Plant Disease Identification using Image Processing

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Abstract— Image Processing is a wide area were various researches are going on for human and plant disease Identification. Identification of plant diseases can not only maximize the yield production. This application help the farmer to identify the various disease and take cure of plant from various diseases. Indian economy is highly depend upon the agriculture. So it is important to introduce new technologies in the horticulture field. So here the disease identification is performed on basis of machine learning mechanisms and image processing. Initially, identify the leaves and capture the image using various modes that are available.

Keywords: Image Processing, Colour Balancing, GLCM

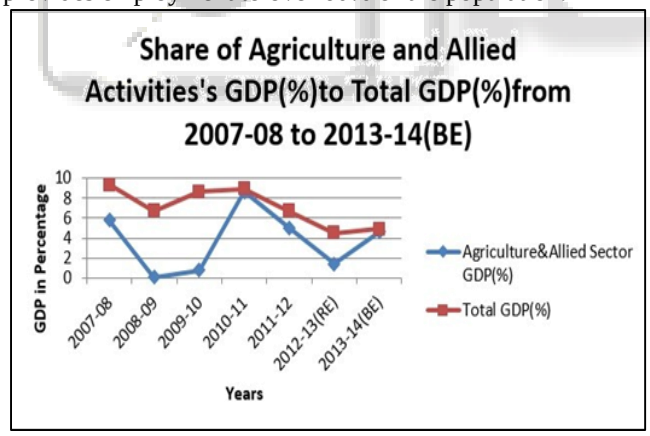
I. INTRODUCTION

A. Description

Here we will elaborate the aspects like description, problem statement, scope, motivation and also the objectives of our project

B. Problem Statement

The economy of India is heavily dependent upon it's agriculture field. Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depends on agriculture. Agriculture is an important sector of Indian economy as it contributes about17% to the total GDP and provides employment to over 60% of the population.



C. Scope and Motivation

This project is designed to assist individuals (farmers and agricultural experts) to get updates about their fields by using machine learning and image processing technology. Farmers will be able to take advantage from this system whenever they have shortage of time and they get all the updates about their fields .Our Proposed system uses the images of infected plant and using machine vision approach for identification of diseases.

D. Project Objectives

The main objectives of this project are to create an application Which can solve the problem related to agriculture field.so the initial step is to capture the image using different modes that are available and then identify the disease using Svm classifier.

II. LITERATURE REVIEW

Here we will elaborate the aspects like the literature survey of the project and what all projects are existing and been actually used in the market which the makers of this project took the inspiration from and thus decided to go ahead with the project covering with the problem statement.

A. Author: Prof. N. karithika and Dr. A. GraceSelvarani

They presented the classification of grapes leaf diseases proposed along with the leaf identification. The grapes images are classified then the histogram of H and a color channel are generated and the pixel values are observed to distinguish the healthy and diseased tissues. Then, features are extracted and classified by using the KNN classification algorithm in order to find the leaf diseases. This was found to be more effective[3].

B. Author: ChutinanTrongtokid et al.

This discussed for help an agriculturist to diagnose the infected plant and to solve the problem immediately. This paper present the knowledge based in an expert system for classifying which analisis from symptoms on mango leaves [6].

C. Author: Sachin D. Khirade and A. B. Patil,

This paper discussed the methods used for the detection of plant diseases using their leaves images, this paper also discussed some segmentation and feature extracting algorithms used in the plant diseases detection [2]

D. Author: Surya Prabha and Dr.J. Satheeh Kumar

In this paper brief review about banana plant diseases that shows symptoms in leaves are given and explains in detail the image processing techniques that are involved in the process of diseases identification in banana leaves [5]

III. PROPOSED SYSTEM

The method proposed in this paper is represented in the block diagram. It consists of two phases –

1) The training phase and the testing phase. The training phase includes evaluating the features and creating a feature vector set.
2) The testing phase takes an input image and uses a classifier to perform comparison with the feature vector set to give the correct identification of the disease. Mango leaves were tested, to be classified into three classes –

