A Survey on Diseases Detection and Classification of Cotton Leaf

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Abstract: Agriculture is one of the demanded field of the country like India and also number of research is going on in agriculture among that found still limitation. Identification of plant disease is very difficult in agriculture field. If identification is incorrect then there is a huge loss on the production of crop and economical value of market. In this paper we survey of cotton leaf diseases detection and classification methods. First step to acquire the cotton leaf by using common digital camera. Second step apply the Image processing technique to remove noise and background of the leaf. Next extract the color, shape, and texture features of the leaf. At the end Apply these features to the classifier to classification of the diseases using Machine learning technique.

Index Terms - Image processing, Leaf diseases, image segmentation, Machine learning.

I. INTRODUCTION

Cotton is a most important crop and use in clothing application. After china India is the second rank cotton producing country in the word. In India more then12 state producing cotton but Gujarat is the most producer of the cotton in the India. Gujarat produce cotton 125 lakh bales in 2014-2015. There are many research area in the agriculture field such as leaf, root, and fruit etc. In this paper I am going to research cotton leaf Diseases throw these diseases farmer face lots of reduction of the cotton production. There are many type of leaf diseases in the cotton Bacterial blight, Alternaria, leaf curl, powdery mildew, and Gray mildew.

In order to identify the leaf diseases image processing and different machine learning technique used. The general step of leaf diseases detection is Image acquisition, image preprocessing, image segmentation, feature detection and classification of the diseases. The color conversion and filtration of the acquisition image is done in image pre-processing step. There are many image segmentation method is given in the literature paper such as Morphologic operator , OTSU's segmentation , Ring projection based segmentation and GLCM method . After segment image in the digital image extract the features of the images. Features play an important role in the diseases detection. There are three main features of the image color, shape, and texture. After extracting the feature apply these features to the Machine learning technique to classify the diseases. In literature paper use different machine learning technique such as Support vector machine (SVM), Homogeneous pixel counting for cotton diseases detection (HPCCDD). Probabilistic neural network (PNN), and Adaptive neuro-fuzzy etc. As we know the features play important role for diseases detection. In the literature paper there is some limitation for classification of the diseases such as less acquire and less number of image in the database [1][2][3][4][5].

This paper divided in five section. In section II describe the type of cotton leaf diseases. In section III, General Method of classification of the diseases. In section IV Literature Review . In section V Proposed system. In section VI conclusion and future work.

II. COTTON LEAF DISEASES

There are various type of cotton leaf diseases such as bacterial blight, leaf curl, alternaria leaf diseases, myrothecium, powdery mildew etc.

A. Bacterial Blight:-

The disease appears on different parts of cotton plant, both at seedling and mature plant stages. The disease first appears on the leaves in form of water soaked region, then turns into black and gets dried up. In some cotton plants, water soaked region gets enlarged into angular reddish spots of about 1 mm in diameter.

Figure 1 Bacterial blight

B. Leaf curl:-

Initially swelling and darkening of leaf veins occur, it is followed by cupping of immature leaves and curling of leaf margins as shown in Figure 4. In some cases the growth extending from the veins on the lower side of the leaf can also occur to have the appearance of cup-shaped structure[1]

Figure 2 Leaf curl

C. Alternaria Leaf Diseases:-

It appears in the form of circular spot of size 1-10mm in size and having color which can vary from circular brown, grey-brown to tan color refer as Figure 2. Irregular dead areas may develop as a result of union of older spots. Mature spots have dead centers which crack and fall out. The disease is more prominent on lower leaves of the plants as compare to the upper part leaves.[1]

Figure 3 Alternaria leaf disease

D. Myrothecium:-

Myrothecium leaf spot caused by *Myrothecium roridum* Tode ex Fr. The symptoms consists of lesions with concentric necrotic rings, with salient structures (sporodochia) irregularly dispensed. Symptoms of Myrothecium spots appear anywhere on leaves. These spots in the beginning appear water-soaked and are dark brown to black in color as shown in Figure 5.

Irregularly shaped black sporodochia can form with a white fringe of mycelium. These spore structures appear in concentric rings within the necrotic areas on the lower surface of the leaf.

