To Detect and Identify Cotton leaf disease based on pattern recognition technique

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ABSTRACT

Cotton leaf diseases on cotton plant must be iden-tified early and accurately as it can prove detrimental to the yield. The proposed work presents a pattern recognition system for identification and classification of three cotton leaf diseases i.e. Bacterial Blight, Myrothecium and Alternaria. The images required for this work are captured from the fields at Central Institute of Cotton Research Nagpur,Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola and the cotton fields in Buldana and Wardha district. Active contour model is used for image segmentation and Hus moments are extracted as features for the training of adaptive neuro-fuzzy inference system. The classification accuracy is found to be 85 percent. Cotton is very important crop in our country and if some disease will affected on that crop the total economy of the farmer as well as country will get collapse. Normally in my country if disease will get detected by the farmer he will contact to the Experienced person and get solution for the same but if the detection and identification of disease not correct will badly affecting on the plant. In second case farmer will contact to the owner of pesticide shop the person will suggest some wrong treatment with respect to his experience. In third case is that farmers are just going with nature they thing is that the disease will get cleared automatically in some period of span. The main motivation of this topic is to identify the type of disease and quantify the damage of crop thereby providing the treatment for the respective disease to the farmer. This identification and detection of disease is possible by using image processing techniques on the different parts of cotton crop. This paper will give information about the possible disease on cotton plants as well as possible treatment should provide to the farmer and what exact treatment for the disease.

Keyword : - *Cotton leaf diseases, Active contour model, spatial moment, Central moments, Snake segmentation, clustering, classification, back propagation*

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1. INTRODUCTION

Cotton is one of the most important fiber crops in entire world to provide basic raw material for cotton textile industry. Cotton crop faces many problems due to diseases which affects it a lot and it is not possible to identify it by naked eyes of human. The largely affected part for the disease is leaf of the plant. About 80 to 90 percent of disease on the plant is on its leaves. Fig. 1 shows some examples of diseased and non-diseased cotton leafs. So our study of interest is leaf of the crop rather than whole cotton crop,

1.1 COTTON LEAF DISEASES

The spots on the leaf are considered as main entity rep-resenting the presence of disease and believed as marker of

Fig. 1. Red Spot Disease

crop disease [6].The underneath of each leaf of the cotton plant contains a small cup like structure called holding nectar. These deposits and the moist stem make the plant attractive to a variety of pests and insects. The various cotton leaf diseases and their symptoms are discussed as follows

1.1.1 Red Spot Disease (Lalya): It is a major and potentially destructive bacterial disease caused by a bacterium, Xan-thomonas campestrispy malvacearum. It starts as angular spot because of the restriction of the spot by the fine veins of the leaf and having red to brown border around it. Firstly these angular spots appear as water-soaked region and in later stages turn dark brown to black as shown detailed in Figure 1. The disease spot may spread along the major veins of the leaf and in the advanced stages leaf petioles and stems may get infected resulting in early fall off of the leaves and it will badly affecting on the growth of the plant.

1.1.2 White Spot Disease (Pandhari Mashi): It appears in the form of circular spot of size 1 to 15 mm in size and having color which can vary from circular brown wholes, grey-brown to tan color refer as shown in Figure 2. Irregular dead areas may develop as a result of union of older spots on edges. Mature spots have dead centers which crack and fall out normally. The disease is more prominent on lower leaves of the plants as compare to the upper part leaves of leaf.

1.1.3 Crumple Leaf Disease (Kokada): Small soft bodied insects on underside of leaves and/or stems of plant of cotton usually green or yellow in color are found, but may be pink, red or black and little bit brownish depending on species. host are available on plant; if aphid infestation is heavy it may cause leaves to yellow and/or distorted form center, necrotic spots on leaves and/or stunted shoots of cotton leaf called honeydew which encourages the growth of sooty mold on the plants and causes loss of production of cotton form plant.

Fig. 2. White Spot Disease

Fig. 3. Crumple Leaf Disease

2. REVIEW OF LITERATURE

Indian agricultural research, automatic disease detection and identification on crop leaf is essential research topic as it monitors large crop fields and thus automatically detect disease immediately if they are appear on plant leaves. The term disease is normally used for destruction of live plants and loss of economy. To improve agricultural products, automatic disease detection of crop leaves is beneficial to farmer and country. This literature review is used to study different types of crop leaf disease detection techniques. Below are certain papers for the detection and identification of diseases on the crop. By using these papers, the survey is done for the invention of new technique of disease.

