Leaf Disease Identification Using Enhanced Machine Learning Algorithm

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Abstract— Nowadays, image processing is among rapidly growing technologies. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction. The different types of commercial crops, food grain, fruits and cereals samples both healthy and unaffected agriculture/horticulture produce used in the present work are collected and create a dataset.

Key words: Leaf Disease, Machine Learning Algorithm

I. INTRODUCTION

The diagnostic process is inherently visual and requires intuitive judgment as well as the use of scientific methods. Plant diseases reduce both quantity and quality of plant products. These diseases are caused by pathogens viz., fungi, bacteria and viruses, and due to adverse environmental conditions. Leaf presents several advantages over flowers and fruits at all seasons worldwide. The cost intensity, automatic correct identification and classification of diseases based on their particular symptoms become essential and very useful to farmers and also agriculture scientists. Early detection of diseases is a major challenge in horticulture/agriculture science.

A. Types of Diseases in Plant Leaf

The diseases on the leaves are classified as,

a) Viral disease: e.g. Leaf Curl, Leaf Crumple, Leaf Roll.
b) Fungal diseases: e.g. Anthracnose, Black Spot.
c) Bacterial disease: e.g. Bacterial Blight, Crown Gall, Lint Degradation.

In this research work mainly concentrated on identification of fungal disease on plant leaves.

II. METHODOLOGY

The prime aim of developing plant disease identification system was to make early diagnosis of the disease and take required measures to prevent the crop from shaman. Following is the methodology of the system involved.

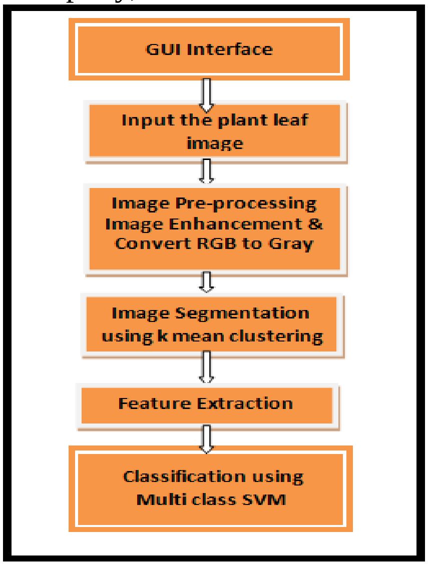

Fig. 1:

A. Image Pre-Processing:

Image Pre-processing Noise gets added during acquisition of leaf images. So, different types of filtering techniques are used to remove noise .Create device independent color space transformation structure. Thus 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.

B. Image Segmentation

K-means clustering method has been used in the present work to carry out segmentation. K-Means Clustering is a method of cluster analysis which aims to partition n observations into k mutually exclusive clusters in which each observation belongs to the cluster with the nearest mean. Following are the steps in K-means clustering.

Step1: Input Image
Step2: Convert Image from RGB to L*a*b*
Step 3: Classify the Colours. Creating Colour Index
Step 4: Label Every Pixel in the Image.
Step 5: Create Images that Segment the original image by Color:

When the segmentation is completed, one of the clusters contains the diseased spots being extracted. This image is saved and considered for calculating AD

C. Feature Extraction

The complexity of visual patterns of the diseases there has been increasing demand for development of more specific and sophisticated image pattern understanding algorithms which can be used for studies like classifying lesion, scoring quantitative traits, calculating area eaten by insects, etc

Hence to conduct high throughput experiments, plant biologist need efficient computer software to automatically extract and analyze significant features.

As far as the leaf of the plant is considered the significant features can be obtained by

1) Color of the leaf
2) Texture of the leaf
3) Shape of the leaf

D. GUI Interface

GUI is developed in MATLAB for easy execution of the experiment. The first step in this execution is selection of the query image. This is the image whose disease is to be detected & identified. This image can be part of database image or it can be imported in MATLAB from other locations as per users requirement. After importing query image in GUI, feature extraction is executed. During this stage the feature vector of query image is calculated and compared with feature vector of the data base image using algorithm. This stage is followed by retrieval where the images which closely match with query image are retrieved. Here only 5 images are retrieved.. The disease of the query image is same as that of the disease of the maximum retrieved images. The result of this stage indicates that the query image is the leaf affected by disease named as 'Anthracnose Disease'. GUI contains the following steps

