Syndrome Detection for Agricultural Plants using Image Processing and its Remedies

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Abstract— India is an agricultural country and most of the people are farmers. Farmers are cultivating different types of crop. These crops affected by fungi, bacteria, viruses and many more. Farmers cannot be determining accurate percentage of observed disease. Patterns of diseases are so many complexes that finding affected area is difficult. Therefore system that provides information about disease will play important role in disease management for famer. For this project we have selected clustered apple crop. There are many disease found on clustered apple like anthracnose, leaf spot, black canker, mealy bug and many more. In this project we are going to process our input image by using computer software, the image will be collected from the farmer. Disease detection involves the steps like taking picture of affected area for image acquisition, image pre-processing, image segmentation, feature extraction and classification. In this project we are going to detect various diseases from the different part of crop by using k-means clustering algorithm and artificial neural network based on the training of images in serial database. In this database various images of different part of clustered apple are affected by disease are stored. The images are threshold to particular values after that detected image threshold are masked over the original image .The image is clustered based on the features using k-means clustering, GLCM algorithm would generate the features from the images and trained using NN and compared so to detect the affected images. Hence, image processing is used for the detection of plant diseases. The obtained result and information about remedies of the disease will be send to via SMS by using GSM module.

Key words: K-Means Clustering, GLCM Algorithm

I. INTRODUCTION

Agriculture has become much more than simply a means to feed ever growing populations. It is very important where in more than 70% population depends on agriculture in India. That means it feeds great number of people. Farmers are called "the backbone of India". Plants become an important source of energy and only a primary source to the problem of global warming. The damage caused by emerging, re-emerging and endemic pathogens, is important in plant systems and leads to potential loss economically. In addition, crop diseases contribute directly and indirectly to the spread of human infectious diseases and environmental damage. As these diseases are spreading worldwide causing damage to the normal functioning of the plant and also damaging the financial condition by significantly reducing the quantity of crops grown. The crop production losses its quality due to much type diseases and sometimes they occur but are even not visible with naked eyes. Farmers estimate the diseases by their experience but this is not proper way. Detection of plant disease and assessment of the amount on individual plants or in plant populations is required where crop loss must be related to disease, for plant disease surveys, in plant breeding to assess host susceptibility, to make cost-effective disease management decisions in crop production and to better understand many basic biological processes (e.g. co-evolution). Disease assessment is also required for aiding in the settlement of crop insurance claims, aspects of crop insecurity (biocrimes) and possibly terrorism. The RGB image feature pixel counting techniques is extensively applied to agricultural science. Bacterial diseases include any type of illness caused by bacteria. Bacteria are a type of microorganism, which are tiny forms of life that can only be seen with a microscope. Other types of microorganisms include viruses, some fungi, and some parasites. Millions of bacteria normally live on the skin, in the intestines, and on the genitalia. The vast majority of bacteria do not cause disease, and many bacteria are actually helpful and even necessary for good health. These bacteria are sometimes referred to as "good bacteria" or "healthy bacteria."

K-Nearest Neighbor is a simple classifier in the machine learning techniques where the classification is achieved by identifying the nearest neighbors to query examples and then make use of those neighbors for determination of the class of the query. In KNN the classification i. e. to which class the given point is belongs is based on the calculation of the minimum distance between the given point and other points. As a classifier the nearest neighbor does not include any training process .It is not applicable in case of large number of training examples as it is not robust to noisy data. For the plant leaf classification the Euclidean distance between the test samples and training samples is calculated. In this way it finds out similar measures and accordingly the class for test samples. A sample is classified based on the highest number of votes from the k neighbors, with the sample being assigned to the class most common amongst its k nearest neighbors. k is a positive integer, typically small. If k = 1, then the sample is simply assigned to the class of its nearest neighbor. In binary (two class) classification problems, it is helpful to choose k to be an odd number as this avoids tied votes.

