Image Processing Based Disease Detection for Sugarcane Leaves

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Abstract: Images are ways of recording and presenting information in visual form and, in the broadest sense, an image corresponds to any kind of two-dimensional data. The naturally occurring form of image is not suitable for processing with computers as computers cannot operate directly on pictorial data but require numerical data. Therefore, images need to be converted into numerical data referred to as digital image, to enable computer. The interdisciplinary research linking image processing with agriculture-oriented application for detecting a leaf disease in sugar cane plant. Plant diseases are of critical importance to humans because they damage plants and reduce plant production on which human relay for fundamental food supply. This research paper suggested a novel algorithm which can cope with the variations and complexities for robust and continuous disease detection. In this chapter, we introduce this research from both aspects of agricultural needs and image-based techniques.Image processing techniques has been proved to be changing the scenario of agriculture in India with a number of research and applications like automatic disease detection, drone based pesticides and fertilizer dispensing, estimation of yield, vegetative growth, fruit sorting etc. This interdisciplinary research linking image processing with agriculture-oriented application for detecting a leaf disease in sugar cane plant. Plant diseases are of critical importance to humans because they damage plants and reduce plant production on which human relay for fundamental food supply.

***IndexTerms* - Sugarcane, leaf disease detection, image processing, computer vision, segmentation.**

I. INTRODUCTION

Since late decades, computerized picture preparing, picture investigation and machine vision have been forcefully created, and they have turned into a vital piece of counterfeit consciousness and the interface amongst human and machine grounded hypothesis and connected innovation. These innovations have been connected broadly in industry and solution, yet seldom in domain identified with horticulture or regular natural surroundings. In spite of the significance of the subject of distinguishing plant illnesses utilizing computerized picture preparing, and in spite of the fact that this has been examined for no less than 30 years, the advances accomplished appear to be a bit. Techniques are excessively particular. The perfect technique would have the capacity to distinguish any sort of plant. Apparently, this is unfeasible given the current innovative level.

A large portion of the specialists don't express this sort of data unequivocally, however in the event that their preparation and test sets incorporate just pictures of a specific development arrange, which is frequently the case, the legitimacy of the outcomes can't be stretched out to different stages. Operation conditions are excessively strict. Many pictures used to grow new strategies are gathered under exceptionally strict states of lighting, point of catch, separation amongst question and catch gadget, among others. This is a typical practice and is impeccably adequate in the early phases of research.

In this research paper, we introduce this research from both aspects of agricultural needs and image-based techniques. Since non-chemical disease control managements such as plant resistant cultivates, crop rotation, or multiple fungicide application do not provide adequate disease prevention. Alternative fungicide spraying is the most important tool for managing disease spread [1]. Usually, optimal and profitable decisions for the timing and frequency of the adaptive fungicide spraying are made in terms of disease severity and local weather conditions [2], by which both economic losses and chemical usage can be reduced for precision plant protection. Therefore, information of disease severity assessment is a fundamental premise for the decision-making process of fungicide sprays [3, 4]. Sugarcane is responsible for 75% of the global sugar production and India is the largest consumer and second largest producer of sugar in the world. Indian sugar industry is the second largest agro based industry, next only to the textiles. But, being long durational crop, sugarcane is prone to the number of disease caused by pathogens viz. fungi, bacteria, viruses and phytoplasmas like organisms. Amongst all the diseases, red rot and smut are causing the major out-breaks in the recent years causing 30-100% yield loss in commercial sugarcane cultivars throughout India [5].

II. LITERATURE REVIEW

India is the largest consumer and second largest producer of sugar in the world. Indian sugar industry is the second largest agro based industry, next only to the textiles. But, being long durational crop, sugarcane is prone to the number of disease caused by pathogens viz. fungi, bacteria, viruses and phytoplasmas like organisms. Amongst all the diseases, red rot and smut are causing the major out-breaks in the recent years causing 30-100% yield loss in commercial sugarcane cultivars throughout India (Vishwanathan et al., 2003, Vishwanathan and Rao, 2011).

Red rot disease is so disastrous in nature that it has been known as cancer of sugarcane (Agnihotri, 1983). First time, red rot is observed in the cultivars of Red Mauritius in the Godavari delta of Andhra Pradesh (Barber, 1901). Outbreak in Co 419 and Co 658 in Andhra Pradesh, Tamil Nadu and Pondicherry indicated that those virulent races of pathogen have got their foothold in these areas. The quest for the new varieties has probably been responsible for the migration of the pathogen from one state to another. In India, red rot is chiefly the disease of standing cane and caused by Colletotrichum falcatum Went.