– Load the leaf image
– Enhance the Contrast
– K-mean Segmented Image
– Feature Extraction
– Classification of Disease
– Affected Region
– Accuracy of Classification

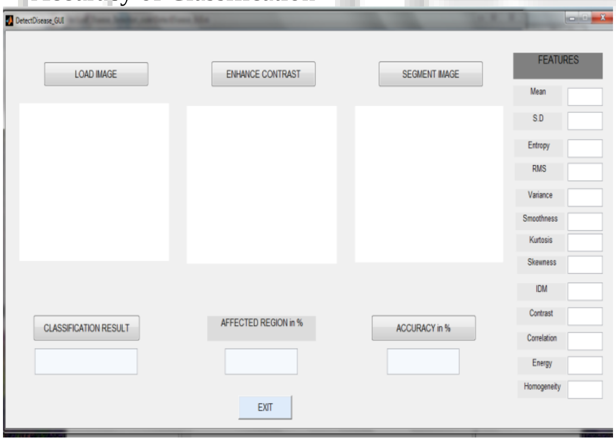

Fig. 1: GUI for leaf disease detection

III. RESULT AND DISCUSSION

A. Alternaria Alternata

Fig. 2: AlternariaAlternata

B. Anthracnose

Fig. 3: Anthracnose

C. Bacterial Blight

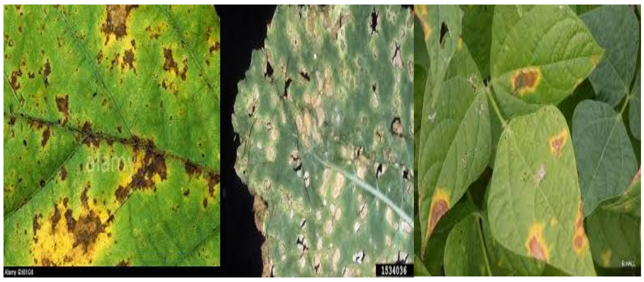

Fig. 4: Bacterial Blight

D. Cercospora Leaf Spot

Fig. 5: Cercospora Leaf Spot

E. Select the Image/Input Image

The input image has to be preprocessed because images are corrupted by a type of multiplicative noise like light intensity and shadow on a cotton leaf images that may contain useful information about the leaf spot that can be used in the diagnosis. In the figure 4.6 Anthronose affected leaf image is selected as input.

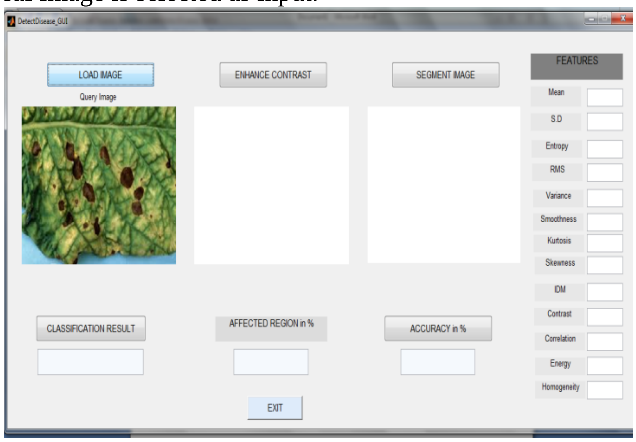

Fig. 6:

F. Enhance Contrast of Image

After the selection of images from the data set, Contrast of the image is enhanced by using low pass filter and high filter to get better classification result. The enhanced image is shown in the figure 4.7. Here anthracnose affected leaf is selected and enhanced. For the image enhancement low pass filter and high pass filter is used.

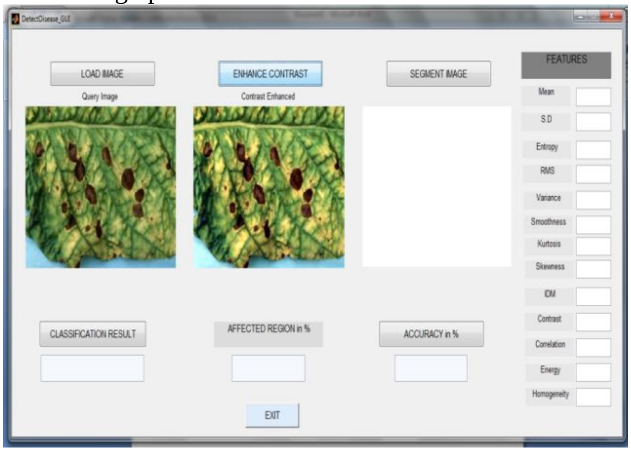

Fig. 7:

G. K Mean Segmentation

When the segmentation is completed, one of the clusters contains the diseased spots being extracted. This image is saved and considered for calculating.

