A Servey on Image Processing Techniques for Plant Leaf Disease Detection

Mrs. Rane Seema Vijay

Department of Computer Science, Smt.G.G.Khadse College, Muktainagar, Dist.: Jalgaon Maharashtra, India

ABSTRACT

In this survey we are trying to get the details of cotton crop and its diseases which effects the quality of products. Now a day's detection of plant disease has caught a great attention while monitoring large fields. This paper present a survey on different classification techniques one can used for plant leaf disease classification. There are so many classification techniques such as Neural network, Genetic Algorithm, SVM, Principal Component Analysis etc. but selection of any of the classification method is always a difficult task as it affect the quality of result for different input data. This paper present a overview of different classification techniques used for plant leaf disease classification.

Keywords : *Neural Network, SVM, Genetic Algorithm, Classification techniques*

1. INTRODUCTION

India is an agricultural country. In many region of central India cotton is the most important cash crop grown on an area of near about 13.00 lakhs hectors. Disease on cotton crop is the main problem as it decrease the productivity of the cotton crop. About 80 to 90% of disease on this crop is on its leaves. Most of the disease on this plant is caused by Fungi, Bacteria, Virus.

1.1 The Image analysis in agriculture

The Image analysis techniques are extensively applied to agricultural science, and it has great use especially in the plant protection field. Image analysis can be applied for the following purposes:

1. To detect diseased leaf, stem, fruit
2. To quantify affected area by disease.
3. To find the boundaries of the affected area.
4. To determine the color of the affected area
5. To determine size & shape of fruits.
6. To identify the Object correctly. [1]

1.2 Cotton Crop leaf diseases

The diseases on the cotton leaves are classified as

a) Bacterial disease: e.g. Bacterial Blight, Crown Gall, Lint Degradation.
b) Fungal diseases: e.g. Anthracnose, Leaf Spot.
c) Viral disease: e.g. Leaf Curl, Leaf Crumple, Leaf Roll.
d) Diseases Due To insects: e.g. White flies, Leaf insects.

The above mention disease dramatically affect the leaf of cotton plant and its leaves. Various diseases are found on the cotton plant out of this we discuss the disease some of the major diseases which are often found on the leaves of cotton, they are:

1.2.1 Foliar leaf spot on cotton

As shown in below figures the, the disease is known as foliar disease arises due to potassium deficiency [2]. The early stage of this disease is as shown in figure 1, now if the more spots of this disease results into the final stage of this plant where the plant leaf is get fall so it is called as Foliar disease of the cotton plant as shown in figure 2. The leaf is having multiple no of spots which clearly denotes more potassium deficiency in the plant**.**

Figure 1

Figure 2

1.2.2 Curl Gemini virus

Figure 3

Figure 4

Figure 5

Cotton leaf curl Gemini virus (CLCuV) causes a major disease of cotton in Asia and Africa [2]. Leaves of infected cotton curl upward Figure 3. and bear leaf-like enations on the underside along with vein thickening Figure 4. Plants infected early in the season are stunted and yield is reduced drastically. Severe epidemics of CLCuV have occurred in Pakistan in the past few years. Another cotton Gemini virus, cotton leaf crumple virus (CLCrV), occurs in Arizona, California, and Mexico. CLCrV symptoms are distinguishable from CLCuV symptoms in that infected leaves curl downward accompanied by interveinal hypertrophy and foliar mosaic Figure 5.

1.2.3 Bacterial Blight

Xanthomonas campestis pv. Malvacearum Bacterial blight starts out as angular leaf spot with a red to brown border [2]. The angular appearance is due to restriction of the lesion by fine veins of the cotton leaf. Spots on infected leaves may spread along the major leaf veins as disease progresses, leaf petioles as shown in Figure 6. The angular leaf spot, results in premature defoliation and stems may become infected resulting in premature defoliation.