Red rot can affect many commercial varieties during its course of infection and epidemiology. Eventually, all the varieties fell prey to red rot and had to be withdrawn from the general cultivation or had to be replaced by the new more tolerant genotypes. The disease is the major constraint for sugarcane production of India and entire cane breeding in India is focused around this disease.

Figure 1: A Disease Affected Plant

The popular cane genotypes that served the Indian sugar industry succumbed to the onslaught of red rot and the list of such causalities is an ever increasing (Duttamajumder, 2008). Probably this is the reason that entire sugarcane breeding in India is geared up and focused around red rot resistance.

Mosaic disease of sugarcane has been known for long in many countries. It is continuously observed on the widely grown variety Co740 in Maharashtra although it is not known to have caused any serious damage to yields, due probably to the absence of virulent strains of viruses ans tolerant nature of the varieties. Mosaic in association with RSD cause reported to be more damaging in terms of yield and recovery.

Figure 2: Mosaic Disease

The main symptom of the disease appear more prominently on the basal portion of younger foliage than the older ones.

III. System Implementation

The system has been developed to detect the three most important disease in sugarcane i.e. red rot disease, mosaic disease and leaf scald disease. The images of infected leaves has been taken to make a database of disease leaf dataset and another dataset of healthy leaves. Various image processing steps such as preprocessing, gray conversion, segmentation have been used. Finally, classification of leaf color texture is done using SVM classifier to obtain feature extraction metrics for both healthy leaves and the diseased leaves. The leaf detection testing system consists of the same steps and the metrics obtained are compared with the existing database of trained healthy and diseased leaves. The final outcome is the detection of leaf disease type.

Pattern recognition is a very important field within computer vision, and the aim of pattern recognition/classification is to classify or recognize the patterns based on extracted features from them. The pattern recognition involves three steps:

(1) Pre-processing
(2) Feature Extraction
(3) Classification.

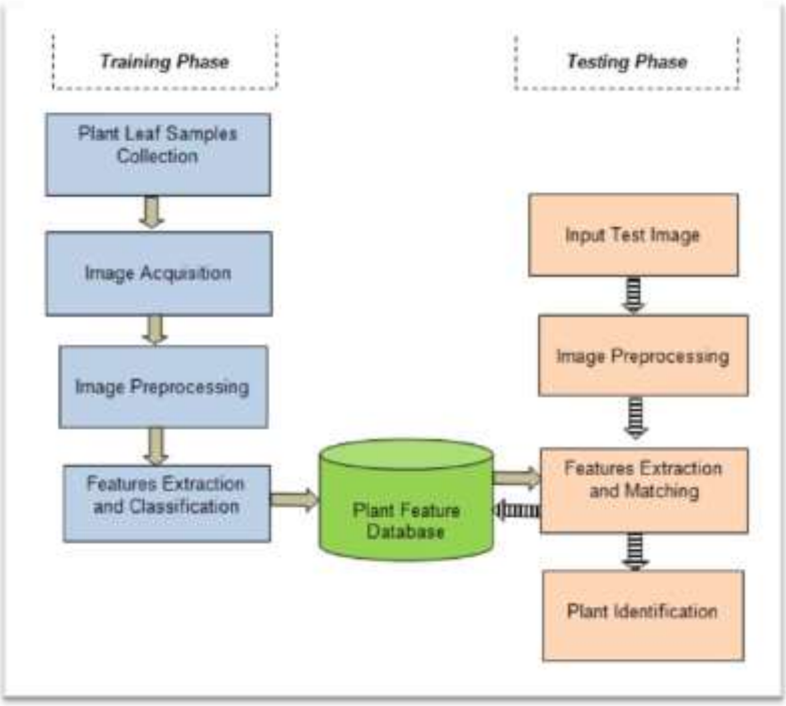


Figure 2: Overview of the System

This research paper suggested the implementation details of the proposed work. The Proposed work use the K-Means clustering method to make the cluster of some data. The K-means clustering is used for classification of object based on a set of features into K number of classes. The classification of object is done by minimizing the sum of the squares of the distance between the object and the corresponding cluster.

