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Detection and Classification of Plant Diseases : An Image Based Approach

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Abstract - *This paper presents a survey on methods that use digital image processing techniques to detect and classify plant diseases, There's a variety of development which has been made regarding digital image processing and machine learning algorithms which also include its various applications. Now we are living in an era where the problem regarding agriculture is a major issue nowadays. The major problem in crop growth is we have to take care of the health of the plants and crops .In this report we basically focused on classification of plants as different type of diseases. For this we use HSI colour model and clustering algorithm .We also used MATLAB for our project.*

Key Words: MATLAB, IMAGE PROCESSING, CNN, 3 layers

1. INTRODUCTION

Plant diseases have turned into a dilemma as it can cause significant reduction in both quality and quantity of agricultural products, Automatic detection of plant diseases is an essential research topic as it may prove benefits in monitoring large fields of crops, and thus automatically detect the symptoms of diseases as soon as they appear on plant leaves. The proposed system is software solution for automatic detection and classification of plant leaf diseases Image is a collection of pixels or dots which are stored in rectangular array. Each individual pixel is having certain kind of colour. We can measure the size of the image by counting the no of pixels in that particular image. Different type of images are there such as Black and White and Grey scale images. Both types vary from each other .In black and white image each dot or pixel is either black or white, therefore only one bit is needed per pixel. Whereas Grey scale images uses 8 bits per pixel, For colour images things gets slightly difficult. In colour images number of bits at every dot termed as the height of image. It is also referred as the bit plane. For bit plane consisting of x, 2x colour are possible, Different methods are available to store the colour information of image. One of the method is RGB image also termed as true colour image. For every pixel red, green and blue component is stored in three dimensional array.

Semantic network also termed as neural networks consist of layer of connected nodes like neurons in brain used for computing purposes. These networks has the ability to learn the data and get trained over that data, in order to identify patterns and also classification, Neural network or semantic network has the advantage that they can solve the complicated problem very easily. To train the neural networks or to implement them in MATLAB we have NN toolbox, Different commands are there to operate with NN toolbox. Different functions are there in NN toolbox for fitting, recognizing the pattern and clustering.

In order to detect the same kind of pattern different pattern recognition techniques are used in MATLAB. Using these techniques we recognize the similar kind of the pattern in the problem. When same kind of pattern are detected then these can be used to generate outputs or solve the problems more efficiently. In order to recognize the pattern, we need to train the machine. For this first we need to classify the data .The data is classified using the key features .For classifying the data we have different type of learning modules is there such as supervised learning and unsupervised learning modules .Bothe of these modules are used to identify the patterns. In supervised learning module we train the machine by recognizing the patterns in the data set and then results which are generated are applied to the testing data set. We train the machine over the training dataset and test it over the testing data set. In unsupervised learning module, there are no visible pattern the dataset, so with the help of the some algorithm we try to catch the patterns. Clustering algorithm, classification algorithm such as Markov Model (MM) is there, For recognizing the patterns we identify we have different techniques such as Preprocessing , Extraction of features and classification. In Preprocessing we try to filter out, smooth the data by normalizing in more ordered way. Filtering such as noise filtering is there. Feature extraction is usually done using the software which collect the information from the data. Sensors are also used for this purpose and the final phase is the classification.

2. LITERATURE SURVEY

Rice Disease detection Pattern Recognition Techniques. Published in 11th International Conference on Computer and Information Technology. The point of this paper is to depict a product model framework for the discovery of malady in rice plant based on different pictures of the rice plants. Pictures of the tainted piece of the rice plant are taken utilizing

computerized camera. With the end goal to identify the abandoned piece of the plant different procedures like picture division, picture developing and so forth.

The purposed methodology is applied to twenty different kind of images result is made on the basis of white and black colors in the resulting image. Black color is used for represent the symptom of disease and which for unaffected region.