Fuzzy Logic classifiers are classification systems that make use of fuzzy sets or fuzzy logic (Kuncheva, 2000) which convert real-world data values into membership degrees through the use of the membership functions (Sade, 1965) so that these rules then can be used for the classification process. This is done by defining "categories" for each one of the attributes As Fuzzy logic classifier's has very high speed they are preferable in cases where there is limited precision in the data values or when classification is required in real time. Plants become an important source of energy and only a primary source to the problem of global warming. The damage caused by emerging, re-emerging and endemic pathogens, is important in plant systems and leads to potential

loss economically. In addition, crop diseases contribute directly and indirectly to the spread of human infectious diseases and environmental damage. As these diseases are spreading worldwide causing damage to the normal functioning of the plant and also damaging the financial condition by significantly reducing the quantity of crops grown. The crop production losses its quality due to much type diseases and sometimes they occur but are even not visible with naked eyes. Farmers estimate the diseases by their experience but this is not proper way. The main approach adopted in practice for detection and identification of plant diseases is naked eye observation of experts. The decision making capability of an expert also depends on his/her physical condition, such as fatigue and eyesight, work pressure, working conditions such as improper lighting, climate etc. That's why this is not a proper way and also time consuming. It might be expensive as continuous monitoring of experts in large farms. So, we need a fast way and remote sensing form to protect the crop from disease.

II. PROPOSED METHOD

In image processing, a Gabor filter, named after Dennis Gabor, is a linear filter used for texture analysis, which means that it basically analyses whether there are any specific frequency content in the image in specific directions in a localized region around the point or region of analysis. Frequency and orientation representations of Gabor filters are claimed by many contemporary vision scientists to be similar to those of the human visual system, though there is no empirical evidence and no functional rationale to support the idea. They have been found to be particularly appropriate for texture representation and discrimination. In the spatial domain, a 2D Gabor filter is a Gaussian kernel function modulated by a sinusoidal plane wave. Some authors claim that simple cells in the visual cortex of mammalian brain scan be modeled by Gabor functions. Thus, image analysis with Gabor filters is thought by some to be similar to perception in the human visual system.

Gabor filters are directly related to Gabor wavelets, since they can be designed for a number of dilations and rotations. However, in general, expansion is not applied for Gabor wavelets, since this requires computation of bi-orthogonal wavelets, which may be very time-consuming. Therefore, usually, a filter bank consisting of Gabor filters with various scales and rotations is created. The filters are convolved with the signal, resulting in a so-called Gabor space. This process is closely related to processes in the primary visual cortex. Jones and Palmer showed that the real part of the complex Gabor function is a good fit to the receptive field weight functions found in simple cells in a cat's striate cortex.

In image processing, Gabor features are ideal for identifying the script of a word in a multilingual document. Gabor filters with different frequencies and with orientations in different directions have been used to localize and extract text-only regions from complex document images (both gray and color), since text is rich in high frequency components, whereas pictures are relatively smooth in nature. It has also been applied for facial expression recognition Gabor filters have also been widely used in pattern analysis applications. For example, it has been used to study the directionality distribution inside the porous spongy trabecular bone in the spine The Gabor space is very useful in image processing applications such as optical character recognition, iris recognition and fingerprint recognition. Relations between activations for a specific spatial location are very distinctive between objects in an image. Furthermore, important activations can be extracted from the Gabor space in order to create a sparse object representation.

A. Artificial Neural Network

Artificial neural networks (ANNs) or connectionist systems are computing systems inspired by the biological neural networks that constitute animal brains. Such systems learn (progressively improve performance on) tasks by considering examples, generally without task-specific programming. For example, in image recognition, they might learn to identify images that contain cats by analyzing example images that have been manually labeled as "cat" or "no cat" and using the results to identify cats in other images. They do this without any a priori knowledge about cats, e.g., that they have fur, tails, whiskers and cat-like faces. Instead, they evolve their own set of relevant characteristics from the learning material that they process.

B. Principal Component Analysis

Principal Component Analysis (PCA) is the general name for a technique which uses sophisticated underlying mathematical principles to transforms a number of possibly correlated variables into a smaller number of variables called principal components. The origins of PCA lie in multivariate data analysis; however, it has a wide range of other applications, as we will show in due course. PCA has been called, 'one of the most important results from applied linear algebra and perhaps its most common use is as the first step in trying to analyze large data sets. Some of the other common applications include; de-noising signals, blind source separation, and data compression.

C. Image Acquisition

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement. Most image processing programs are designed to start by loading an image from disk. Igor provides some facilities for acquiring images directly from a camera or from a video source. This capability means that you can skip the steps involved in using two separate programs: the first to control the acquisition and the second for data analysis.

