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PLANT DISEASE DETECTION AND ITS SOLUTION USING IMAGE CLASSIFICATION

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Abstract : Crop cultivation plays an essential role in the agricultural field. Presently, the loss of food is mainly due to infected crops, which reflexively reduces the production rate. To identify the plant diseases at an untimely phase is not yet explored. The main challenge is to reduce the usage of pesticides in the agricultural field and to increase the quality and quantity of the production rate. Our paper is used to explore the leaf disease prediction at an untimely action. We propose an enhanced k-mean clustering algorithm to predict the infected area of the leaves. A color based segmentation model is defined to segment the infected region and placing it to its relevant classes. Experimental analyses were done on samples images in terms of time complexity and the area of infected region. Plant diseases can be detected by image processing technique. Disease detection involves steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. Our project is used to detect the plant diseases and provide solutions to recover from the disease. It shows the affected part of the leaf in percentage. We planned to design our project with voice navigation system, so a person with lesser expertise in software should also be able to use it easily.

Keywords : Disease Detection, Production rate, k-means clustering, Voice navigation, Infection region

1. Introduction

India is eminent for Agriculture that means most of the people are engaged towards agriculture industry. The agriculture industry act as a significant role in the economic sectors. Most of the plants are infected by variant fungal and bacterial diseases. Due to the exponential inclination of population, the climatic conditions also cause the plant disease.The major challenges of sustainable development is to reduce the usage of pesticides, cost to save the environment and to increase the quality. Precise, accurate and early diagnosis may reduce the usage of pesticides.

Data mining is termed as extracting the relevant information from large pool of resources. The advents of data mining technologies have been adopted in the prediction of plant diseases. Rice is one of the major crops cultivated in India. Nowadays, technology is widely used for plant disease prediction. The management of perennial leaf requires close monitoring system especially for the diseases that affects production and post-harvest life. The concept of image processing with data mining technologies assists us in following purposes:

i) Recognizing infected leaf and stem
ii) Measure the affected area
iii) Finding the shape of the infected region
iv) Determine the color of infected region
v) And also influence the size and shape of the leaf.

The user is to select a particular diseased region in a leaf and the cropped image is sent for processing [4].This paper intends to study about the prediction of the plant diseases, at an untimely phase using k-mean clustering algorithm. Specifically, we concentrate on predicting the disease such as Alternaria alternate, Anthracnose, Cercospora, bacterial blight and leaf spot. It would be useful for identifying different diseases on crops [5].It provides various methods used to study crop diseases/traits using image processing and data mining. In addition, the infected area and affected percentage is also measured. Back Propagation concept is used for weight adjustment of training database [6].

2. Literature Survey

An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques by Kiran R. Gavhale, and U. Gawande, Gavhale and Gawande (2014) presented reviews and summarizes image processing techniques for several plant species that have been used for recognizing plant diseases. The major techniques for detection of plant diseases are: back propagation neural network (BPNN), Support Vector Machine (SVM), K-nearest neighbor (KNN), and Spatial Gray-level Dependence Matrices (SGDM). These techniques are used to analyses the healthy and diseased plants leaves.

Intelligent Diagnose System of Wheat Diseases Based on Android Phone by Y. Q. Xia, Y. Li, and C. Li , In 2015, Xia and Li have proposed the android design of intelligent wheat diseases diagnose system. In this process, users collect images of wheat diseases using Android phones and send the images across the network

to the server for disease diagnosis. After receiving disease images, the server performs image segmentation by converting the images from RGB color space to HSI color space. The color and texture features of the diseases are to be determined by using colour moment matrix and the gray level co-occurrence matrix. The preferred features are input to the support vector machine for recognition and the identification results are fed back to the client.

Implementation of RGB and Gray scale images in plant leaves disease detection –comparative study by Padmavathi and Thangadurai (2016) have given the comparative results of RGB and Gray scale images in leaf disease finding process. In detecting the infected leaves, color becomes an important feature to find the disease intensity. They have considered Grayscale and RGB images and used median filter for image enhancement and segmentation for extraction of the diseased portion which are used to identify the disease level. The plant disease recognition model, based on leaf image classification, by the use of deep convolution networks have developed. 13 kinds of diseases are identified from the healthy leaves with the capability to differentiate leaves from their surroundings.

3. Proposed System

Our project is to detect the plant diseases and provide the solutions to recover from the leaf diseases. We planned to design our project with voice navigation system so that a person with lesser expertise in software should also be able to use it easily.