3. METHODOLOGY

[10]Digital devices such as digital camera or smartphones are used to take photos of the plant leafs and these images are used to separate out and measure the diseased part area. In order to properly identify the affected region we need image without and impurities so contrast enhancement other image processing techniques are applied on every input image. By enhancing the image using the image processing techniques we get different features of the images which are not visible from the human eye. Below is the flowchart depicting the basic architectural flow.[10]
Image acquisition is the first step in the image processing. Any image is taken from the digital devices thereafter image preprocessing and segmentation are done and necessary

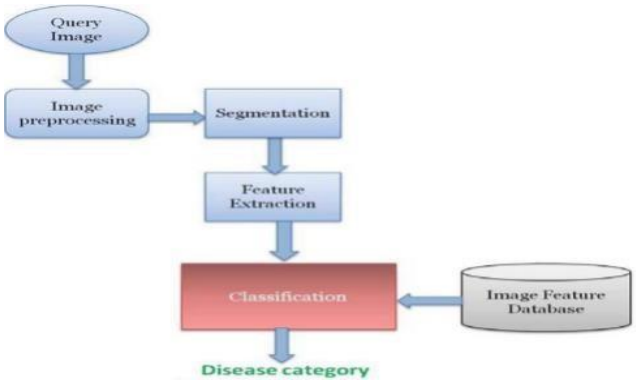

Fig -1: Block diagram of basic architecture

feature are extracted from image. During classification, with the help classification algorithm different clusters are made. We used k means color based clustering in order to detect and identify the affected area. By selecting the one of the cluster our algorithm uses support vector machine for the prediction of disease.

Image acquisition means to collect different type of samples for the formation of the input dataset. Dataset images further go through the various steps. In order to provide best solution to any problem it is necessary that dataset cover majority of the different type of inputs. We have covered different plant leaves. Different image formats are taken in our dataset. Any other image excluding dataset can be used in our algorithm provided its size is matching and format is known, out algorithm and its classifier gives the prediction of the disease for that random image. It is the second phase in digital image processing. In this using MATLAB input image noise is reduced, pixel values gets more classified, spot reduction and contrast enhancement is there. The purpose of the image preprocessing and enhancement step is that after preprocessing the image its get easy to separate the infected area. Indirectly the classifier we use works better with preprocessed image without and impurities. Values of the pixels also get adjusted in the preprocessed image. MATLAB provides user number of different filters for the enhancement of the image.

In figure 3 we can see the difference between the two of the images. The first image is the input image and the second one is the preprocessed image in which we enhance the contrast other features of the image using the MATLAB. Preprocessing let the users to reduce the noise in the image and overall quality of the image is improved. The leftover space in the first image is also gets separated in the second preprocessed image. For every different color the contrast gets more enhanced for every pixel value.

3.1 IMAGE SEGMENTATION

Image segmentation is the third step in our purposed methodology. After image acquisition and preprocessing we segment the image in to three different clusters. For clustering we use k means color based clustering algorithm and the classification is done through the Otsu classifier. After making three different clusters user is asked to choose one of the cluster and then disease is predicted using that particular cluster

K MEANS COLOR BASED CLUSTERING

In our methodology the initially seventy five different images are take which belongs to different leafs. After image preprocessing and image segmentation images are classified into three different clusters .Initially one of the cluster is chosen and disease is predicted for that particular cluster. There after users are also provide options to calculate the affected region area and also we can calculate the percentage of the area. The figure describes the GUI of our application.

In user interface plot we have different buttons which are load image, enhance image and segment image. Above GUI is designed in MATLAB using guide command. Load image lets