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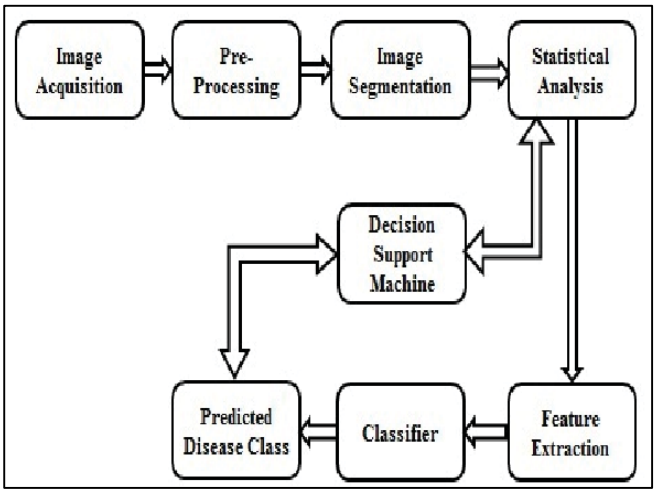
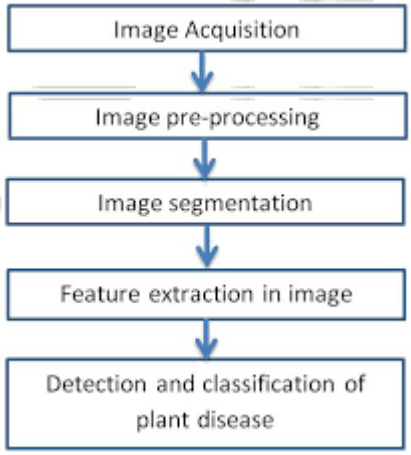


Diseases in the plants may show various physical characteristics i.e. difference in colors, shapes and forms etc. We are using a machine learning and Image processing based approach for disease detection. Based on these facts following characteristics are analyzed:

1) Locations symptom: Diseases affect not only leaves of the plant but other parts like stems and fruits also.
2) Diseases patterns: Visible variations are shown on either front or back side of leaves by the symptoms of diseases.
3) Fungus type: Some diseases can easily be differentiated by the identification of type of fungus.

IV. Application Architecture



A. Image Acquisition

The general aim of Image Acquisition is to transform an optical image (Real World Data) into an array of numerical data. Image must be captured by camera and converted into a manageable entity [4]. The Image Acquisition process consists of three steps:-

1) Optical system which focuses the energy
2) Energy reflected from the object of interest
3) A sensor which measure the amount of energy.

B. Image Pre-processing

The main purpose of image pre-processing is to improve the image data contained unwanted distortion or to enhance some image features for further processing. Pre-processing method uses various techniques such as changing image shape and size, filtering of noise, image conversion, enhancing image and other operations.

C. Image Segmentation

Image segmentation is the method for conversion of digital image into several segments and rendering of an image into something for easier analysis. Image segmentation is used for locating the object and bounding line of that image.

D. Feature Extraction and classification

In feature extraction desired feature vector such as color, texture, morphology and structure are extracted. Feature extraction is method of involving number of resources required to describe large set of data accurately. Minimum distance classifier as well as Support vector machine classifier are used one at a time in proposed method for classification.

$$P_{i,j} = \sum_{x=0}^{M-1} \sum_{y=0}^{N-1} C[I(x,y) = i \text{ and } I(x \pm d\emptyset_1, y \pm d\emptyset_2) = j]$$

1) Colour Balancing

Pre-processing is a critical step in image processing as it provides with a suitable and compatible image which gives optimum results for feature extraction. Colour Balancing method gives enhancement of the diseased part on the leaves and reduces the intensity of the green parts of the leaves.

The algorithm for this technique is as follows:

1) Take the input image from user and resize it to a desired level.
2) Extract the R, G, and B planes of the image.
3) Calculate the mean value of pixel intensities of each plane.
4) Find out the smallest mean value of the three planes.
5) Divide this smallest value by the mean values of each plane to obtain three scaling factors for three planes.
6) Multiply each plane with the obtained scaling factors to obtain enhanced image.