In our proposed system we are providing a solution to recover from the leaf diseases and also show the affected part of the leaf by image processing technique. The existing system can only identify the type of diseases which affects the leaf. We will provide a result within fraction of seconds and guided you throughout the project.

We briefly explain about the experimental analysis of our methodology. Samples of 75 images are collected that comprised of different plant diseases like Alternaria Alternata, Anthracnose, Bacterial Blight, Cercospora leaf spot and Healthy Leaves. Different number of images is collected for each disease that was classified into database images and input images. The primary attributes of the image are relied upon the shape and texture oriented features. The sample screenshots displays the plant disease detection using color based segmentation model.

Table 1.1: Measuring time complexity and area estimation of the infected region.

Types of diseases	No. of images	Clustering time (s)	Area of infected region (%)
Alternaria Alternata	22	Below 20 S	15.0062
Anthracnose	23	Below 20 S	15.0915
Bacterial Blight	7	Below 20 S	13.0093
Cercospora leaf spot	9	Below 20 S	18.2951

3.1 Plant Diseases- Fundamentals

In the field of crop production, plant disease is a significant factor that degrades the eminence and quantity of the plants. The common approach followed in plant diseases are the classification and detection model. Both the classification and detection model are widely studied by the Engineering and IT fields.

3.2 Bacterial Diseases

A bacterial disease is generally referred as the "Bacterial leaf spot". It is initiated as the small, yellow-green lesions on young leaves which usually seen as deformed and twisted, or as dark, water-soaked, greasy - appearing lesions on older foliage.

3.3 Viral Diseases

All viral disease presents some degree of reduction in production and the life of virus infected plants is usually short. The most available symptoms of virus-infected plants are frequently appear on the leaves, but some virus may cause on the leaves, fruits and roots. The Viral disease is very difficult to analyze. Leaves are seen as wrinkled, curled and growth may be undersized due to the virus.

3.4 Fungal Diseases

Fungal disease can influence the Contaminated seed , soil, yield, weeds and spread by wind and water. In the introductory organize it shows up on lower or more seasoned clears out as water-soaked, gray-green spots. Afterward these spots are obscure and at that point white fungal development spread on the undersides. In wool buildup yellow to white streak on the upper surfaces of more seasoned clears out happens. It spreads outward on the leaf surface causing it to turn yellow.

4. Proposed Methodology

In this section, we explain about the leaf disease prediction using k-mean clustering algorithm. This paper includes several steps Image Acquisition, Image Pre-Processing, Feature Extraction, and neural network based classification [2]. It works as follows:

- Image Acquisition
- Image Preprocessing
- Image segmentation
- Feature extraction

4.1 Image Acquisition

The initial process is to collect the data from the public repository. It takes the image as input for further processing. We have taken most popular image domains so that we can take any formats like .bmp, .jpg, .gif as input to our process

4.2 Image Preprocessing

As the images are acquired from the real field it may contain dust, spores and water spots as noise. The purpose of data preprocessing is to eliminate the noise in the image, so as to adjust the pixel values. It enhances the quality of the image.

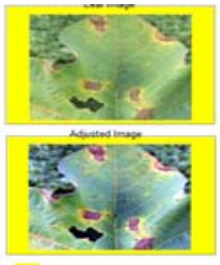

Fig.1. Image preprocessing

4.3 Image segmentation

Image segmentation is the third step in our proposed method. The segmented images are clustered into different sectors using Otsu classifier and k-mean clustering algorithm. Before clustering the images, the RGB color model is transformed into Lab color model. The advent of Lab color model is to easily cluster the segmented images.

4.4 K-means Clustering Algorithm

a) Load the input images.
b) Commute the RGB image into L*a*b color space.
c) RGB images are combination of primary colors (Red, Green, Blue) [1].
d) RGB image feature Pixel Counting technique is extensively applied to agricultural science [3].
e) The L*a*b* space consists of a radiance layer 'L*', chromaticity-layer 'a*' indicating where color falls along the red-green axis and chromaticity-layer 'b*' indicating where the color falls along the blue-yellow axis. All of the color information is in the 'a*' and 'b*' layers.
f) Clustering the variant colors using k-mean method.
g) The Euclidean distance between two objects is defined as follows:

$$Dis_{(a,b)} = \sqrt{\sum_i (x_i - y_i)^2}$$

f) Each pixel is labeled under clusters based on its estimated variant cluster-centers.