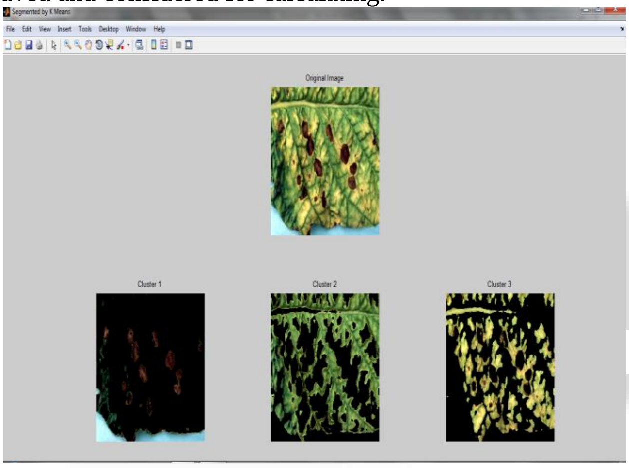

Fig. 8: Segment image of Clusters

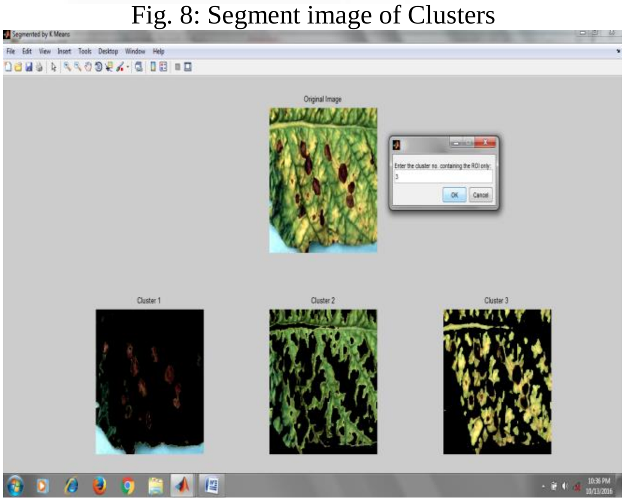

Fig. 9: Cluster Selection from segmented image

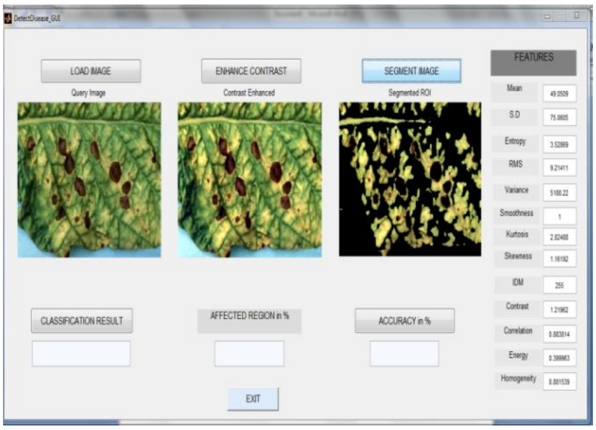

Fig. 10: Segmented Image

H. Feature Extraction

In this phase , feature extraction & statistical analysis on modified infected cluster obtained in previous phase is carried out.

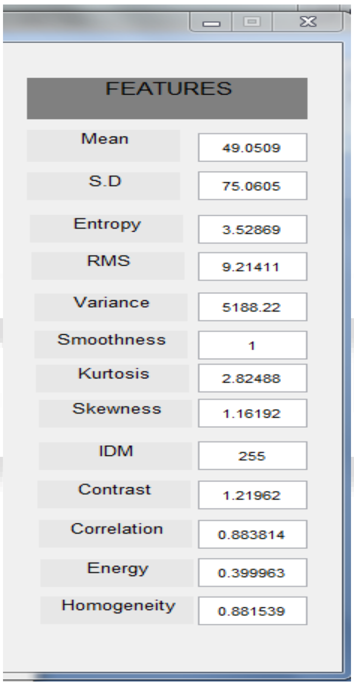

Fig. 11: Feature Extraction

I. Classification of Disease

After the segmentation and feature extraction disease is classified as Anhtracnose. It is shown in the figure 4.12