D. Image Preprocessing

Image pre-processing may have dramatic positive effects on the quality of feature extraction and the results of image analysis. Image pre-processing is analogous to the mathematical normalization of a data set, which is a common step in many feature descriptor methods. Or to make a musical analogy, think of image pre-processing as a sound system with a range of controls, such as raw sound with no

volume controls; volume control with a simple tone knob; volume control plus treble, bass, and mid; or volume control plus a full graphics equalizer, effects processing, and great speakers in an acoustically superior room. In that way, this chapter promotes image pre-processing by describing a combination of corrections and enhancements that are an essential part of a computer vision pipeline.

E. Image Smoothing

The main aim of image smoothing is to remove noise in digital images. It is a classical matter in digital image processing to smooth image. And it has been widely used in many fields, such as image display, image transmission and image analysis, etc. Image smoothing has been a basic module in almost all the image processing software. So, it is worth studying more deeply. Image smoothing is a method of improving the quality of images. The image quality is an important factor for the human vision point of view. The image usually has noise which is not easily eliminated in image processing. The quality of the image is affected by the presence of noise. Many methods are there for removing noise from images.

F. Image Segmentation

Image segmentation is an important topic in the field of digital image processing. The purpose of image segmentation is to partition the image into essential regions with respect to the appropriate locations. For the segmentation we need the Images. But the images are either in form of black and white or color. Color images are due to the grey level. As the grey level contrast changes the color of color image also changes. Image segmentation plays important role in segmentation of medical images. Medical images play vital role in assisting health care which provides health care access patients for treatment. For the medical images, segmentation is crucial as a follows by first step in Medical Image Analysis (MIA).

G. Region Based Segmentation

It is used the threshold in order to separate the background from an image, whereas neural network based techniques used the learning algorithm to train the image segmentation process. In this technique pixels that are related to an object are grouped for segmentation.The thresholding technique is bound with region based Segmentation. The area that is detected for segmentation should be closed.

H. Edge-Based Techniques

It is used the most common method of detecting boundaries and discontinuities in an image. An edge is a set of connected pixels, i.e., same intensity level, between two adjacent pixels and can be distinguished by estimating the intensity gradient. Edge detection is a basic step for image segmentation process. It divides an image into object and its background. Edge detection divides the image by observing the change in intensity or pixels of an image. Gray histogram and Gradient are two main methods for edge detection for image segmentation. Yu Xiaohan proposed a new image segmentation technique based on region growing and edge detection methods. Their hybrid method helps the segmentation process to avoid from errors when both techniques used in a separate manner. Region growing is used to find the edge pixels in the image, while 2nd order derivative is used for edge detection. Experiments are conducted on 3D MRI image data.

III. EXPERIMENTAL RESULTS

Our experimental study and its results mainly will focus on SVM algorithm. This algorithm will first take an input image, which is in RGB form. It detects the infected part of the disease. We have taken two data sets mainly named train dataset and training data set. Train data set contains images, which already have been processed, and diseases and feature extraction about them have been detected. Another dataset named training dataset contain the images, which needed to be processed for detection of diseases. One image from training data set is taken and its features are matched to images in the training dataset. Main thing in this work is that whole area, which is infected by disease, will be calculated in the terms of percentage %. And disease is also detected. Now following are the results of the implemented work

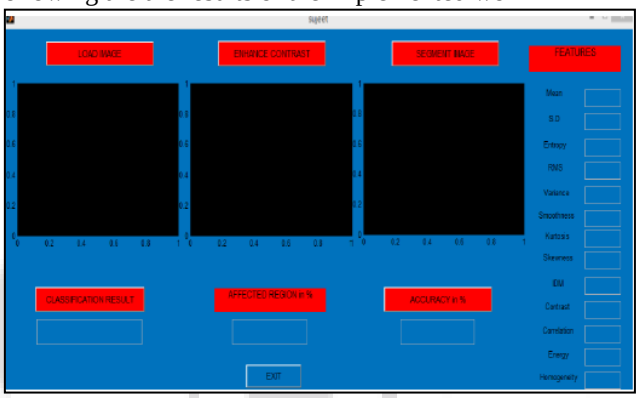

Fig. 1: GUI of Proposed Work

A. Testing and Output of the Project

Fig. 2: Loading of an Image

After loading an image, next work is the enhancing the contrast from the image. SVM enhance the image very accurately. This action is performed by clicking on the Enhance Contract button next to the Load Image. After click on this button all the features are enhanced from the loaded image and the new image is generated in contrast enhanced box.