2) Gray Level Co-occurence Matrix (GLCM)

The Gray level Co-occurrence Matrix (GLCM), proposed by Haralick [7], is being used widely for texture segmentation in various fields of image processing. The construction of GLCM depends on the relative distance (d) and orientation (?) between pixels, where d is distance measured in the pixel number and ? is the angle, generally four directions (horizontal- 0?, diagonal- 45?, vertical- 90? and anti-diagonal- 135?). A GLCM Gm,n for an image I(x,y) can be generated as follows.

Where C(.)=1 if the argument is true, otherwise C(.)=0

$$G_{m,n} = \begin{bmatrix} P(1,1) & P(1,2) & \cdots & P(1,N_x) \\ P(2,1) & P(2,2) & \dots & P(2,N_x) \\ \vdots & \vdots & \cdots & \vdots \\ P(N_x,1) & P(N_x,2) & \dots & P(N_x,N_x) \end{bmatrix}$$

Formulaes for these are depicted in equation 2-9

% Derive Statistics from GLCM

stats = graycoprops(glcms,'Contrast Correlation Energy Homogeneity');

a) Contrast

Contrast = stats.Contrast;

b) Correlation

Correlation = stats.Correlation;

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c) Energy
Energy = stats.Energy;
d) Homogeneity
Homogeneity = stats.Homogeneity;
e) Mean
Mean = mean2(seg_img);
f) Standard_Deviation
Standard_Deviation = std2(seg_img);
g) Entropy
Entropy = entropy(seg_img);

3) Support Vector Machine

Support Vector Machine (SVM) is a learning machine for two group classification problems [14]. The basic idea of SVM is the construction of a hyper plane which provides the decision boundary for classification between two classes. The optimal hyper plane is so constructed that the two supporting hyper planes are equidistant from it which ensures least probability of misclassification. The supporting hyper planes are constructed either side of the optimal hyper plane using the support vectors which are nothing but the data points that lie closest to the decision boundary. Hence, decision making is fully specified by the small subset of training samples, the support vectors.

The algorithm used in the proposed method for classification between three classes is as follows:

1) Create three feature vector sets. One each for classification between anthracnose - leaf spot, anthracnose -normal, leaf spot - normal.
2) Create three class labels (L) for each of the above feature vector sets (FVS).
3) Use one feature vector set and its corresponding class label at a time.
4) Accept input image from user and create a testing-set containing feature values of the input image.
5) Train the classifier using svmtrain(FVS,L) function. Save the trained classifier in a variable (here, 'svmstructure').
6) Perform classification using function svmclassifiy(svmstructure, testing-set).
7) Store the obtained class value in a variable and repeat steps (e) and (f) for other two feature vector sets.
8) After performing three times, the class obtained two times out of three is the required class.

V. Results and Discussion

The confusion matrices for the 24 test images with 8 of each type are shown. Tables 1-7 give the accuracies obtained using the minimum distance classifier while tables 8-14 give the accuracies obtained using SVM classifier. Table 1 gives the accuracy for disease identification by considering the GLCM, Colour and Gabor features together. Tables 2, 3 and 4 are evaluated considering GLCM, Colour and Gabor filter features independently. Tables 5, 6, 7 give the accuracy with different combinations of the three methods.

	Anthracnose	Bacterial	Leaf Spot	Accuracy
Anthracnose	7	1	0	87.5%
Bacterial	2	5	1	61%
Leaf Spot	0	1	7	86%

VI. Conclusion

Disease identification was performed and leaves were diagnosed for three different diseases–anthracnose, bacterial and leaf spot. Three feature groups were used for the feature extraction process??

1) The GLCM feature extraction proved to be effective for classification of normal leaves and those affected by anthracnose. However, the detection of leaf spot was found to be difficult??
2) The Colour based features gave best classification results against normal leaves, good for anthracnose affected leaves, but very poor for leaf spot affected leaves.??
3) The Gabor filter features gave the best results amongst the three for leaf spot detection.

Thus, it can be concluded that the boundary extraction performed by the Gabor filter identified the small spots in the case of leaf spot more effectively while the other two techniques are responsible for the denser texture analysis as in the case of anthracnose. Finally, best results were achieved on considering all three features sets together, however at the expense of increased computational complexity.

References

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