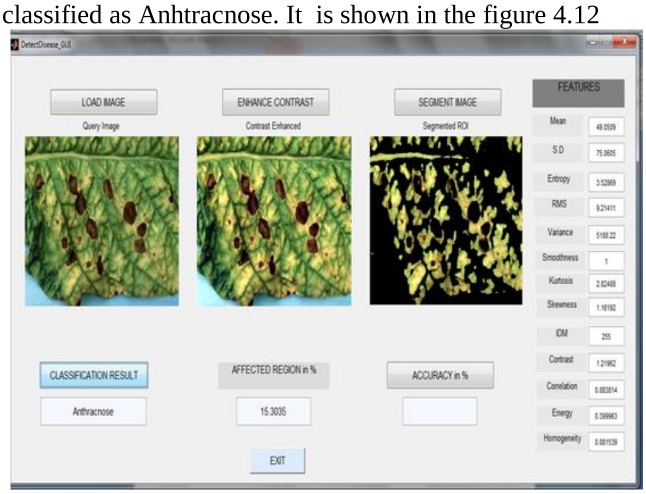

Fig. 12: Classification of Disease

J. *Accuracy of the Classification*

In this research 4 types of disease considered for classification. Anthracnose is classified using multiclass SVM. Accuracy of classification is calculated using 500 iteration. The figure 4.14 shows the iteration of accuracy of anthracnose disease. Finally the accuracy of classification is 98.38%. It is shown in the figure 4.15

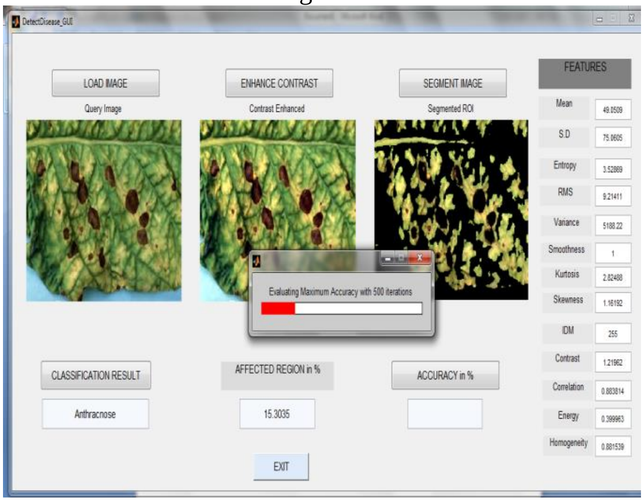

Fig. 13:

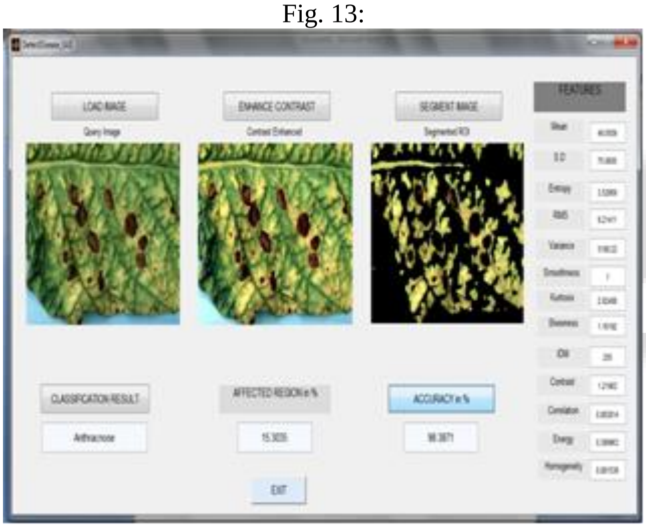

Fig. 14:

IV. CONCLUSION & FUTURE WORK

The main motive of this research is to improve the efficiency and productivity through a robust system which can overcome the shortcomings of the manual process. Looking at the current scenario an approach to automatically grade the disease on plant leaves is very much essential. This work consists of identifying the affected part of the plant leaf disease. Also it is observed that the classification of lternaria(96.77%), Antracnose (98.38%) , bacterial blight(98.38%) and cercospora (96%) were obtained with higher accuracy.

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