Fig. 3: Contrast Enhanced

To work on our area of interest we have to segment the image. After clicking on the Segment image button, we got an image, which is segmented in our region of interest (ROI). Below Fig 4 shows the segmented ROI results.

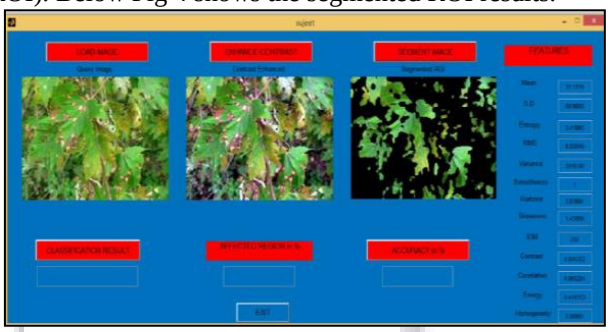

Fig. 4: Segment ROI

Classification results in the below Fig 5 shows that the loaded image of the leaf is the healthy leaf and there is no affected regions in the leaf. Corresponding features of the leaf image is calculated.

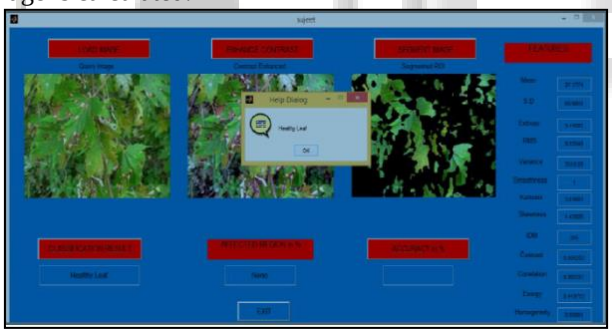

Fig. 5: Result of the Loaded Image

Accuracy of the proposed results is 96.77 % as shown in the below Fig 6. This results proof that our proposed algorithm is much accurate as compare to existing one.

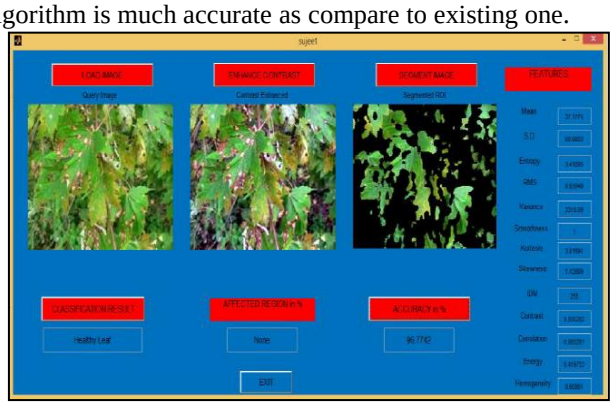

Fig. 6: Accuracy

After calculating the accuracy of the healthy leaf, we upload a new image for finding the affected region and the accuracy of the proposed algorithm. A new image loaded is shown in Fig 7

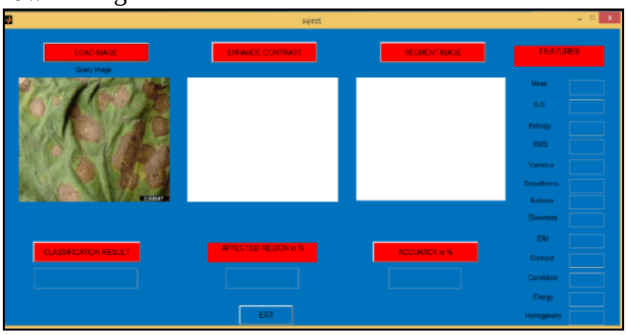

Fig. 7: Loading of an Image

Same as the first image, the contrast enhancing is performed on the image shown in below Fig: 8.