The algorithm for K –means Clustering:

1. Pick center of K cluster, either randomly or based on some heuristic.
2. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster center.
3. Again compute the cluster centers by averaging all of the pixels in the cluster. Repeat steps 2 and 3 until convergence is attained.

IV. Result And Analysis

The algorithm has been implemented using MATLAB 2014a software tool. Following are the details of the simulation results obtained.

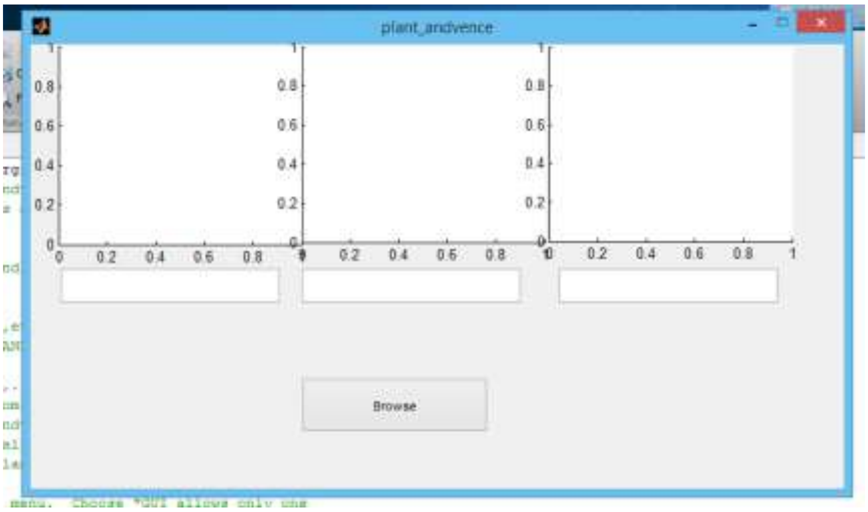


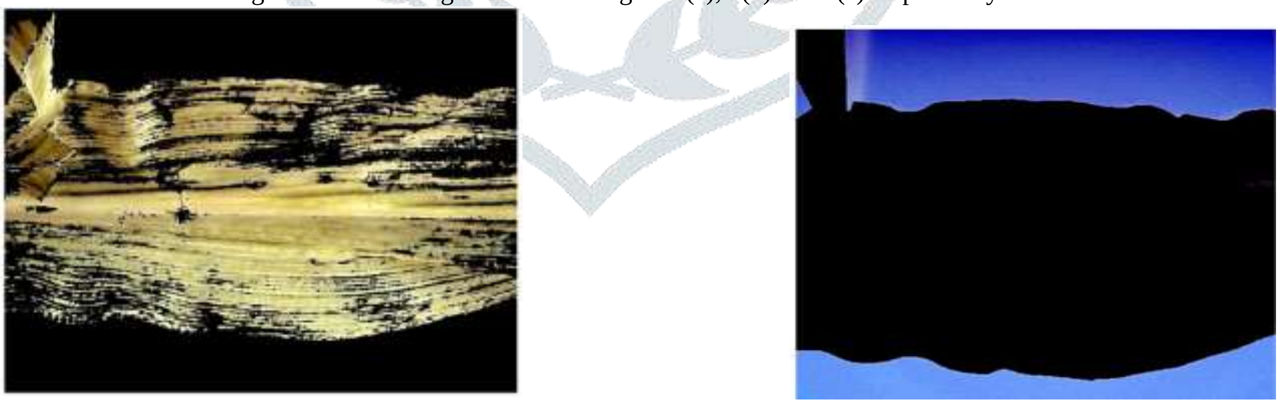
Figure 4: GUI Developed for System

The GUI for the system is shown in figure 4. It has three axes which show the three part of image based on clustering and one browse button which is use to read the file from dataset of leaf. Browse button is used to select the diseased leaf from the dataset of disease and select our first leaf which has Mosaic Disease and Leaf Scald Disease. Figure 5(a) shows the result after image enhancement and figure 5(b) shows the image after colour transform from RGB to HSI.

a) b)

