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A SURVEY PAPER ON PLANT DISEASE DETECTION USING IMAGE PROCESSING

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Abstract— Identification of the plant diseases manually is very difficult. Hence, image processing is used for the detection of plant diseases. Diseases are caused due to fungi, bacteria, viruses and so on. Diseases in plants reduce both quality and quantity of agricultural products. Hence it is important to identify the diseases. This paper gives the overview of methods used for the detection of plant diseases using their leaves images.

Keywords— Image processing, RGB, Image acquisition, Image pre-processing, Image Segmentation, Feature extraction.

I. INTRODUCTION

India is an agricultural country where most of the population depends on agriculture and farmers have large number of ways to select suitable crops. Such crops caused by fungi, bacteria, viruses. Disease management is a challenging task. Large numbers of disease are seen on leafs or stems of plant [3]. The main goal of Research in agriculture is to increase productivity and food quality [4]. Monitoring of health and disease on plant is very important in successful cultivation of crops in the farm. In early days, the monitoring and analysis of plant diseases were done manually. This method is very difficult and time consuming. Hence image processing techniques can be used in the plant disease detection [2]. Image Processing is having good scope in

different application areas. Image processing area is a vast application area that is having the larger scope defined under different applications [1].

II. PLANT DISEASE DETECTION/ CLASSIFICATION MODEL

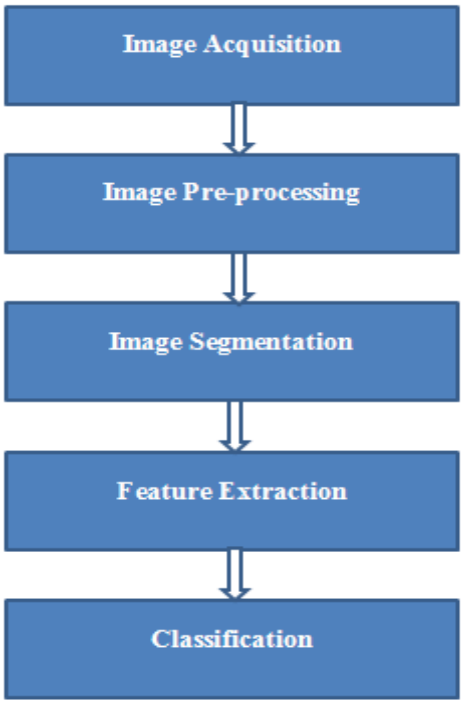


Figure 1: Plant disease detection/ Classification model

The figure 1 shows the Plant disease detection/ Classification model.

A) Image Acquisition

The first step is to accept the plant or the leaf image as input. The image acquisition is very difficult to collect from primary source. Because of this issue, the data obtained from the agricultural organization can be used as the input image [1]. The images of the plant leaf can also be captured through the camera. This image is in RGB (Red, Green and Blue) form. RGB images are difficult to implement. Hence Color transformation structure for the RGB leaf image is created [2]. The image which is taken has input always not satisfactory. Because some noises are present in image hence the image will not clear [3].

B) Image pre-processing

The second step is image pre-processing is to improve the image features. To perform this features extraction there is the requirement to adjust the image features [1]. In image processing step clipping, smoothing, enhancement are the three steps included in pre-processing phase [3]. Image pre-processing is used to remove noise in image or other object removal, hence different pre-processing techniques is considered. Image clipping/cropping of the leaf image to get the interested image region. Smoothing filter is used for image smoothing [2].

Filtering in image processing is used for highlighting specific information. A various techniques are available such as median filter, Gaussian filter, SRAD (speckle Reducing Anisotropic Diffusion) etc. In image processing enhancement refers to accentuation, or sharpening of image features such as boundaries or contrast.

Histogram Equalization, AHE (Adaptive Histogram Equalization), CLAHE (Contrast Limited Histogram Equalization)[5].

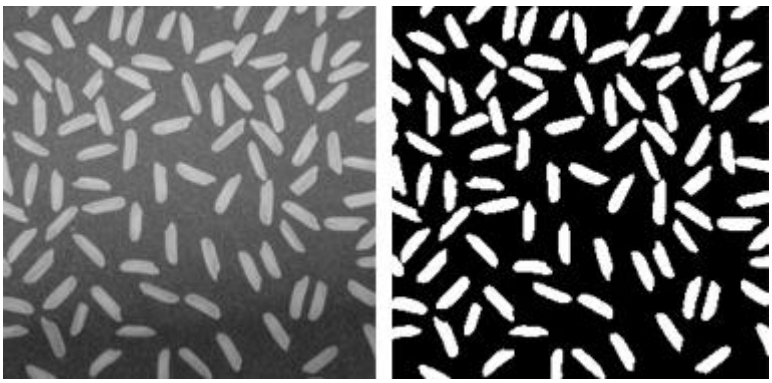
Image is pre-processed to improve the image data that removes noise in image and also used to smoothing the image. The image processing step includes color space conversion, image enhancement, and image segmentation. The RGB images of leaves are converted into color space representation. The main purpose of the color space is to convert the image into specific standard which is acceptable. RGB images converted into Hue Saturation intensity color space representation. Because the RGB image is very difficult to implement. HIS model is an ideal tool for color perception. Hue is a color attribute that describes pure color which is perceived by an observer. The term Saturation refers to relative purity or the amount of white light added to hue and value means amplitude of light [4].