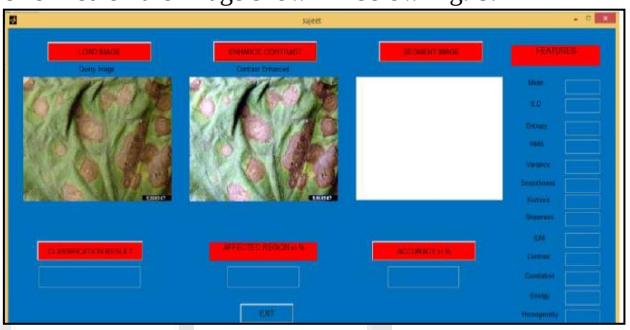

Fig. 8: Contrast Enhancing of Second Image

Segmenting the interested region from the Image shows the results as given in 9. As it is clear from the Fig. that segmentation result is very dark as compare to loaded image. Afetr segmentation corresponding features of the leaf image is calculated and results are diaplayed in Fig 9.

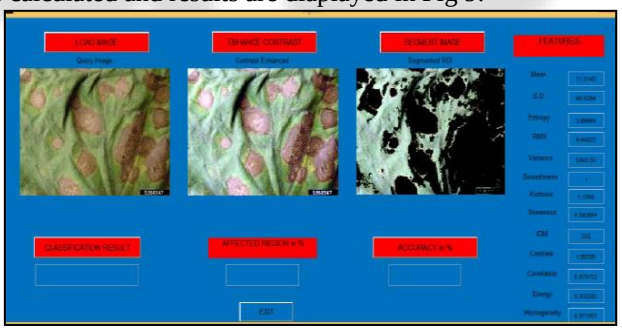

Fig. 9: Segment ROI of Second Image

Classification results in the below Fig 5.10 shows that the loaded image of the leaf is the disease affected leaf and name of the disease is Cercospora leaf spot. There is 30.439% affected regions in the leaf. Corresponding features of the affected leaf image is calculated and results are displayed in Fig 10.

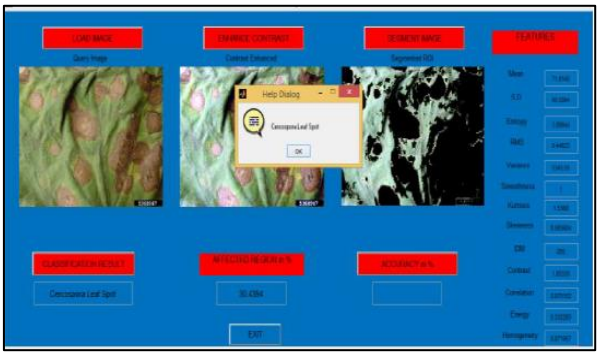

Fig. 10: Result of the Second Image

Accuracy of the proposed results of the affected leaf is 98.38 % as shown in the below Fig 11. This results proof that our proposed algorithm is much accurate as compare to existing one.

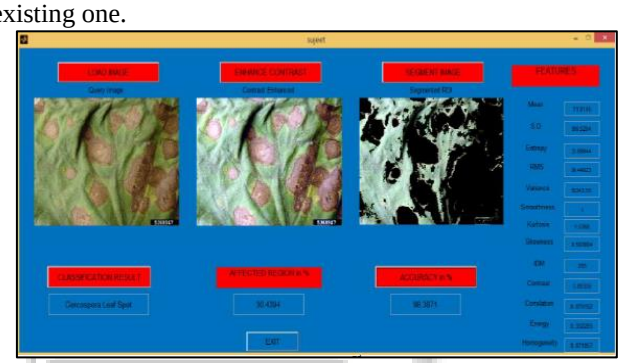

Fig. 11: Accuracy of second Image

Below table and bar graph comparison shows the comparison of accuracy on four different images.

Accuracy	Existing Method	Proposed Method
Image 1	79%	98.3871%
Image 2	76%	96.7742%
Image 3	70%	90.4312%

Table 1:

IV. CONCLUSION & FUTURE SCOPE

The accurate detection and classification of the plant disease is very important for the successful cultivation of the crops, this can be done using digital image processing. In this project, the detection as wells the remedy for curing it is achieved. This project utilizes various image processing techniques which provide accurate results.

This project has been considered only for four diseases and it can be extended for various diseases. In future it can be extended to find the percentage of infection in accordance with area affected.

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