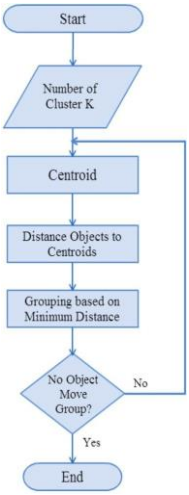

Fig -2:: K Means Algorithm

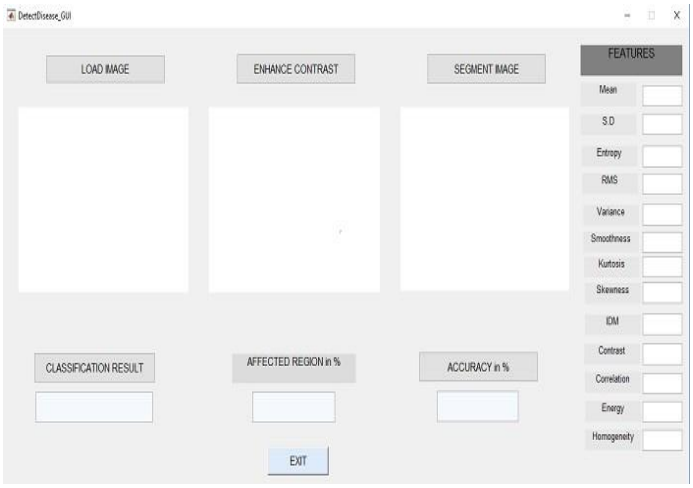

Fig -3: GUI

The user to choose image from the dataset. When user select one of the particular diseased or healthy leaf image then that particular image is loaded in the user interface.

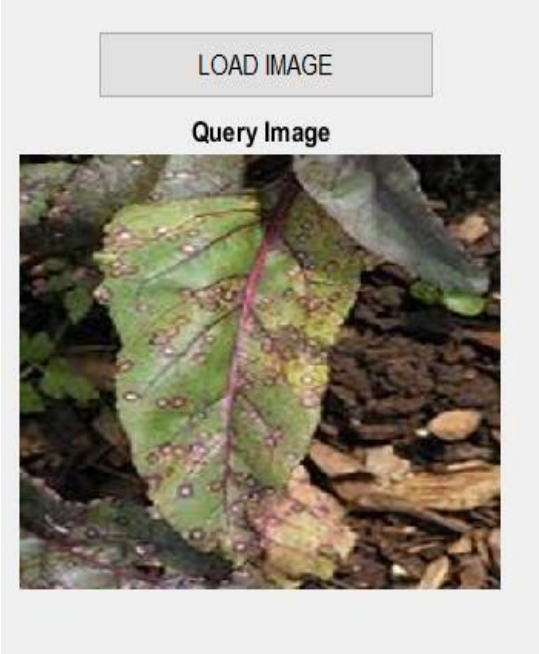

Fig -3: Input Image

Above figure shows user the image which is loaded from the input dataset. One of the image corresponding to particular type of the disease is chosen by the user and it gets loaded in the user interface for further process. Query image can be replaced with other images from the input dataset by clicking again on the load image button.

In figure we see the another button named enhance contrast. This tab is basically responsible for the preprocessing of the loaded image before sending it to the segmentation process. Noise reduction and pixel gets more clarified in this phase.

Fig -4: Enhanced Preprocessed Image

The above figure shows the contrast enhanced image of the input image. In this phase if in any diseased leaf of the plant dark level spot are there then contrast enhancement button highlight those buttons and it gets easy to segment the image into the different clusters for the classification and the prediction of the disease. There is improvement of the unwanted distortions and enhances the features of the image for further process.

The third button named image segmentation is third step in image processing of input image. In this phase main algorithm starts working. K means color based clustering algorithm and the classification using the Otsu method is done in this phase.