[1] The detection of disease on a cotton or any leaf is done in number of steps. Firstly the original True-color image transformation is done into HSV(Hue saturation value) which is a color descriptor structure where hue component is used for further analysis of plant.The green color masking is performed by assigning zero or some background value(near about zero) to the green pixel which is not our part of interest. Therefore segmentation is performed and useful segments are obtained which contains significant amount of information for decision making. Color co-occurrence method is used by computing the important parameters of Spatial Gray-level Dependence Matrices (SGDM) like Contrast, Energy, Local homogeneity and correlation for hue content of the individual pixel of an image.

[2] In pre-processing, true color image is converted to intensity image which having some additional property of the pixel. During thresholding process (guided signal), each pixel is considered as an individual object. If its pixel value is greater than or equals threshold value. The histogram of this thresholded image is obtained and is equalized for respective pixel. Now textural features are extracted using color co-occurrence matrix (CCM) and K-means clustering technique is used for disease detection and conclusion.

[3] The system which is discussed in third paper is divided in three steps: (i) Given Leaf segmentation (ii) Disease seg-mentation of leaf and (iii) Classification of disease with respect to data set. For leaf segmentation, LAB color space is used. This resulted image is clustered using Self-organizing feature which is quite similar to unguided network map (SOFM) and color features are extracted using Error Back Propagation Neural Network (BPNN). This focuses on grapes leafs now grape leaf disease segmentation is performed using modified self-organizing feature map with genetic algorithms for opti-mization and Support Vector Machine(SVM) for classification purpose. Gabor filter is also used to analyze leaf disease color features more efficiently and accurately.

[4] The system is proposed to regularize and extract eigen feature of pixel from cotton leaf image. To extract the eigen feature, scatter matrices are created using 100 sample images are taken. This scatter matrix is developed which is within class type and this matrix is decomposed into various sub-spaces related to various diseases by considering the various variation of pixel value independently. Feature extraction and dimensional reduction occur at the final stage of processing. After comparison of feature, it results in disease identification take place.

[5] The RGB is transformed into other color space that is HSV(Hue saturation value) color space and most green color pixels are identified and detected by applying K-means clustering technique. For masking these green color pixels, Otsus method of thresh-olding is used in this approach. Next, diseased segmented RGB image is converted to HIS format and texture features are cal-culated using Color Co-occurrence Matrix (CCM) technique which gives detailed information about the pixels. Finally, the recognition process is performed for the pixel is extracted features of individual pixel through a retrained neural network.

[6]In this system the methodology is proposed for early and accurate disease detection and identification on plant using diverse image processing techniques and Artificial Neural Network (ANN) that is arfificial intelligence. The work starts with capturing sample images as an input. These RGB images and detection of leaf disease.

[7]In this approach firstly the image is converted from RGB to gray scale, filtered using LPF and guassian filter technique. For segmentation, K-means clustering is applied followed by graph cut energy minimization operation on pixel. In color feature extraction, the segmented RGB image is partitioned into 64 blocks and a single representative color space is calculated by averaging of pixel colors from each block and converted the image from RGB to YCbCr color space with more information about pixels. After that 8X8 DCT is applied to obtain DCT of Y, Cb, Cr and

zigzag scanning is performed to get color layout descriptor of the input image or pixels. By considering the parameters like area, perimeter, sharpness, etc.of the region, the shape features are calculated and identified.

[8]In this approach the image acquisition is done using digital camera and images are enhanced or smoothed with the help of Low Pass Filter and Gaussian filter band pass filter is bypassed here. Active contour model (snakes) is used for image segmentation and seven Hues moments are extracted as features to train the classifier that is neurons . Those hues moments are variable in rotation, scale and object translation of neurons. Finally using this feature pattern vector, the feed-forward back propagation network(EBPTA)training method is used for the classification of plant disease.

[9] The effect of RGB(Red Green Blue)color space to Gray, YCbCr, HSI and CIELAB color space is compared during pre-processing stage to detect the diseased spots on cotton leaf. The converted image is then smoothed using Median filter by removing noise accurately. From this noise free image, the diseased spots are detected and identified by the application of Otsus thresholding method on particular color plane of leaf. In first Method: RGB image is converted to Gray and applied Otsus thresholding on the same image . In Second Method: RGB image is first converted into YCbCr color space model and after filteing otsus threshold method is applied on Cr plane to detect the diseased spots of leaf. In Third step: Here, instead of YCbCr, RGB color space image is converted to HIS Hue and saturation color space, filtered and otsus method of thresholding is applied on H component respectively. In Fourth method: Again same work is performed for CIELAB color space and thresholding is applied on A component of filtered LAB color space respectively. Finally CIELAB color model is used after comparing all methods has been applied.

