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Plant Infection Detection Using Image Processing

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ABSTRACT: Economy of a country depends on agricultural productivity. Identification of the plant diseases is the key for preventing the losses in the productivity and improving the quality of the agricultural product. Traditional methods are reliable but require a human resource for visually observing the plant leaf patterns and diagnose the disease. Traditional method consumes more time, tedious work for labours. In big farm lands, early stage detection of plant disease by using automated techniques will reduce the loss in productivity. In this paper, we propose a vision based automatic detection of plant disease detection using Image Processing Technique. Image processing algorithms are developed to detect the plant infection or disease by identifying the colour feature of the leaf area. K mean algorithm is used for colour segmentation and GLCM is used for diseases classification. Vision based plant infection showed efficient result and promising performance.
KEYWORDS:- Image Processing, K- Mean Segmentation, GLCM, Classification, Patterns.

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I. INTRODUCTION

A Country's economy development depends on the agricultural land mass and productivity. Majority of the population are depended on the agriculture. Farmers cultivate various crops based on the soil fertility and availability of resources. Due to changes in the environmental conditions such as rain fall, temperature soil fertility, the crops can get infected by fungi, bacteria and viruses. They use suitable pesticides and herbicides for the plants for preventing diseases and increasing the productivity and quality of the product. Visual observation patterns on the plants are used for identifying and studying the plant diseases. Detection of plant disease at the initial stage will be beneficial since the disease can be controlled.

In few countries the farmers don't have any idea or facility for contacting the experts. Existing method for detection is visual observation of the leaf patterns by experts. But it requires large expert team. In such situation a automated plant infection or disease monitoring system will be very useful. By comparing the plants leafs in the agricultural farm land with the stored plant disease symptoms by automation will be cheaper. Here we classify the plant disease into three namely Anthracnose, Cercospora Leaf Spot and Bacterial Blight.

Anthracnose causes irregular shaped spots on the leaf with tan or brown colour. These blotches will be close to leaf veins. Severe infection will result in leaf dropping. Cercospora leaf spot leaf will be having small, brown flecks with a reddish border. It spreads out with a grey centre. Later on the leaf tissue becomes thin and brittle, and drops out leaving a hole. Bacterial Blight disease can affect trunk, branches, shoots, buds, flowers, leaves and fruit of a plant. A small pale green spots appears on the leaf and it spread over the leaf. Lesion region later become dry dead spot. Sample of the leaf are fed to the image processing systems for identifying the infection / disease. The various steps involved in Plant disease detection are image acquisition, pre-processing, segmentation, feature extraction and classification.

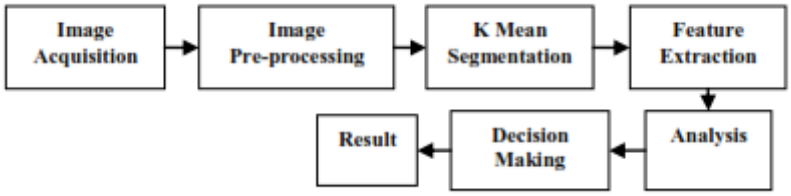
II. LITERATURE SURVEY

In recent years, image processing techniques are used in various fields such as automation, medical etc. Even the identification of plant infection using traditional method is replaced by image processing. The image processing systems requires camera, computer and necessary software. Steps involved in plant disease detection are image acquisition, pre-processing, segmentation, feature extraction and classification [1]. Performing image enhancement, improves the quality of the image as well as the clarity. Basic primary colours red, green and blue combinations produce many varieties of colours. Hence, implementing image processing using RGB

components is difficult and its range is very high. Converting RGB image into its equivalent grey image is done for easier implementation [2]. Automated plant disease using image processing technique is beneficial for the farmers as it reduces large human labours and can help to detected by symptoms at early stage [3]. MATLAB software's image processing tools are used for detecting the disease of the plants.

Image acquisition is performed using digital cameras. K-mean clustering algorithm used Euclidean distance metric method and clusters the image based on the specified number of groups [4][5]. Gray-Level Co-occurrence Matrix (GLCM) is one of the most popular methods for texture analysis. It produces a feature based gray level matrix for the colour image and measures the spatial distance between the pixels. GLCM represents the distance and angular spatial relationship of an image in a specific size. GLCM calculates how often the pixel with gray level intensity occurs. Horizontally values are represented as 'i' and vertically or diagonally values to adjacent pixels are labelled as 'j' [6][7][8].