Figure 8

Figure 6

Figure 7

1.2.4 Cerco Spora-leaf Spot Cerco Spora

The disease affects older leaves of mature plants. The spots are round or irregular in shape yellowish brown, with purple, dark brown or blackish borders and white centers affected leaves become pale in colour and finally fall off [2] as shown in Figure 7.

1.2.5. *Alternaria Leaf Spot-alternaria Macro Spora*

As shown in Figure 8, small, pale to brown, round or irregular spots measuring 0.5 - 3 mm in diameter and cracked centers appears on the affected leaves of the plant. Affected leaves become dry and fall off [2]. The disease may cause cankers on the stem. The infection spreads to the bolls and finally falls off.

2. LITERATURE SURVEY

P.Revathi & M.Hemalatha in the paper title "Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques" in this paper concentrate on the plant leaf disease detection based on the texture of the leaf. Homogenize techniques like sobel and canny filter has been used to identify the edges. These extracted edge features have been used in classification to identify the disease spots. The proposed homogeneous pixel counting technique for cotton diseases detection (HPCCDD) algorithm has been used for categorizing the diseases. They claim the accuracy of 98.1% over existing algorithm. [1]

In a paper of title "Detection of diseases on cotton leaves and its possible diagnosis" present the colour image segmentation feature extraction technique to extract the colour feature of the cotton leaves. This technique provides easy way to extract the various features of diseased leaf of cotton image. After that the unsupervised SOFM network is used to obtained group of colour in the image and then back propogation neural network are applied for clustered the resulting colour pixels and extract cotton leaf colour from diseased part of image respectively [2].

P.R. Rothe *et al.,*[3] in the paper title "SVM-based Classifier System for Recognition of Cotton Leaf Diseases" thresholding is used to for segmentation, a natural way to separate light and dark region and feature extraction is done by color feature extraction creating spots in three classical planes red, green and blue of the segmented image and shape based feature extraction computes the area, sharpness, perimeter, eigen values and aspect ratio to detect the disease. And finally SVM classifier is used for classification. The two class problem is then extended to multiclass problem where the detected leaf diseases are then classified into various categories.

In the paper "Leaves Recognition Using Back Propagation Neural Network-Advice For Pest and Disease Control On Crops", Prasad Babu & Srinivasa Rao proposed Back propagation neural network for recognition of leaves. In this paper, the methods used are first the edge of image is detected by Prewitt edge detection algorithm and then applying Thinning algorithm to find the token values. Then applying a back propagation neural network for recognition of leaves and shape of leaf image is enough to pest and disease control on crops. [4].

Anand.H.Kulkarni & Ashwin Patil R. K.in the paper title "Applying image processing technique to detect plant diseases" proposed a method for plant disease recognition. In their work they used a Gabor filter for feature extraction and ANN classifier for the classification of image. With this method they got a better results and recognition rate upto 91%. The in this research, the ANN classifier adopted uses the combination of color and texture features to recognize and classify plant disease.[5]

In this paper "Crop Disease Detection Using CBIR" the application of texture statistics for detecting the plant leaf disease is explained Firstly by color transformation structure RGB is converted into HSV space because HSV is a good color descriptor. Masking and removing of green pixels with pre-computed threshold level. After that segmentation is performed using 32X32 patch size and obtained useful segments. These segments are used for texture analysis by color co-occurance matrix. Finally if texture parameters are compared to texture parameters of normal leaf and evaluated using Co-occurrence matrix. [6]

Kamljot Singh Kailey and Gurjinder Singh Sahdra in paper title "Content based image retrieval (CBIR) for identifying image based plant disease" gives a method for identify plant disease based on color, edge detection and histogram matching. This research is divided is into two main phase. In the first phase all the healthy and diseases leaves are taken as input to the MATLAB for finding the infected image of disease. Then layers of RGB image into Red, Green and Blue layers and then apply CANNY"s edge detection technique to detect the edges of layered images. After that histogram is plot for both samples of healthy and disease leaf image and then immediately applied the comparison technique based on histogram and edge detection technique. In the second phase same process is repeated for testing leaf and compared all the stored result and identifies result [7].

"Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features" [8] in this paper four main steps are used for detection of plant leaf disease.in the first step a color transformation structure for the input RGB image is created, and then the green pixels are masked and removed using specific threshold value then the infected region is then followed by segmentation process, computing the texture features using color co-occurrence method for the useful segments, finally the extracted feature are passed through the classifier. Support vector machines are a set of related supervised learning method used for classification and regression. The detection accuracy is improved by SVM classifier. By this method, the plant diseases can be identified at initial stage itself and the pest control tools can be used to solve pest problems while minimizing risks to people and the environment.

"Investigation and monitoring for leaves disease detection and evaluation using image processing" is proposed in [9]. In this, the developed system identifies leaves disease of plants and also determines the stage in which the disease is. The system has various image processing techniques. The images are captured and processed for enhancement. Then image segmentation is carried out to get disease regions. Later, image features such as shape, color and texture are extracted for the disease regions. The feature extraction process used colour co-occurrence methodology (CCM method). It is a method, in which both the colour and texture of an image are taken into account, to arrive at unique features, which represent that image. These resultant features are given as input to disease classifier to appropriately identify and grade the diseases. the SAS classifier, the test data sets were used to analyze the performance of accurate classification.

[10] In this paper the image filtering using median filter is done first and then the conversion of RGB image to CIELAB color component is carried out, in second step image segmented using k-medoids clustering methods. K-medoids clustering is partitioning based clustering method. K-medoids or PAM (Partition around medoids): Every cluster is represented by one of the objects in the cluster.que, and then masking green-pixels & removal of masked green pixels is done , after that Texture features Statistics is calculated, and in the last step this features passed in neural network. The Neural Network classification performs well and could successfully detect and classify the tested disease.

In the paper "Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clustering" [11] proposed a methodology in which first the image preprocessing is done by clipping, smoothing and enhancement in which first image is collected and then filter is used to smoothing of an image,after that image enhancement process is carried out to bring out details that are hidden in an image, or to increase the contrast in a low contrast image.next step in this work is segmentation which was done by the two techniques: Otsu Threshold and K-means clustering. Finally the feature extractis carried out for both the segmentation method and compared give the conclusion that the edge, background, Foreground background ratio, foreground Background Difference extracted for Otsu threshold are more than the same extracted value for k-means clustering. As the above extracted values are less for k-means clustering the clarity of the clusters are more and so the k-means technique is more accurate than other method.

[12] In this paper " Leaf Image Segmentation Based On the Combination of Wavelet Transform and K Means Clustering" Discrete Wavelet Transform (DWT) is applied to plant leaf images because wavelets provide frequency information as well as time-space localization. And then the Denoise the decomposed leaf image using average filter and then the processed image is then thresholded using global image threshold with Otsu's method when a black and white image is obtained. Finally the k-means clustering algorithms is applied, both supervised and unsupervised clustering techniques are used in image segmentation. The performance of the segmentation is analyzed by Jaccard, dice, variation of index and global consistency error method.

[13] In the paper , "Cotton Pests and Diseases Detection based on Image Processing" by] Qinghai He et.al. proposed a method which measures the damage ratio of the cotton leaf caused by the diseases or pests based on machine vision and image processing. The first process in the work is to image enhancement id carried out with the Histogram Equalization Process to increase the contrast of the image, strengthen the edges of background image. Then the process of filtering was used to eliminate the influence of noise. The Filtering general include spatial filtering and frequency domain filtering, the experiment shows better results after spatial linear filtering. Then the image extraction is is carried out and compared using three color models: RGB, HSI, YCbCr which shows good accuracy in extracting the damaged image form the cotton image in three different color model and concluded that the comparison shows that Ycbcr color model is the best color model for extracting.