[10]This focuses on rice plants in this approach the samples of diseased rice leaves are collected and the images are captured in macro mode through Digital camera with high pixel intensity. During pre-processing, captured images are replaced into Hue Intensity Saturation (HIS) model space for segmentation and after increasing brightness and contrast.to preserve the detailed image information. For segmenta-tion, Entropy based bi-level thresholding method is used and boundaries are detected to extract the diseased spots with the help of novel 8-connectivity method. The spot size is defined for the range between 300x300 to 1500x1500 pixels. In post-processing, Self Organizing Map (SOM) neural network method is used for classification of disease on rice plant.

[11]In this proposed system, the work is done on Grapes leaf for the diagnosis and classification of diseases using Neural network. Initially, the grape leaf image with complex background is captured as input and re-sized to standard size 300X300 that is pre-processing of an image. The background is removed using green color pixel masking and the noise is removed with the help of an isotropic diffusion upto 5-6 iterations to preserve the infected part of information. Then, disease segmentation is carried out using K-means clustering and the textural information from diseased part of segmented image is calculated from GLCM matrix for nine features respectively. The extracted features are used by Feed forward BPNN to classify (EBPTA).

In latest approach, a color image is captured by digital camera with great clarity in the laboratory with dark back-ground to avoid the effect of environmental factors,noise effect and then images are transferred to the computer system as an input to the same. The segmentation is done to get the diseased part by setting appropriate threshold value mathematically and edges of image are detected using Sobel method of detection. Next, The extraction of texture-feature for color image is done using CIE and XYZ color space and the extraction of color-feature for color image is done using CIE L*a*b color space with zero noise. The shape feature is also extracted by considering the parameters like area, roundness, shape complexity, etc. of the leaf. Using these features, membership function is calculated individually and defined for each class of disease for disease recognition and lastly it is used in a nearest neighbor classification and respective hyper boxes are formed in classification.

3. SYSTEM ARCHITECTURE / SYSTEM OVERVIEW

The proposed system with respect to the base system the additional features are provided that is after detection of the disease by this intelligent system with high accuracy approach. The EBPTA (Error back propagation Training Algorithm) is used with the remedial solution on the identified disease as we know that back propagation is using feed backward technique. The back propagation learning rule is based on gradient descent approach in the weight space W(Weight matrix) to identify the optimal solution. The change in magnitude and direction is given by equation,

deltaW ij = ((deltaE)=deltaW ij)epsilon (1)

4. SYSTEM ANALYSIS

As we know that noise is present in some images hence to remove the noise present in the image the low pass filter is used. As the edge which corresponds to high frequency is to be retained the information Gaussian filter is used. It does not have sharp cut into instead it has elegant and natural stop band response which allows adequate higher frequency components and thus exhibits small time-bandwidth product. It perform averaging of the current pixel with the neighboring pixel values as every pixel is having some characteristics. Their effect is observed as blurring of the image also on contrast. The prior knowledge of disease symptoms can be easily incorporated in active contour model and after segmentation it provides quite regular object which can be conveniently used for recognition and classification therefore the same has been selected for separating the disease spot from the background. Active contour model (snakes) is an energy minimizing curve, which is influenced by external constraint and image forces that its it on the object contours

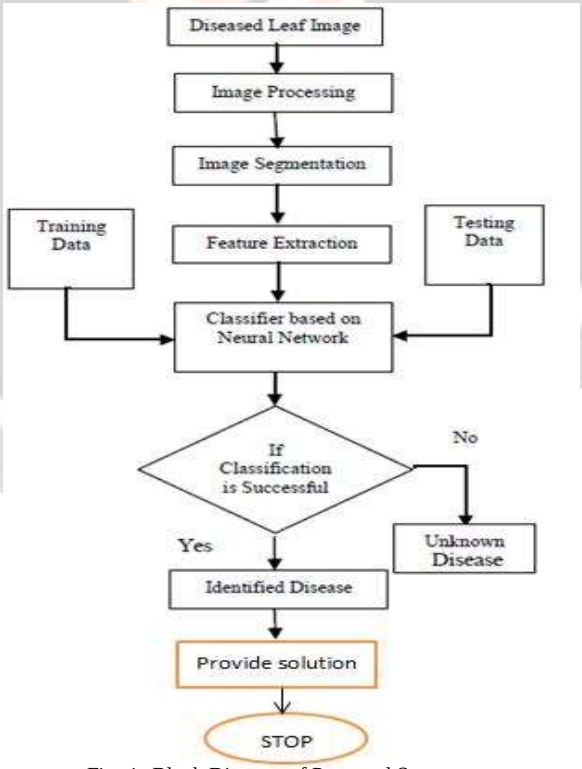


Fig. 4. Block Diagram of Proposed System

the steps as follows: 1) Firstly the diseased leaf image is selected and then the value of ? for Gaussian smoothing is selected. 2) The initial position of the snake is selected by clicking its position.