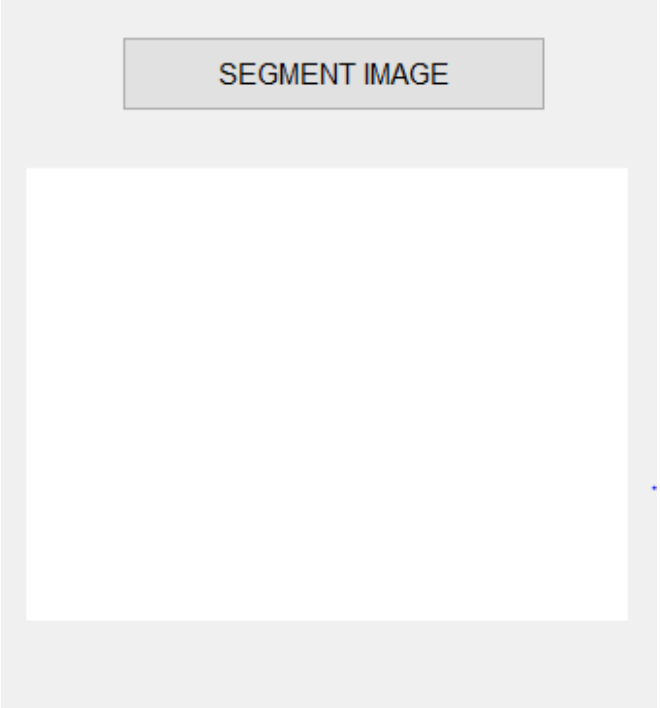

Fig -5:: Segmented Image Box

The third button segment image button. When the user click this particular button then user is directed to new window show the original image and its three different clusters. Image segmentation is done using k mean clustering. Color based clustering is done in k means and best three clusters are displayed. For the classification purpose we use the Otsu classifier which classifies the type of the image in the chosen image.

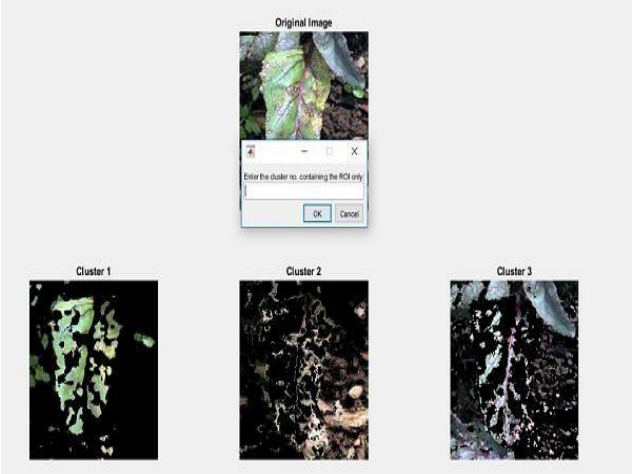

Fig -6:: Segmented Image Clusters

Figure 6 shows the segmented image of the input image. Original image and three different clusters of that particular image are shown in the figure. Also input dialog box is shown which asks the user to enter the cluster number in which the user has the region of the interest. User is required to choose the cluster in maximum color separation is there.

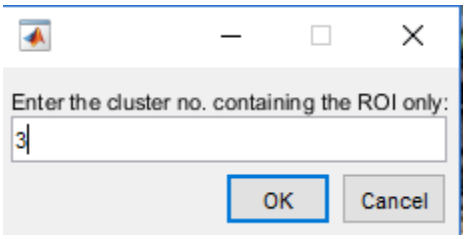

Fig -7: Input dialog box

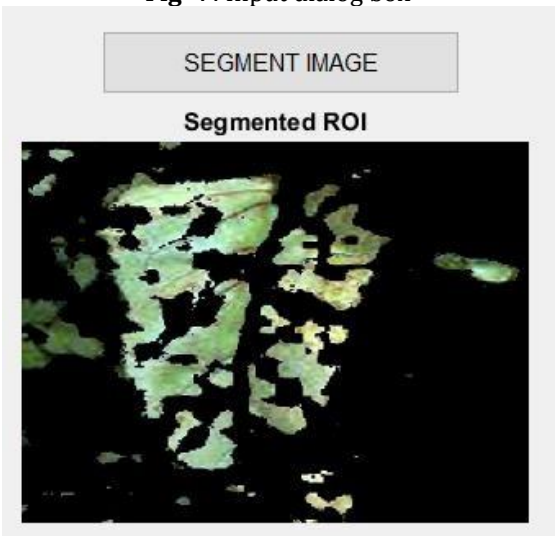

Fig -8: Segmented ROI

the above figure shows the cluster with the region of the interest gets loaded into the segment box. This image passes through OTSU classifier and different shape and color

oriented features are calculated using those prediction of disease is made.

3. CONCLUSION

The data mining techniques are playing a significant role in the agriculture industry and other industries. Data mining algorithm are easy implement, we can solve complex problems using these techniques. Using image techniques and data mining algorithms we successfully identified the affected area in the plant leaf. Various features of the image are extracted with their numeric values. The algorithm used here is very much efficient and best case time space complexities are achieved. For ninety percentage of images average clustering and processing time is less then twenty seconds. Average accuracy of ninety plus percentage is achieved in every query image of the dataset

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