C) Image segmentation

This step is s about how to extract the image feature to explore the specific image attributes. The image segmentation process has different approaches and ways. ROI (Region of Interest) is one of most important approach in image segmentation [1]. Partitioning a digital image into multiple segments is known as image segmentation. The Multilevel thresholding, Edge detection, active contours are typically used to locate objects and boundaries in the image [5]. Image segmentation refers to partitioning of image into various part of same features or having some similarity. Image segmentation can be done using various methods like Otsu' method, k-means clustering, converting RGB image into HIS model etc. [2]

1) Otsu' method

Otsu' method is used to automatically perform clustering-based image thresholding or the reduction of a graylevel image to a binary image. Otsu's algorithm assumes that the image contains two classes of pixels following bi-modal histogram, it then calculates the optimum threshold separating the two classes so that their combined spread is minimal, or equivalently, so that their inter-class variance will be maximal. Consequently, Otsu's method is roughly a one-dimensional [7].

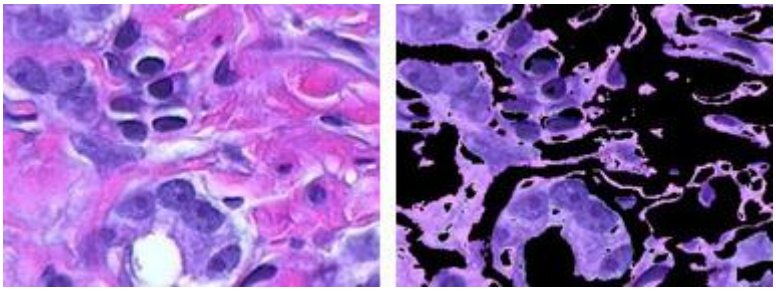


Original image **segmented image**

2) K-means clustering

It is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. *K*-means clustering aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. *K*-means algorithm has a loose relationship to the *k*-nearest neighbor classifier, a popular machine learning technique for

classification that is often confused with *k*-means because of the *k* in the name. One can apply the 1-nearest neighbor classifier on the cluster centers obtained by *k*-means to classify new data into the existing clusters [6].



Original image **segmented image**

Image will be segmented according to the region of interest. Dividing the image into same meaningful region refers to image segmentation [3].

D) Feature extraction

Feature extraction refers to transforming the input data into the set of features [5]. After segmenting the area of interest that is diseased part extracted. The next step is feature extraction; in this step significant features are extracted. The features extracted can be used to determine the meaning of a given sample. Actually, image features usually includes color, shape and texture features. The texture is a most important feature. [4]

The features extraction is the input data transform into set of features. The feature set will extract the relevant information so should carefully chosen [3]. In this step plays an important role for identification of an object. In many application of image processing feature extraction is used. [2]

E) Classification

This section discussed the various approaches used for classification

1) Artificial neural networks

ANNs are popular machine learning algorithms that are widely used. Multilayer Perception (MLP) is the basic form of ANN which updates the weights through back propagation during the training. There are other variations in neural networks, which are become popular in texture classification [4].

a) Probabilistic Neural Network (PNN):

PNN is derived from Radial Basis Function (RBF) network. PNN has parallel distributed processor that has a natural tendency for storing experiential knowledge. Probabilistic Neural Network is an implementation of a statistical algorithm called kernel discriminate analysis in which the operations are organized into a multilayered feed forward network having four layers such as input layer, pattern layer, summation layer, and output layer [4].

b) Convolutional neural network:

Convolutional neural network is a neural network that has convolution input layers acts as a self-learning feature extractor directly from input images. Hence, Convolutional neural network can perform both feature extraction and classification under the same architecture [4].

c) Back propagation network:

It consists of three parts: input layer, hidden layer and output layer. The largest characteristic of Back propagation network is that network weight value reach expectations through the sum of error squares between

the network output and the sample output, and then it continuously adjusted network structure's weight value. Back propagation is popular and extensively used for training feed forward networks. Also Back propagation has no inherent novelty detection, so it must be trained on known outcomes for training feed forward networks [4].

2) Support vector machine (SVM)

It is one of the most useful learning algorithms that is considered as the alternative to the neural network approach [1]. SVM is a non-linear classifier, and is a newer trend in machine learning algorithm [4]. SVM algorithmic approach is based on distinctive characteristics analysis by analyzing the expected error minimization. SVM approach considered the empirical risk to improve the training procedure. The risk estimation in this method is based on the structural analysis so that the generalization error will be reduced. In this method the error margin is analyzed under class deviation and based on it nearest training patterns are obtained. SVM is effective to analyzing the separating planes and to identify the largest margin so that the support to the data points will be identified. SVM model is also based on the polynomial kernel representation so that the effective learning to the elements will be done and more accuracy will be obtained [1]. SVM is popularly used in many pattern recognition problems including texture classification. Support vector machine is designed to work with only two classes. This is done by maximizing the margin from the hyper plane. The samples which are closest to the margin that were selected to determine the hyper plane is known as support vectors. [4]

III. CONCLUSION

This paper gives the overview of methods used for plant disease detection. This paper discussed the methods used for the detection of plant diseases using image processing. This paper also discussed some classification methods used for plant disease detection.

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