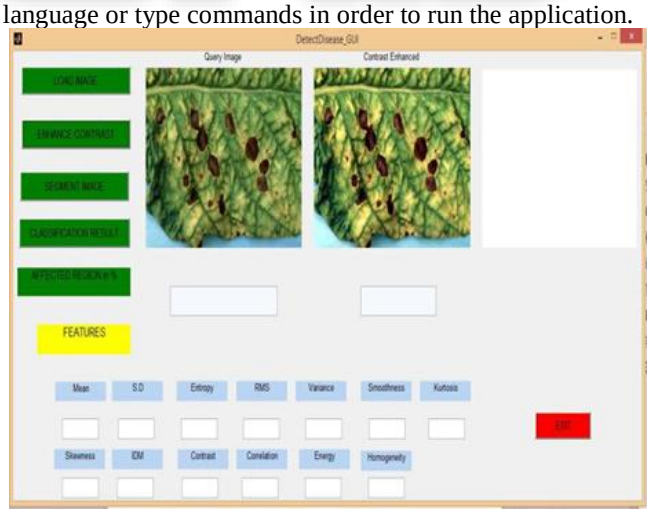

Fig. 4: Contrast of the image is enhanced

Description: By selecting the button of Enhance Contrast, it gives the contrast enhanced image in the second view box named as Contrast Enhanced.

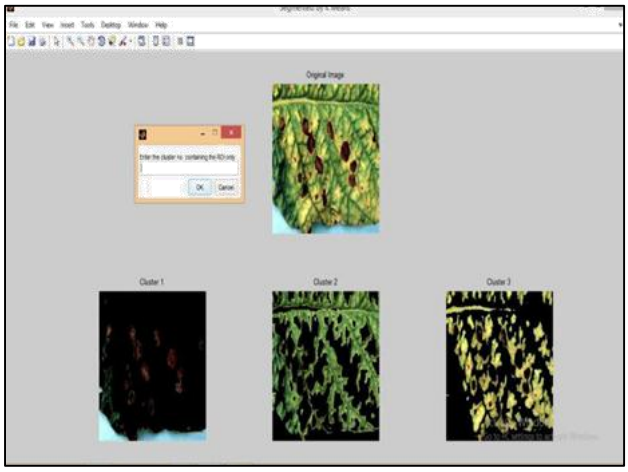

Fig. 5: Image segmentation using k means clustering

Description: After getting contrast enhanced image when we press next button we get three cluster of the image, where we have to select a cluster of our area of interest (ROI).

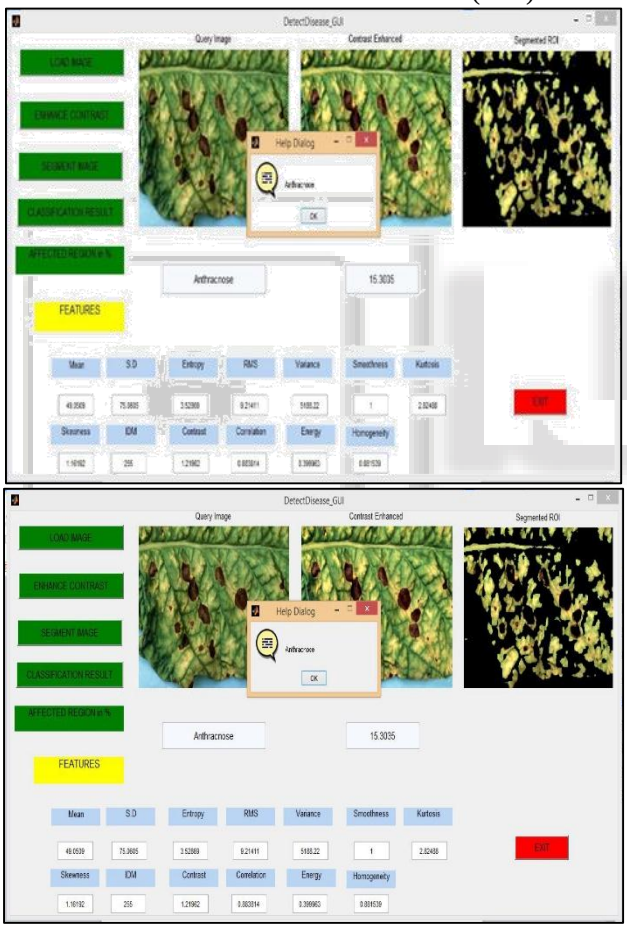

Fig. 6: Classification result is seen

Description: Pressing the last Button for Classification result after getting segmented image and features.

IV. CONCLUSION

The plights of farmers is increasing day by day and it is very necessary for the interference of technology in agriculture. Detection of disease manually may or may not be accurate as the farmers may be inexperienced(those who are just starting out in the agriculture field) or a human error may occur. This may prove very costly to the farmer. Thus, machine learning techniques such as support vector machine and image processing help in the easy detection of the leaf diseases and also give highly accurate results ranging from 80%-90%.Thus with the help of highly expert botanist and the machine learning techniques, new plant diseases can also be discovered. This in turn can help in proper aid provided to the plants to recover from the diseases and increase the crop yield production.

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