Tables of different cotton leaf diseases. The Table 1 shows the moments derived from each type of cotton leaf disease under consideration. The set of seven moments are utilized as feature vectors for training and classification of neurons.

Bacterial Blight	Myrothecium	Alternaria
1.6202e-006	0.012999	0.0010557
1.6076e-006	0.010117	0.00087101
0.0012012	0.12691	0.034868
0.0012139	0.1207	0.033656
1	1	1
0.0012712	o.099054	0.028825
0.99976	0.99215	0.9559

TABLE I

TABLE NAME (MOMENT OF COTTON LEAF DISEASE)

5. IMPLEMENTATION DETAILS

5.1. Disease Module

It is a major and potentially destructive bacterial dis-ease caused by a bacterium, Xanthomonas campestrispy mal-vacearum. It starts as angular spot because of the restriction of the spot by the fine veins of the leaf and having red to brown border.

5.2. Image Segmentation Module

It is observed mainly in the cool wet weather. The affected plants first appear darker green and they are prevented from growing properly. The leaves become yellowish and they drop off. The leaf margins wilt then turned yellow to brown shown in fig-5.

5.3 Image Cropping Module

After calculating the mean values of Red, Blue and Green components, the values are to be compared with each other in order to find the maximum value of the components. For eg., if the value of Red component is High than the rest of the two, then we can conclude that the respective image is Red Intensity oriented image and which can be clustered into Red Group of Images. Whenever the query image is given, calculate the RGB components average values. Then compare this with the stored values shown in fig-6.

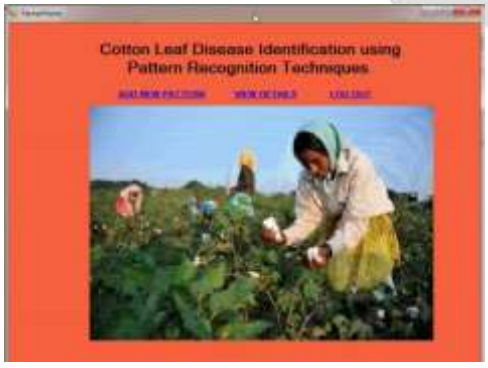
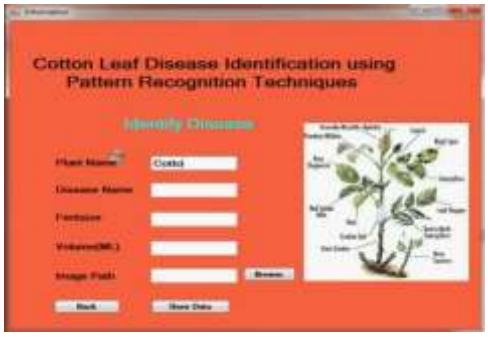


Fig. 6. Uploading image of affected cotton leaf

Fig. 7. Uploading image of affected cotton leaf

Fig. 5. Home Page Fig.



8. Identifying disease

Fig. 9. Pattern Identified

Fig. 10. Registration

6. PROPOSED SYSTEM

The proposed systems intends at processing the images captured in natural conditions from varying distances. This makes the system more robust under different climatic con-ditions. Figure 4 shows the flowchart of the system proposed for identification of Alternaria, Bacterial leaf blight and My-rothecium diseases on cotton leaf. The images are acquired using a digital camera and image preprocessing techniques are used to smooth the images. Then image segmentation methods are applied to images to isolate the disease spot from the background. The features are extracted from these segmented parts and the significant features are utilized to train the network that carry out the classification.

7. CONCLUSION

In this paper, the diseased cotton leaf images are classified using Error Back propagation neural network where the training is performed by extracting seven invariant moments from three kinds of diseased leaves images. The average accuracy of classification is found to be 85.52 percent. The snake segmentation algorithm provides efficient technique to isolate the diseased spot but is a very slow process. This results in longer training and testing phase for the system. Various other promising features can be added in feature extraction process for making the system more robust. This may help in increasing the performance of the system. Same work can be carried out for identification of diseases on other crops like Orange, Citrus, Wheat, Corn, Maize, etc. Additional extension to this paper by using EBPTA training algorithm we can provide solution to disease to the farmer. As the identification of the problem is not only important part of this research but if we are going to provide solution to the cotton disease will help for my all farmer brothers ,and I am very happy that is my small try for my Nation as student of Technology.

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