Leaf Disease Classification using Hybrid Classifier

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Abstract— Plant diseases can cause significant reduction in crops and lead to poor quality of agricultural products. Research in agriculture is aimed towards increase of productivity and food quality at reduced expenditure and with increased profit . With the advent of new technologies and superior techniques, adopting these means would indeed help this sector to outperform in the coming days. This work presents a method for identifying plant leaf disease based on color. Agrarians are suffering from the issue rising from different types of plant diseases. The goal of proposed work to diagnose the disease using image processing and clustering techniques on image of plant leaves disease.

Key words: Hybrid Classifier, Leaf Disease Classification

I. INTRODUCTION

Leaf presents several advantages over flowers and fruits at all seasons worldwide. Farmers are very much concerned about the huge costs involved in disease control activities and it causes severe loss. 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. Many disease produce symptoms which are the main tools for field diagnosis of diseases showing external symptoms out of a series of reactions that take place between host and pathogen. As such, several important decisions regarding safe practices, the production and processing of plant have been made in the recent past.

Initially plant pathologists rely on naked eye grading of the infected plant. This system was not very effective when it comes to critical diseases. Hence, the computerized application of grading emerged with some basic methods to classify the infected plants. This classification is done based on the morphological structure of the plant. Classification techniques involved in this are Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, k-Nearest Neighbour Classifier.

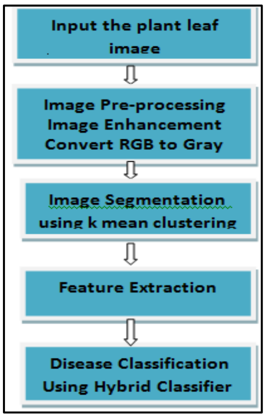

Fig. 1: Classification

A. Input the Leaf Image

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. These images are used as a input. Figure1 is sample image

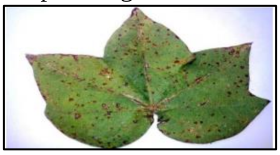

Fig. 1: Input Image

II. IMAGE PRE-PROCESSING

Noise would disturb the segmentation and the feature extraction of disease spots. So they must be removed or weakened before any further image analysis by applying an appropriate image filtering operation. In the present work, authors have considered Gaussian filter to filter out the input images. Preprocessing uses the techniques such as image resize, filtering, segmentation, cropping, contrast enhancement, angle correction, morphological operations etc. In the contemporary exertion, image resize and filtering are performed as a part of pre-processing. Initially, captured images are resized to a fixed resolution so as to utilize the storage capacity or to reduce the computational burden in the later processing. Noise is inevitable during image acquisition or transmission.

A. Contrast Enhancement

A contrast stretch improves the intensity differences consistently across the dynamic range of the image, whereas tonal enhancements improve the intensity differences in the highlight (bright), midtone (grays), or shadow (dark) regions at the expense of the brightness differences in the further regions.

Fig. 2: Original Image

Fig. 3: Contrast Enhanced Image

III. IMAGE SEGMENTATION

Image segmentation refers to the process of partitioning the digital image into its constituent regions or objects so as to change the representation of the image into something that is more meaningful and easier to analyze. The level to which the partitioning is carried depends on the problem being solved i.e. segmentation should stop when the objects of interest in an application have been isolated. In the current work, the very purpose of segmentation is to identify regions in the image that are likely to qualify as diseased regions. There are various techniques for image segmentation such as clustering methods, compression-based methods, histogram-based methods, region growing methods etc.

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.

1) Step 1: Read Image
2) Step 2: Convert Image from RGB Color Space to L*a*b* Color Space: This conversion enables to quantify the visual differences present in the RGB image.
3) Step 3: Classify the Colors in 'a*b*' Space Using K-Means Clustering. K-means clustering treats each object as having a location in space. K-means finds partitions such that objects within each cluster are as close to each other as possible, and as far from objects in other clusters as possible. Since the color information exists in the 'a*b*' space, the objects of interest are the pixels with 'a*' and 'b*' values. The output of k-means is the set [cluster_index cluster_center].
4) Step 4: Label Every Pixel in the Image Using the Results from K -means: For every object in the input image, k-means returns an index corresponding to a cluster and labels every pixel in the image with its cluster index.
5) Step 5: Create Images that Segment the original image by Color: This step will result in k number of images each of which is a segment of the original image that are partitioned 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

IV. FEATURE EXTRACTION

The diseases can be controlled by proper Disease management which is a challenging task. This challenge can be converted to easiest task by using image processing for detecting diseases of leaf, stem, root & fruit. With image processing it is possible to detect the affected area, type of disease &severity of the disease. Mostly diseases are seen on the leaves or stems of the plant. Because of 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. Now a days almost all of these tasks are processed annually or with distinct software packages. It is not only tremendous amount of work but also suffers from two major issues:

– excessive processing time and
– subjectiveness rising from different individuals. 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;

– Color of the leaf
– Texture of the leaf
– Shape of the leaf

V. PROPOSED METHOD

The proposed method use Hybrid classifier to classify the leaf disease. Hybrid classifier is the combination of Support Vector Machine and Neural Network. Support Vector Machine: Support Vector machine (SVM) is a non -linear Classifier. In SVM, the input data is non -linearly mapped to linearly separated data in some high dimensional space providing good classification performance. SVM maximizes the marginal distance between different classes. The division of classes is carried out with different kernels. SVM is designed to work with only two classes by determining the hyper plane to divide two classes. This is done by maximizing the margin from the hyper plane to the two classes. The samples closest to the margin that were selected to determine the hyper plane is known as support vectors.

