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MACHINE VISION BASED PADDY LEAF DISEASE RECOGNITION SYSTEM

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Abstract: In the agricultural field, paddy cultivation plays an important role. But their growths are affected by various diseases. There will be a decrease in production if the diseases aren't identified at an early stage. The main goal of this work is to develop an image processing system that will identify and classify the varied paddy plant diseases affecting the cultivation of paddy namely brown spot disease, leaf blast disease, false smut, leaf streak and bacterial blight disease. This work is split into two parts namely, paddy disease detection and recognition of paddy plant diseases. In disease detection, the affected portion of the paddy plant is identified using Haar-like features and AdaBoost classifier. In disease recognition, the paddy disease type is recognized using Scale Invariant Feature Transform (SIFT) feature and classifiers namely k-Nearest Neighbor (k-NN) and Support Vector Machine (SVM). By this approach, one can detect the disease at an early stage and can take necessary steps in time to minimize the loss of production.

Keywords: Field images, Haar-like features, AdaBoost classifier, Scale Invariant Feature Transform(SIFT), K-Nearest Neighbor(K-NN).

I. INTRODUCTION

Indian economy depends on the agricultural productivity. To assess the development of any country agriculture is the major thing. Diseases are the principal cause of yield loss of paddy production. Farmers which are lack of training cannot be able to implement the technological aids like robots and sensors. But general technological applications like machine vision, image processing and virtual environment are easy to implement in the agriculture. A widely used method to automate the detection of disease is to use computer vision. Machine vision provides the optimal solution to extract and recognize the plants based on different features automatically.

II. METHODOLOGY

In proposed system, using a robust and accurate method is proposed segmenting objects acquired under various controlled conditions. And also to improve the performance of the segmentation methods using preprocessing tools such as color distance map and input strokes. Based on these methods, we can eliminate the unwanted boundaries and localize the leaf object efficiently. The main goal of this is to develop an image processing system that can identify and classify the various paddy plant diseases affecting the cultivation of paddy namely brown spot disease, leaf blast disease, leaf streak, false smut and bacterial blight disease. Thus by using MATLAB software, the disease in paddy leaves can be detected.

Feature Extraction

Feature extraction starts from an initial set of measured data and builds derived values intended to be informative and non-redundant, facilitating the following learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction.

When the input data to an algorithm is simply too large to be processed and it's suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it are often transformed into a reduced set of features. Determining a subset of the initial features is known as feature selection. The selected features are expected to contain the relevant information from the input data, in order that the specified task are often performed by using this reduced representation rather than the complete initial data.

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Feature extraction involves reducing the quantity of resources required to explain a large set of knowledge . When performing analysis of complex data one of the most problems stems from the quantity of variables involved. Analysis with an outsized number of variables generally requires an outsized amount of memory and computation power, also it's going to cause classification algorithm to overfit to training samples and generalize poorly to new samples. Feature extraction may be a general term for methods of constructing combinations of the variables to urge around these problems while still describing the info with sufficient accuracy.

Haar-like extraction

Haar-like features are image features utilized in object recognition. They owe their name to their intuitive similarity with Haar wavelets and were utilized within the primary real-time face detector.

Historically, working with an image intensities made the task of feature calculation computationally expensive. A Haar-like feature consider adjacent rectangular regions at a particular location during a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is employed to categorize subsections of an image. For example , let us say we've an image database with human faces. It is a typical observation that among all faces the region of the eyes is darker than the region of the cheeks. Therefore a typical haar feature for face detection could even be a group of two adjacent rectangles that lie above the attention and thus the cheek region. The position of those rectangles is defined relative to a detection window that acts quite a bounding box to the target object.

In the detection phase of the Viola-Jones object detection framework, a window of the target size is moved over the input image, and for each subsection of the image the Haar-like feature is calculated. This difference is compared to learned threshold that separates non-objects from objects. Because such a Haar-like feature is just a weak learner or classifier an outsized number of Haar-like features are necessary to clarify an object with sufficient accuracy. The Haar-like features are organized in something called a classifier cascade to make a strong learner or classifier.

The key advantage of a Haar-like feature is its calculation speed. due to the utilization of integral images, a Haar-like feature of any size is often calculated in constant time (approximately 60 microprocessor instructions for a 2-rectangle feature).

SVM classifier

Support Vector Machines (SVM) are supervised learning models with associated learning algorithms that analyze data used for classification and multivariate analysis . Given a group of training examples, each marked as belonging to at least one or the opposite of two categories, an SVM training algorithm builds a model that assigns new examples to at least one category or the opposite, making it a non-probabilistic binary linear classifier.