4.5 Otsu's classifier

In image processing technique, Otsu's strategy is utilized to perform clustering based image Threshold**.** The diminishment of a gray level image to a binary image is done by Nobuyuki Otsu .This algorithm assumes , image contains two classes of pixels .It incorporates bi-modal histogram (foreground pixels and background pixels).We can calculate the optimum threshold by isolating the two classes and their combined spread (intra-class variance) is negligible or equivalently.

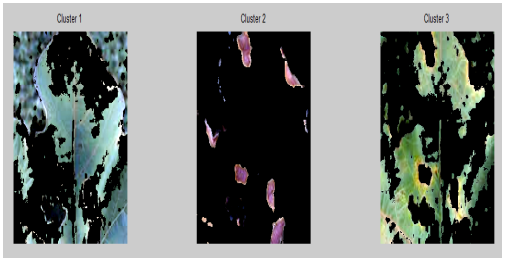

Fig.2.Image clustering

4.6 Feature extraction

Feature extraction is the important part to gracefully predict the infected region. Here shape and textural feature extraction is done. The shape oriented feature extraction like Area, Color axis length, eccentricity, solidity and perimeter are calculated. Similarly the texture oriented feature extraction like contrast, correlation, energy, homogeneity and mean. Leaf image

is captured and processed to determine the health of each plant [7].

5. System Architecture

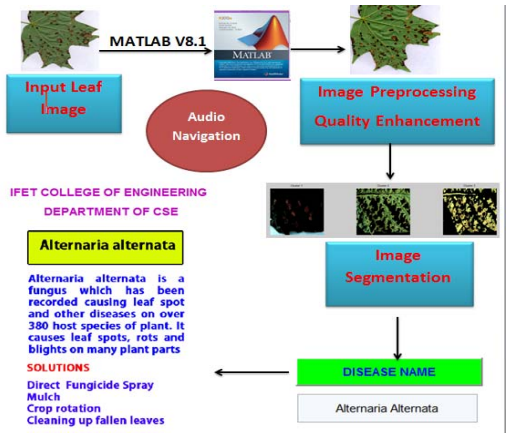

Fig.3.Architecture

The initial process is to select the image. By using the image preprocessing technique, the leaf has to be diagnosed whether it was affected or unaffected. Then the image has to be segmented and the name of the disease to be identified. These project provides a solution to overcome from the leaf diseases and it also analyze the overall percentage of the affected leaf and its surrounding region.

6. Results& Discussion

6.1 Alternaria Alternata

It is a fungus which influences the leaf spots over 380 have species of plant. It can too influences leaf spots, rots, blight and other plant parts.

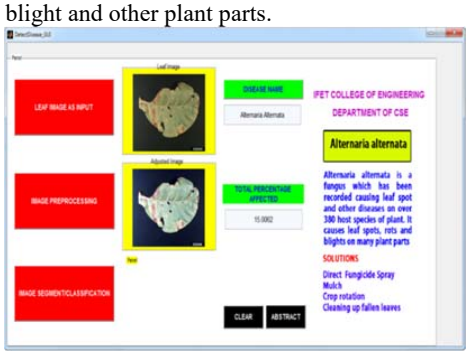

Fig.4 Alternaria alternata

6.2 Bacterial Blight (Paddy)

Bacterial Blight is characterized by small, pale green spots or streaks appeared as water-soaked. The lesions will expand then appear as dry dead spots. It may extend until the full length of the leaf.

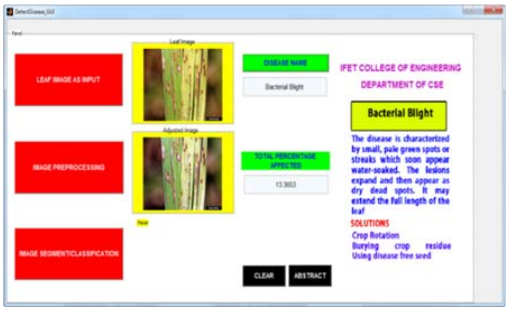

Fig.5.Bacterial Blight

7. Conclusion

Data mining technologies has been incorporated in the agriculture industry. This project implements an innovative idea to identify the affected crops and provide remedy measures to the agricultural industry. By the use of k-mean clustering algorithm, the infected region of the leaf is segmented and analyzed. The images are fed to our application for the identification of diseases. It provides a good choice for agriculture community particularly in remote villages. It acts as an efficient system in terms of reducing clustering time and the area of infected region. Feature extraction technique helps to extract the infected leaf and also to classify the plant diseases. The embedded voice navigation system helps to guide us throughout the process. As future enhancement of the project is to develop the open multimedia (Audio/Video) about the diseases and their solution automatically once the disease is detected.

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