III. METHODOLOGY

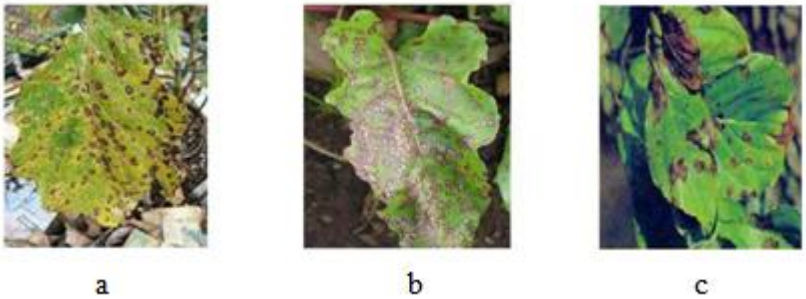


(Fig. 1) Block Diagram of Steps Involved in Plant Infection Detection System

Mobile phones or digital camera are used to take images of infected leafs of different plants. Image processing techniques are applied on those images to get useful features for analyzing. The various steps involved are shown in the Figure 1.

3.1 Image Acquisition

First step in image acquisition is to capture the leaves using mobile phone or digital camera. These stored images of the leaves from the database are load by specifying the path. Figure 2 shows the images of the samples of plant leaves.



(Fig. 2) Images of the Leaf Affected by a) Anthracnose b) Cercospora Leaf Spot and c) Bacterial Blight

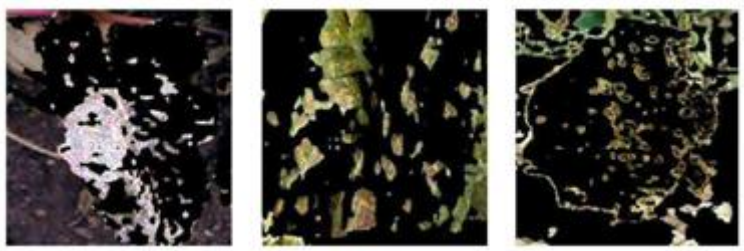
3.2 Image Pre-processing

Pre-processing improves the quality of the image by removing unsought distortions. Clipping the images based on the region of interest (ROI), image smoothing and contrast enhancement are done here. Figure 3 shows the images after performing image enhancement.

(Fig. 3) Enhanced Images after Pre-processing

3.3 Image Segmentation

Image segmentation is the method of dividing an image into different sub images. Here we use K-mean segmentation technique which uses hue estimation method for dividing and clustering the image. Since the green colour of the leaves is normal, we do not consider them. We select the cluster image showing the infected area for feature extraction. Figure 4, below shows the segmented images of the leaves.



(Fig. 4) Segmented Images of the Infected Leaves

K-means clustering algorithm, the data vectors are grouped into clusters based on the closeness of the pixels by the Euclidian distance measurement. Centroids of the clusters are initialized randomly and their dimensions are equal to data vectors.

3.4 Feature Extraction

Interesting part of an image from where the required informations are extracted is called as feature extraction. The dimension of the region of interest (ROI) will be smaller than the original image. Gray level co-occurrence matrix (GLCM) is one of the best methods for texture analysis. It uses second order statistics methods for estimating the image properties. GLCM calculates the pixel with a particular intensity or gray value occurs in the image. Resultant will be the sum of occurrence of the pixel with specific intensity in the spatial domain. Size of the GLCM will be based on the number of gray levels.

3.5 Classification

Leaves are affected by diseases caused by fungi, bacteria and viruses. Sometime insects also damage the leaf which appears as leaf spot disease. The infected part of the leaf will vary in size and colour, depending on the stage and organism involved. Spots will be noticed with various colours such as yellow, brown, tan, black. Based on the texture information from GLCM the disease is classified. Here, we classify the disease as Anthracnose, Cercospora Leaf Spot and Bacterial Blight.

IV. RESULT ANALYSIS

Infections are detected based on K-means clustering and GLCM techniques. Segmented image texture analyses are used for classifying the infection as Anthracnose, Cercospora Leaf Spot and Bacterial Blight. The results obtained for different leaf samples with disease classification and affected area is shown in Table 1. This system was capable of identifying the infection and classifies them accordingly with 98.27% of accuracy.

Sample No.	Disease Classified	Affected Area (Percentage)
1	Anthracnose	49.88
2	Anthracnose	53.12
3	Anthracnose	66.37
4	Cercospora Leaf Spot	30.56
5	Cercospora Leaf Spot	43.25
6	Cercospora Leaf Spot	21.89
7	Bacterial Blight	30.51
8	Bacterial Blight	15.68
9	Bacterial Blight	88.76

(Table 1) Classification of Disease and Affected Area

V. CONCLUSION

This work gives efficient and accurate plant disease detection and classification technique by using image processing technique. K-means and GLCM techniques are used for plant leaf disease detection. This automated system reduces time of detection and labour cost. It can help the farmers to diagnose the disease and

take remedial action accordingly. In future work, we will extend our database for more leaf disease identification.

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