An SVM model may be a representation of the examples as points in space, mapped in order that the samples of the separate categories are divided by a clear gap that's as wide as possible. New examples are then mapped into that very same space and predicted to belong to a category based on which side of the gap they fall. In addition to performing linear classification, SVM's can efficiently perform a non-linear classification using the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces.

When data aren't labeled, supervised learning isn't possible, and an unsupervised learning approach is required, which attempts to find a natural clustering of the data to groups, then map new data to those formed groups. The clustering algorithm which provides an improvement to the support vector machines is named support vector clustering and is usually utilized in industrial applications either when data aren't labeled or when just some data are labeled as preprocessing for classification pass.

III. MODELING AND ANALYSIS

Fig.1 shows the paddy leaves segmentation architecture. RGB images with white background of 100 samples of healthy leaves, disease 1 leaves, disease 2 leaves which are collected from different regions. One clinically proved healthy images as the standard image. Histogram of standard image is compared with 100 samples of each type which gives 100 values and whose average value represents the particular type and it is considered as the standard value representing that type of the leaf. This is called as training phase. Test image is image of leaf whose diseases/type has to be detected. Its histogram is also compared with standard healthy leaf image value.

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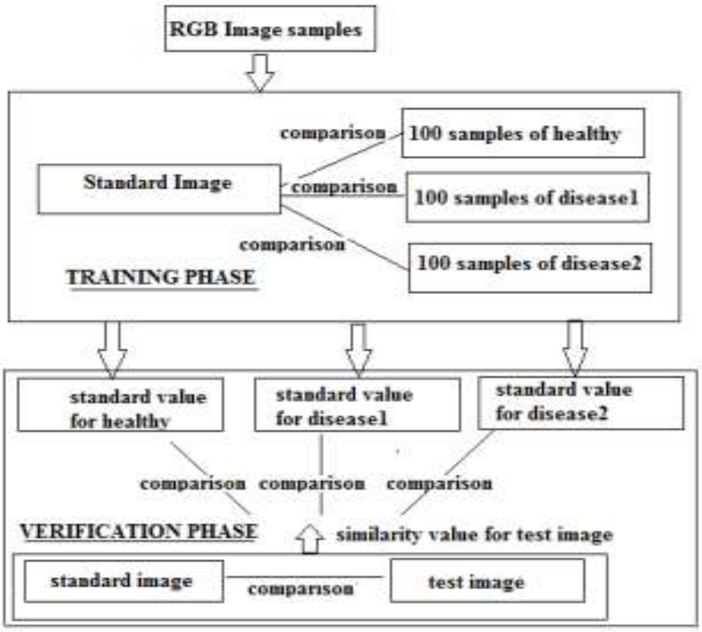

Fig. 1 Paddy leaves segmentation architecture

IV. RESULTS AND DISCUSSION

The following are the images obtained as results from Machine Vision system for disease recognition in paddy plant using the features like color and texture. This section clearly explains about the process and output in each stage.
Fig. 2 shows the design of obtaining output by using the MATLAB.

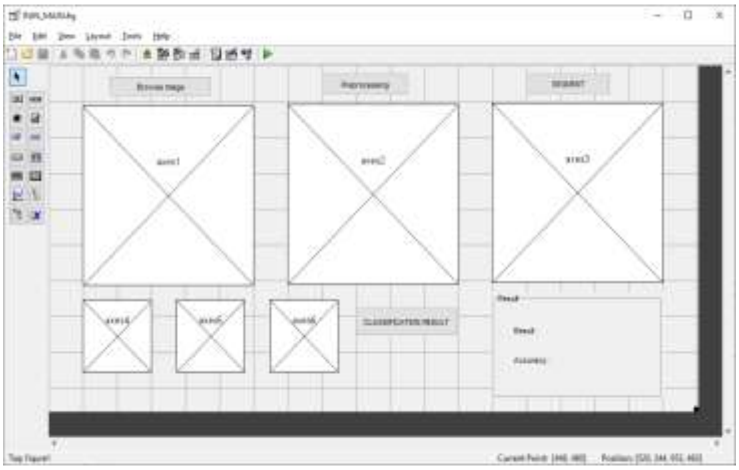

Fig. 2 Design of obtaining output

Fig. 3 shows the browsing the input image acquired from external environment is fed as input to further stages.

