Leaf Disease Detection Using Image Processing

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Abstract – Identification of the disease of leaf is one of the important factor. The studies of leaf disease means the study of observable shades on leaf surface.In the field of agriculture the monitoring the plants and detecting the diseases is basic requirement in current technological world. Plant diseases cannot be monitor easily. It requires large amount of efforts and also more time along with experts in that field. Hence, image processing is used for the detection of leaf diseases. Image acquisition, image pre-processing, image segmentation, feature extraction and classification these are the steps involves in detecting plant disease using their leaves. This paper also discussed some segmentation and feature extraction algorithm used in the plant disease detection using SVM classifier.

Keywords–*Image acquisition; Segmentation; feature extraction.*

I. INTRODUCTION

India is cultivated country and about 75% of population depends on agriculture. Large number of diversity for selecting crops and different pesticides according to various diseases are available for farmers. The quality and quantity of products get affected when plant is suffering from Diseases. The leaf disease can be detected by observing its visual patterns. The projects like monitoring health and disease plays important role in successful cultivation of crops. In ancient times, analysis of plant disease and monitoring was done by expert faculty in that field. this process take lots of effort and longer time to provide results. Now image processing techniques can be used in the plant disease detection. In most of the cases the disease symptoms can be identified by observing change in color, shape and some changes in leaves surface. This paper gives the introduction to image processing technique used for leaf disease detection using SVM classifier.

II. RELATED WORK

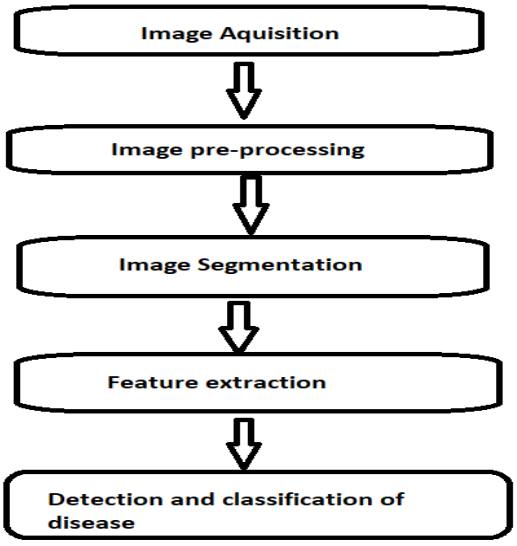
Here various method of image processing for plant disease detection is discussed. For indirect monitoring of plant diseases the vegetation indices have been shown but they cannot 0. Huang et al developed the new spectral indices for recognizing the winter wheat disease. The three different pests considered in this project-Powdery mildew, yellow rust and aphids.The wavelengths of diseases are extracted using RELIEF-F algorithm. The classification accuracies of this project using new indices is 86.5%, 85%, 91.7%, 93% respectively[1].Enhanced images have more quality and clarity compare to original image. Color images have three different colors i.e Red, Blue, Green and their range is from 0 to 255 therefore it is difficult to implement application using color image. Hence they convert the RGB i.e color images into the grey images. Then the histogram equalization which distributes the intensities of the images is applied on the image to enhance the affected images. Monica Jhuria uses image processing for fruit disease detection grading in [3]. They have used ANN for detection of disease. They have created one dataset for training the disease images and second set is for implementing query images.Weight adjustment is one by training databases. They consider three feature vectors that is, colour, textures and morphology [3]. In which They have found that the morphological feature gives better result than the other two features. Zulkifli Bin Husin, in their paper [4], they determined the health status of chilli plant by image processing.Their technique says that the chemicals should apply to the affected chilli plant only. The feature extraction and feature recognition is completed using MATLAB. In this paper pre-processing is done using the Fourier filtering, edge detection and morphological operations. Computer vision extends the image processing for object classification and recognition. Here image captured by digital camera and GUI build by LABVIEW tool in MATLAB. For extracting the feature from image the image segmentation is used. Mrunalini R. Badnakhe, Prashant R. Deshmukh compared the Otsu's threshold algorithm and the k-means clustering algorithm used for infected leaf analysis in [5]. According to them extracted values of the features are less for k-means clustering and clarity of k-means