Main advantages of SVM are:

1) Its prediction accuracy is high. Its working is robust when training examples contain errors.
2) Its simple geometric interpretation and a sparse solution.
3) Like neural networks the computational complexity of SVMs does not depend on the dimensionality of the input space.

A. Result of Prosed Method:

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.

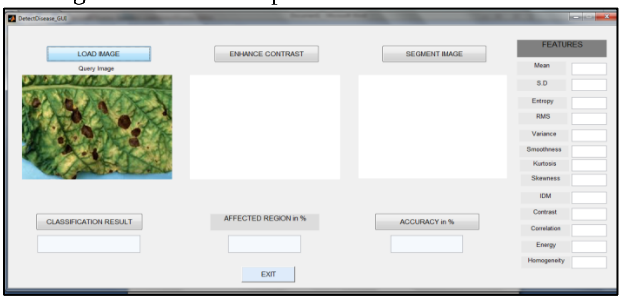

Fig. 4: Anthronose affected leaf image as input

Fig. 5: Enhance the Contrast of the Image

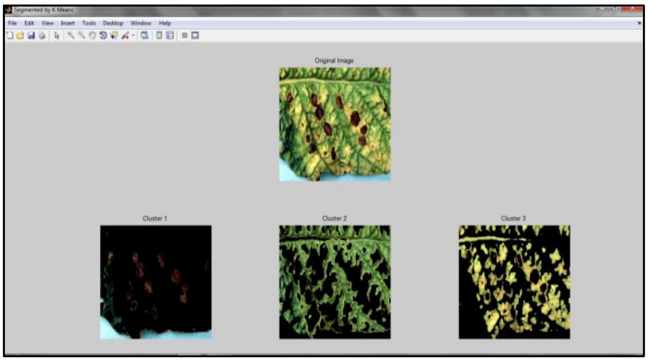

Fig. 6 Segment image of Clusters

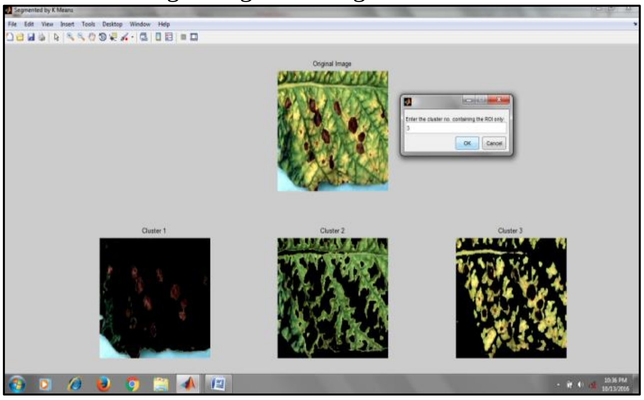

Fig. 7 Cluster Selection from segmented image

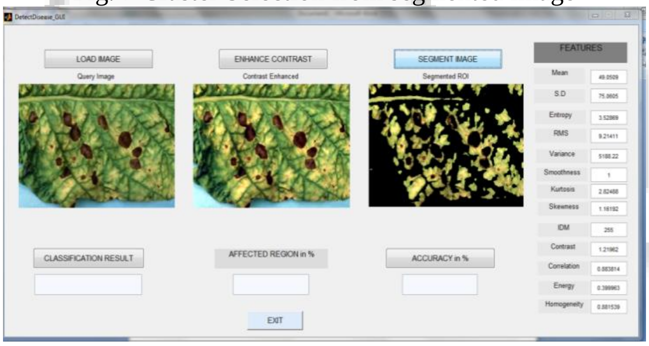

Fig. 8: Segmented Image

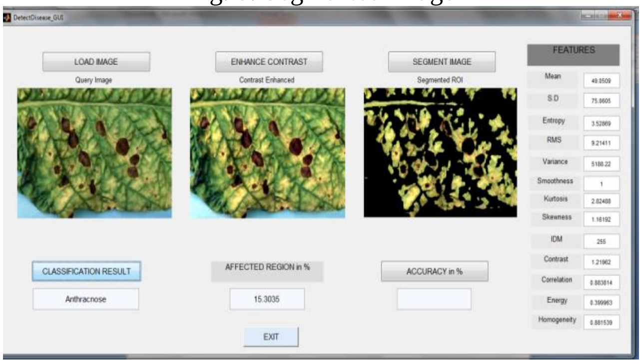

Fig. 9: Classification of Disease

VI. CONCLUSION

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. Most affected part was segmented efficiently according to color classification tasks. Initially Image often more complex structures are needed in order to segmentation is done, and finally image analysis and make an optimal separation, i.e., correctly classify important features are extracted and classification performed using SVM and Neural network. Also it is observed that the hybrid classification of Alternaria (96.77%), Anthracnose (98.38%), bacterial blight (98.38%) and cercospora (96%) were obtained with higher accuracy.

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