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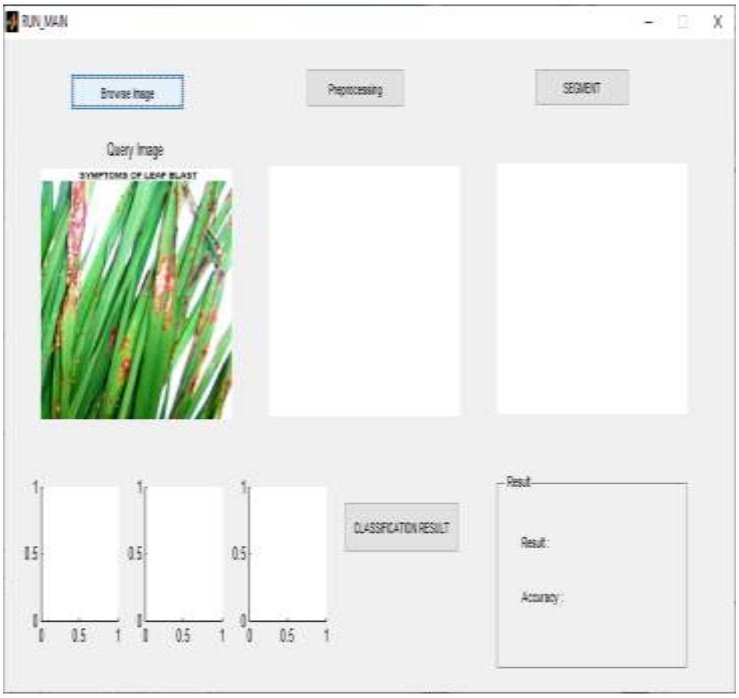

Fig. 3 Input image

Fig. 4 shows the processing of an input image. After browsing an image, it has to preprocess the image by clicking on the preprocessing button.

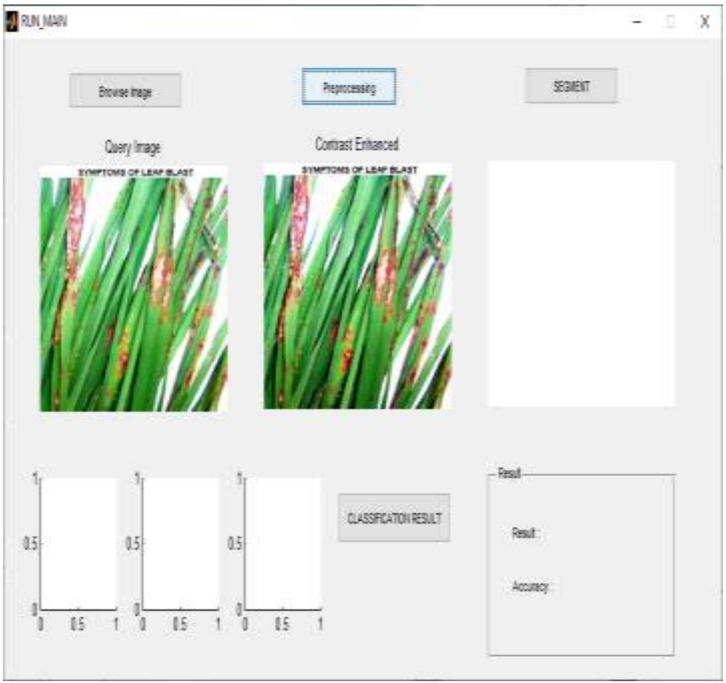

Fig. 4 Preprocessing of an image

Fig. 5 shows the segmentation of preprocesses image. This figure explains that after preprocessing, segment the image by clicking on the segment button. It will classify an image into three clusters i.e., cluster 1, cluster 2, cluster 3.

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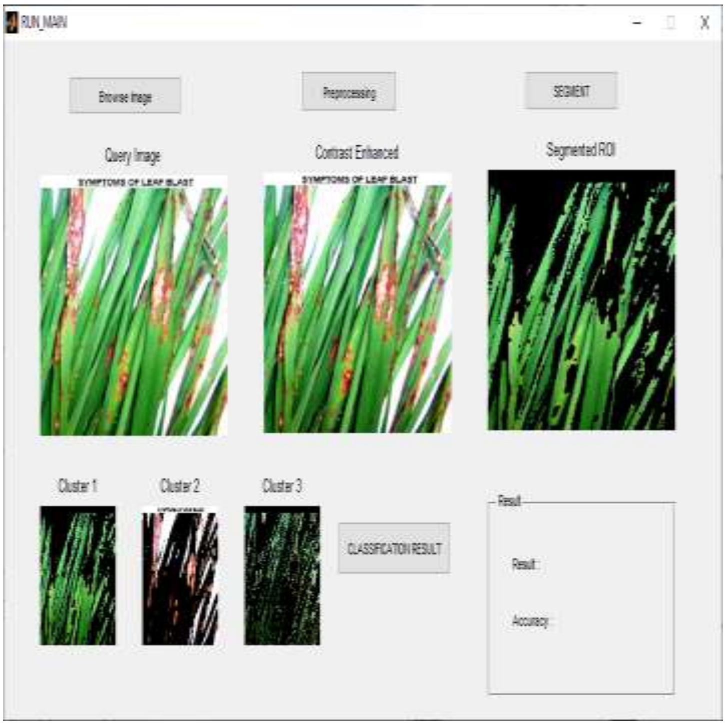

Fig. 5 Segmentation of preprocessed image

Fig. 6 shows the command window for cluster selection. In the command window, enter the cluster number for segment the preprocessed image.