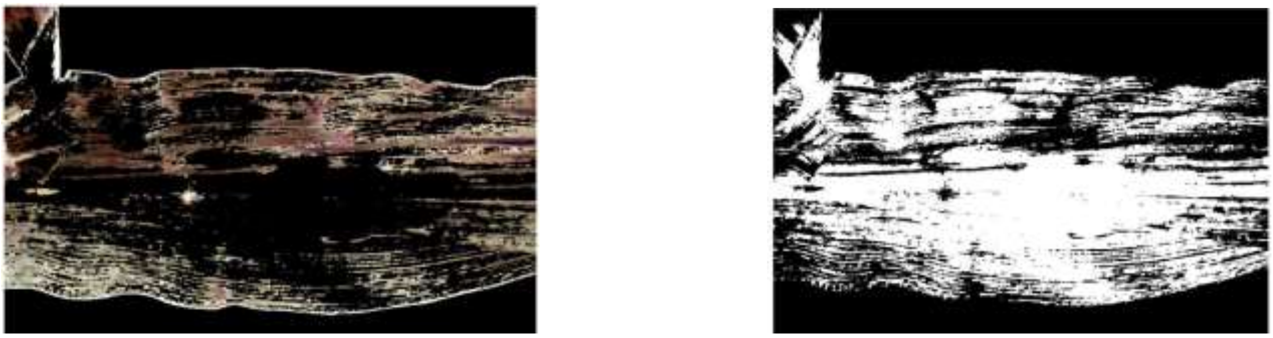
Figure 5: a) Image after enhancement b) Image after Colour transform

K-means clustering is then applied to form clusters of same colour patter. Figure 6(a) shows image after segmentation is then applied to obtain three different segments of the image as shown in figure 6(a), 7(b) and 7(a) respectively.



a) b)

Figure 6: a) Segment 1 b) Segment2



a) b)

Figure 7: a) Segment 3 b) Binary Converted Segment 1

Figure 8: a) Binary Converted Segment 2 b) Binary Converted Segment 3

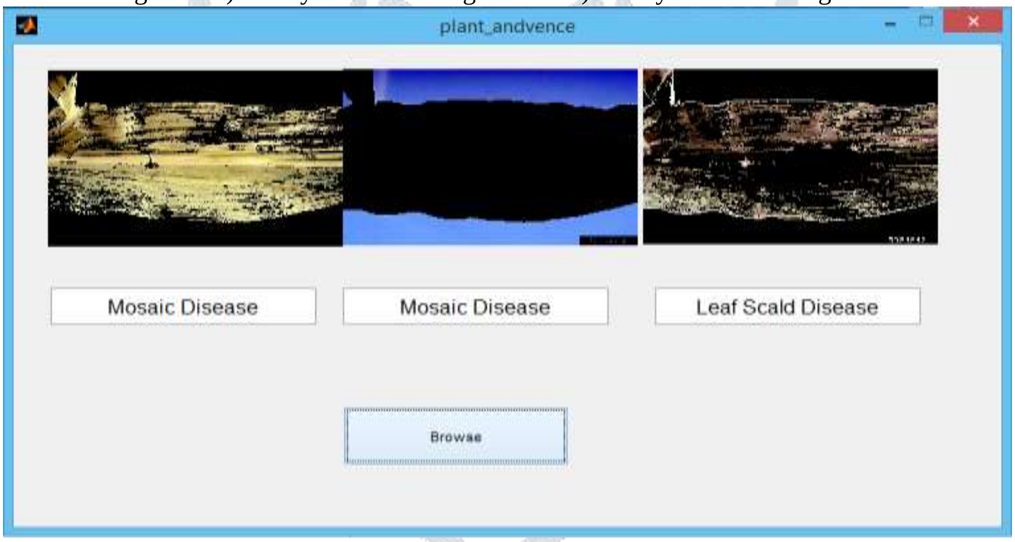


Figure 9: Disease Detected

As shown in the figure 9, the disease existing in the input leaf image is detected and is shown as the output as Mosaic Disease and Leaf Scald Disease.

V. Conclusion

The accurate detection and classification of the plant disease is very important for the successful cultivation of crop and this can be done using image processing. This paper discussed various techniques to segment the disease part of the sugarcane plant. The sugarcane leaves can be analysed to detect symptoms of various kinds of diseases. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The use of k-means clustering and co-occurrence matrix methods for classification of disease in plants such as self-organizing feature map, back propagation algorithm, SVMs etc. can be efficiently used. From these methods, accurate identification and classification of various plant diseases using image processing techniques, can be performed, as seen by the experiments conducted.

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