Figure 4 Myrothecium diseases

E. Powdery Mildew:-

Powdery mildew is one of the easier plant diseases to identify, as its symptoms are quite distinctive. Infected plants display white powdery spots on the leaves and stems. The lower leaves are the most affected, but the mildew can appear on any above-ground part of the plant. As the disease progresses, the spots get larger and denser as large numbers of asexual spores are formed, and the mildew may spread up and down the length of the plant. Powdery mildew grows well in environments with high humidity and moderate temperatures.

Figure 5 Powdery mildew

III. GENERAL APPROACH FOR CLASSIFICATION OF LEAF DISEASES

Generally the classification of the leaf disease categorise in the five step.

1) Image acquisition
2) Image pre – processing
3) Image segmentation
4) Features extraction
5) Classification diseases

Image acquisition : To acquire the cotton plant leaf is called acquisition . There are different source to capture the image from the plant leaf such as common digital camera , mobile phone etc.

Image pre-processing : There are various type of noise present in the image acquisition time such as Gaussian noise and paper salt noise etc. To Improve the quality of the image pre-processing used. In the Image pre-processing mean and median filter use.

Image Segmentation : Image segmentation use to categories the image in various segment.

1. Identified the object from the leaf
2. Find similar pixel
3. Find boundary between the region
4. Remove unwanted region

There are various segment technique use in the literature paper such as OTSU's segmentation, canny , sobel edge detection, morphologic operator, Gray level co-occurrence Matrix (GLCM)[4] etc.

Features Extraction : There are main three type of disease present in the leaf such as color, shape, and texture. In the proposed work we use color , shape , and texture features.

Classification Method : After extracting the features of the image apply these features to the machine learning technique. In the proposed wok different machine learning such as Support vector machine (SVM)[4], Probabilistic neural network (PNN)[2] , Homogeneous pixel counting for cotton leaf diseases detection (HPCCDD) and Adaptive Neuro fuzzy.

IV. LITERATURE REVIEW

Earlier paper describe the detection of the classification of the cotton leaf diseases. [1] This paper classified cotton leaf disease using back propagation neural network where training is perform by extracting seven invariant moment for three type of disease. [2] This paper extract the features of the leaf by using ring projection method. And disease classified using PNN method. But it use less number of image database. [3] In this paper edge detection base image segmentation is done. finally use HPCCDD algorithm to classified diseases. [4] This paper use GLCM method to extract the features and support vector machine (SVM) for classification of the leaf disease. [5] This paper use PCA/KNN classification method to classified the Diseases based on the frequency of the pixel. The comparison of all the literature paper is given in the table1.

Author	Number of Image Dataset	Type of Diseases	Segmentation Technique	Features	Accuracy	Classification type	Number of features
P. R. Rothe, R. V. Kshirsagar	Not Specified	1. Bacterial Blight 2. Myrothecium 3. Alterneria	Active Contour Model	Hu's Moment	85%	Adaptive Neuro – fazzy	1
Priyanka Soni, Rekha Chahar	20	Not Specified	histogram equalization	Color, Contrast and Intensity	92%	PNN (Probablistic Neural Network)	3
P.Revathi, M.Hemalatha	Not Specified	Foliar Fungal Diseases 1. Fusarium wilt 2. Verticillium wilt 3. Leaf blight	Edge detection using Homogenous operator techniques	Edge Detect	98%	HPCCDD(Homogeneous Pixel Counting For Cotton Disease Detection)	Not Specified
Supriya S. Patki, Dr. G. S. Sable	103	1. Red spot disease 2. White spot disease 3. Crumple leaf disease 4. Healthy disease	Otsu's Segmentation	Colour and Texture	87.5%	SVM(Support Vector Mahine)	Not Specified
Adhao Asmita Sarangdhar, Prof. Dr. V. R. Pawar	623	1. Bacterial Blight 2. Alternaria 3. Aray Mildew 4. Cereospra 5. Fusarium wilt	Thresholding Technique	Colour and Texture	83.26%	SVM(Support Vector Mahine)	8

Table 1 Comparison of all the literature paper

V. PROPOSED WORK

The proposed diagram of this survey paper is given in figure1. The proposed work divided in five section such as Image acquisition , image preprocessing, image segmentation, features extraction and classification.