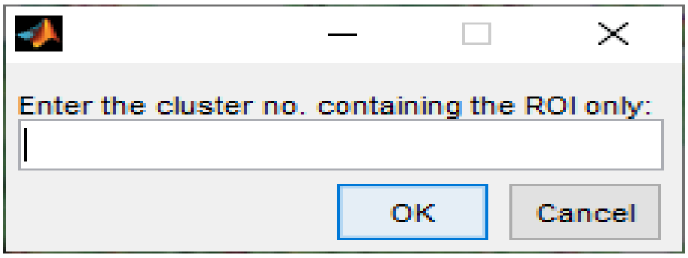

Fig. 6 Command Window for cluster selection

Fig. 7 shows the accuracy evaluation. This figure clearly explains that after segmented preprocessed image it evaluating the maximum accuracy of the segmented preprocessed image.

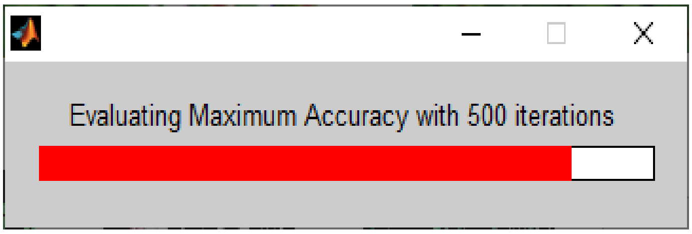

Fig. 7 Accuracy evaluation

Fig. 8 shows the performance of the proposed system. This figure clearly explains that after evaluating the preprocessed image, it gives the accuracy of the preprocessed image which is shown as graph form.

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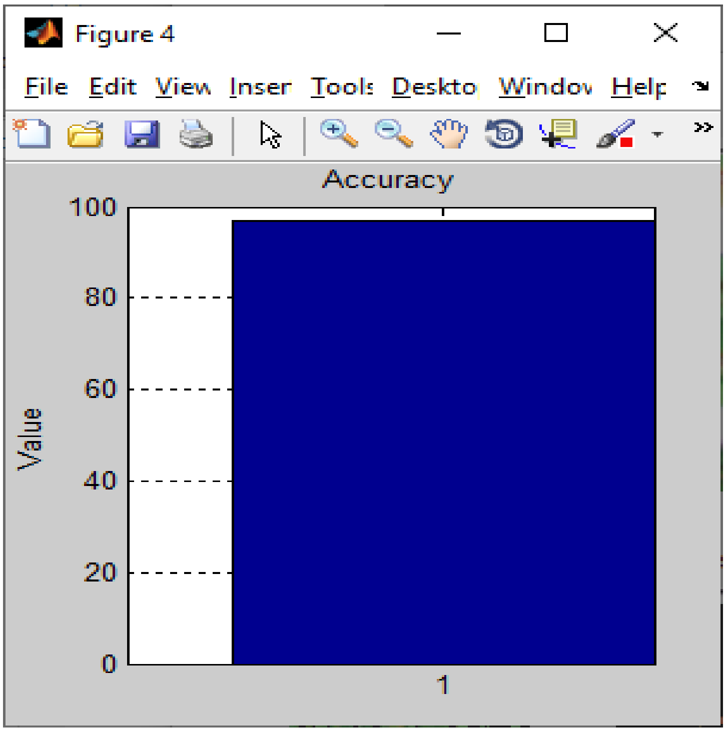

Fig. 8 Performance of the proposed system

Fig. 9 shows the result of the leaf image. The image is processed in various steps and divided into several parts. The segmented image is analyzed with the help of machine vision or feature extraction method. The output of proposed system clearly shows the infected portions of a paddy.

Fig. 9 Result of a leaf image

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V. CONCLUSION

Thus, the image processing techniques were used to deploy the classification system. In this work Scale Invariant Feature Transform (SIFT) is used to get features from the disease affected images. Then these features are taken to recognize the image using Support Vector Machine (SVM) and k-Nearest Neighbors (KNN). This work mainly concentrates on three main diseases of the paddy plant namely Brown spot, Leaf blast and Bacterial blight. It is useful to farmers and agriculture related researches. For future work, some alternative methods can be used to extract features and some other classifiers can be used to improve the result accuracy.

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