clustering is more in compare to others. The color image is used for the identification of disease. After applying k-means clustering techniques, the similar pixels is identified and then using otsu's method, varying threshold value. Colour co-occurance method used for feature extraction. color image is converted into the HSI translation. For the texture statistics computation the SGDM matrix and GLCM function the feature is calculated [6].The FPGA and DSP based system is developed by Chunxia Zhang, Xiuqing Wang and Xudong Li, for monitoring and analyzing of plant diseases [7]. Field plant image got by FPGA or video data for diagnosis. The DSP TMS320DM642 is used to process and encode the video or image data. The nRF24L01 single chip 2.4 GHz radio
transmitter is used for data transfer. It has two
methods data compress and transmission method to provide user's different need and
uses multi-channel wireless communication to lower the cost of system. Shantanu Phadikar and Jaya Sil done identification of rice disease using pattern recognition techniques [9]. This paper describes a software prototype for rice disease detection based on input image of rice plant. The HIS model is used for segmentation of image after getting interested region, then the boundary and spot detection is done to identify infected part of the leaf.

III. ALGORITHM FOR DISEASE DETECTION

In this section, the algorithm for plant disease detection and classification using image processing are shown (Fig. 1)).

Fig 1. Algorithm for plant disease classification and detection



A. A] Image Acquisition

The images captured by camera are colored images. The transformation structure of color image (RGB image) is created and then an independent color space transformation for color transformation structure is applied[6].

B. B] Image Pre-processing

The image pre-processing is done to remove noise in image and to remove unnecessary objects. Cropping required part of image is done by Image clipping. Image smoothing is done using the smoothing filter and Image enhancement is carried out for increasing the contrast.the colored images into the grey images using colour conversion using equation (1).f(x)=0.2989*R + 0.5870*G + 0.114.*B - - - - - - - - - - - - (1)

Then histogram equalization technique used to distributes the intensities of the images is applied on the image to enhance the leaf disease images. Distribution intensity values is done by commulative distribution function. [2].

C. Image Segmentation

Segmentation means partition of image with similar value pixels are in same cluster.Various methods like otsu' method, k-means clustering,converting RGB into HIS model are used for segmentation.

1) *Segmentation using Boundary and spot detection algorithm*: The Color image is converted into the HIS model for segmenting.

Infected part can be find by boundary detection and spot detection as discussed in [9]. Boundary is detected using the 8 connectivity of pixels and boundry detection algorithm is applied[9].

2) *K-means clustering*:

The K-means clustering is used for classification of object having similar features into K number of clusters. Classification of objects in image 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:

a) Pick center of K cluster, randomly or based on some heuristic.
b) 2. Assign all the pixels in the image to the cluster that minimizes the distance between the pixel and the center of cluster.
c) 3. Again compute the cluster centers by taking mean of all of the pixels in the cluster. Repeat steps 2 and 3 until required result is obtained.

3] Otsu Threshold Algorithm:

Thresholding is used to binarize the grey scale image.The image below certain threshold value is set to zero and all pixels above threshold is set to one. The otsu algorithm is define in[5]. is as follows:

- According to the threshold, partition of pixels into two clusters.
- Then find the average of each cluster.
- Square the difference between the average values.
- Multiply the number of pixels in one region times the number in the other. The infected leaf shows the symptoms of the disease by changing the color of the affected area on leaf surface. Hence the green color of the leaves can be used for the detection of the infected portion of the leaf. The R, G and B component are

extracted from the input image. Otsu's method is used to find threshold. Then the Green color pixels are removed if their intensities less than computed threshold.

D. Feature Extraction

For object identification feature extraction plays important role. Feature extraction is used in many applications of image proccessing. Color, texture, morphology, edges etc. are the features which can be used in leaf disease detection.In paper [3], Monica jhuria et al considers color, texture and morphology as a feature for disease detection. They have concluded that morphological result gives better result than other features. Texture define the way to distribute color in image according to roughness, hardness of image. It can also be used for the detection of infected plant areas.