3. BASIC METHODOLOGY

The methodology used in all the above research is carried out in the following steps which is generally used for classification various kind of plant disease:[3]

Image Acquisition
Image Processing
Image Segmentation
Feature Extraction
Statistical Analysis
Classification

4. CONCLUSION

According to the above study Digital Image Analysis has proven to be a very good approach in the identification of any of the plant disease. The major techniques for detection of plant diseases are: SVM, K-means clustering, CBIR, and SGDM. These techniques are used to analyses the healthy and diseased plants leaves. From the above study of classification techniques the k-nearest-neighbor method is perhaps the simplest of all algorithms. This review suggests that all this disease detection technique shows a good potential with an ability to detect a plant leaf diseases. Therefore, there is scope of improvement in the existing research. The extension of this work will provide emphasis on developing algorithms and NN's in order to increase the recognition rate of classification process.

5. REFERENCES

[1] P.Revathi, M.Hemalatha," Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques, 2012 - International Conference on Emerging Trends in Science, Engineering and Technology.

[2] Mr. V. A. Gulhane & Dr. A. A. Gurjar, "Detection of Diseases on Cotton Leaves and Its Possible Diagnosis", International Journal of Image Processing (IJIP), Volume (5) : Issue (5) : 2011 , 590-598.

[3] P.R. Rothe and Dr. R. V. Kshirsagar, "SVM-based Classifier System for Recognition of Cotton Leaf Diseases", International Journal of Emerging Technologies in Computational and Applied Sciences, 7(4), December 2013-February 2014, pp. 427-432.

[4] M. S. Prasad Babu and B. Srinivasa Rao "Leaves Recognition Using Back Propagation Neural Network-Advice For Pest and Disease Control On Crops," *IndiaKisan.Net: Expert Advisory System*, 2007.

[5] Anand.H.Kulkarni, Ashwin Patil R. K., "Applying image processing technique to detect plant diseases", International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.5, Sep-Oct. 2012 pp-3661-3664 ISSN: 2249-6645.

[6] Mr. Nitin P. Kumbhar, Prof. Sanjay B. Dhaygude, " Crop Disease Detection Using CBIR", International Journal of Emerging Technologies in Computational and Applied Sciences (IJETCAS), 3(2), Dec.12-Feb.13, pp. 113-118.

[7] Kamljot Singh Kailey and Gurjinder Singh Sahdra "Content based image retrival (CBIR) for identifying image based plant disease*," IJCTA,* Vol 3(3), 1099-1104, May–June 2012.

[8] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features", CIGR, vol. 15(1), pp. 211-217, March 2013.

[9] K. Padmavathi**,** Investigation and monitoring for leaves disease detection and evaluation using image processing, International Research Journal of Engineering Science, Technology and innovation (IRJESTI) Vol. 1(3) pp. 66-70, June 2012.

[10] Arti N. Rathod, Bhavesh A. Tanawala, Vatsal H. Shah, " LEAF DISEASE DETECTION USING IMAGE PROCESSING AND NEURAL NETWORK", *International Journal of Advance Engineer ing and Research Development (IJAERD) Volume 1,Issue 6,June 2014, e-ISSN: 2348 - 4470 , print-ISSN:2348-6406, pp- 1-10.*

[11] Mrunalini R. Badnakhe, Prashant R. Deshmukh, "Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clustering", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 3, March 2012,pp 449-452.

[12] N.Valliammal, Dr.S.N.Geethalakshmi, " Leaf Image Segmentation Based On the Combination of Wavelet Transform and K Means Clustering, *(IJARAI) International Journal of Advanced Research in Artificial Intelligence, Vol. 1, No. 3, 2012, pp37-43.*

[13] Qinghai He, Benxue Ma, Duanyang Qu, Qiang Zhang,Xinmin Hou,Jing Zhao, " Cotton Pests and Diseases Detection based on Image Processing", TELKOMNIKA, Vol. 11, No. 6, June 2013, pp. 3445 - 3450, e-ISSN: 2087-278X.