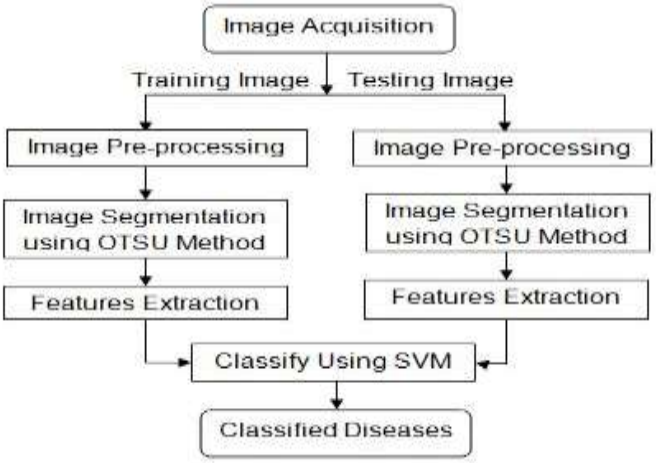

Figure 6 Proposed diagram

Image Acquisition : In image acquisition we capture the cotton leaf image from common digital camera with white background.
Image pre-processing : While capture the image various type of noise present in the image such as shadow , light reflection, and camera problem. To remove these noise mean and median filter use.
Image segmentation: The main purpose of image segmentation to manage image into something that is more meaningful and easier to analyze. In this we use OTSU's segmentation method.
Feature extraction: Features extraction play a important role in image disease classification. In the proposed work we extract color, shape and texture features.
Color Feature detection: In the color feature total 9 features detected from the segmented images. These 9 features are maximum of each RGB. max(R), max(G), max(B). And other 6 color features detected by the two features vector that is mean and standard deviation.Mean(R), mean(G), mean(B), andstd2(R), std2(G), std2(B). The mean and standard deviations are define as the
Mean:

$$\mu_i = \frac{1}{N}\sum_{j=1}^{N} f_{ij}$$

Standard deviations:

$$\sigma_r = \sqrt{\frac{1}{N}\sum_{j=1}^{N}(f_{ij-\mu_i})^2}$$

Shape Features : The shape features is determine using the *regionprops* MATLAB function. Total number of eleven features detected using *regionprops* function. These features are area, Euler number, orientation, extent, perimeter, convex area, filled area, eccentricity, equidiameter, major axis length, min axis length.
Texture features: Using the normalization matrix total four feature detected. That is correlation, contrast, energy, homogeneity. These texture feature detected by the following equation .
If total number of pixel pair is :

$$p(i,j) = \frac{p(i,j)}{n}$$

Correlation:

$$\sum_{i=1}^{K}\ \sum_{j=1}^{K}\ \frac{(1-m_r)(j-m_c)p_{ij}}{\sigma_c\sigma_r}$$

Where m_r - mean value of row
m_c - mean value of Column
σ_r - standard deviation of row
σ_c - standard deviation of column

Contrast:

$$\sum_{i=1}^{K}\ \sum_{j=1}^{K}\ (i-j)^2 p_{ij}$$

Energy:

$$\sum_{i=1}^{K}\ \sum_{j=1}^{K}\ [p(i,j)]^2$$

Homogeneity:

$$\sum_{i=1}^{K}\ \sum_{j=1}^{K}\ \frac{p_{ij}}{1+|i-j|}$$

After extracting all these features the classification tree use to classified the different category of the tomato disease [7].

Classification of the cotton leaf diseases: From the literature paper we found that support vector machine (SVM) is the better classification method to classified the leaf diseases.

VI. CONCLUSION & FUTURE WORK

Throw this survey paper we conclude that the features of the leaf play important role in classification of the diseases. So in the proposed work we capture image in white background and we extract total 24 color, shape, and texture features. In this we use OTSU's segmentation to assign a label to every pixel in image. Throw these survey paper we found that SVM is better for leaf diseases classification. There are five step in my proposed work out of these four step have been implemented and to manage dataset and diseases classification will implement In future work.

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