1) Color co-occurrence Method :

In this method unique feature of image is calculated by both color and texture. For that the RGB i.e color image is converted into the HSI translation.

$$H = \begin{cases} \theta & \text{if } B \le G \\ 360 - \theta & \text{if } B > G \end{cases} \qquad (6.2.2)$$

with

$$\theta = \cos^{-1}\left\{\frac{\frac{1}{2}[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{1/2}}\right\}.$$

The saturation component is given by

$$S = 1 - \frac{3}{(R+G+B)}[\min(R,G,B)]. \qquad (6.2.3)$$

Finally, the intensity component is given by

$$I = \frac{1}{3}(R+G+B). \qquad (6.2.4)$$

For the texture statistics computation the SGDM is generated and using GLCM function the feature is calculated.

2) Leaf color extraction using H and B components: To preserve the information of affected pixels input image is enhanced by using anisotropic diffusion technique [8]. Grape leaf and non-grape leaf part separated by H and B component from HIS and LAB color space.A SOFM with back propagation neural network is implemented to identify colors of disease leaf.

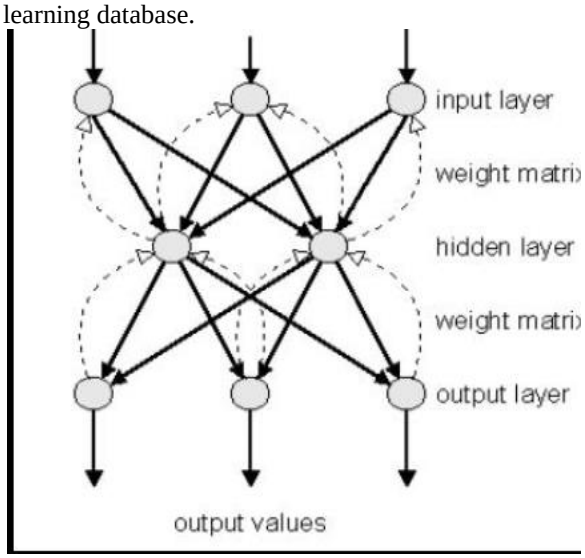
E. Classification

1) Using ANN:

After feature extraction , the learning database images are classified by using neural network. These feature vectors in ANN are considered as neurons [3]. The output of the neuron is the function of weighted sum of the inputs. The back propagation algorithm, modified SOM; Multiclass Support vector machines can be used.

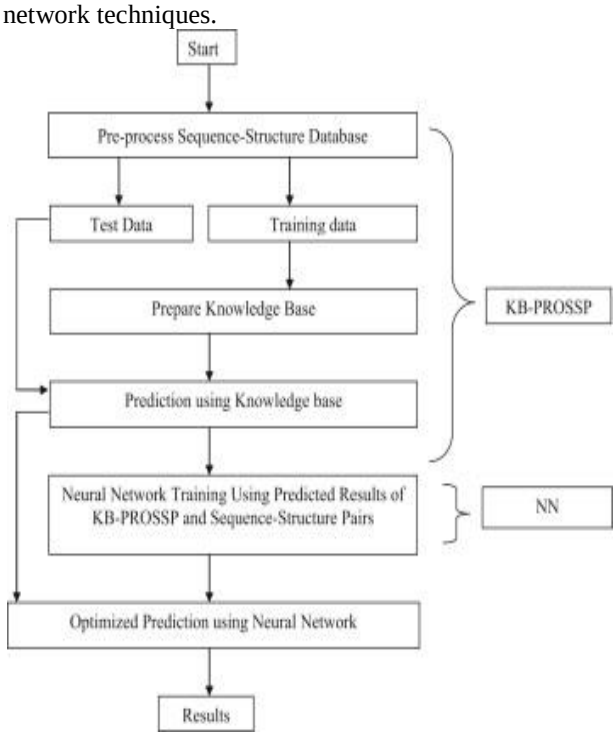
2) Back propagation:

Back propagation neural network algorithm is used in a recurrent network. Once it is trained, the neural network weights are fixed and can be used for computation output values for query images which are not present in the learning database.



Testing of query images

After the step of getting the weight of learning database, the testing of query image is done. The below fig. shows the flowchart for the testing of query image using the neural network techniques.



IV. CONCLUSION

The accurately detection and classification of the leaf 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 infected part of the leaf. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plants according to their diseases. The use of ANN methods for

classification of disease in plants such as self-organizing feature map, back propagation algorithm, support standard vector machine etc. can be efficiently used. From these methods, we can more accurately and precisely identify and classify various plant diseases using image processing techniques.

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