Leaf Disease Recognition System

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ABSTRACT
Agriculture is the back-bone of country economy, where farmer source of income widely depend upon the farming. During the cultivation of crops, it require proper monitoring and due to change in atmospheric condition or the loss of soil nutrition these crops get encountered with certain type of disease. These disease farmer cannot recognize easily because of which they get loss in production. So here we proposed the system where we detect the disease based on leaf symptoms and diagnose for proper medication based on the result.

Keywords
Hue, Saturation, Value (HSV), Luminesce, A&B (Chromatic component) (LAB), K-main clustering algorithm, Color co-occurrence matrix, Gray Level Co-occurrence Matrix (GLCM), segmentation, classification

1. INTRODUCTION
Research in agriculture can increase productivity and food quality at reduced expenditure with increased profit. Plant disease diagnosis is prime concern in the field of agriculture and it is main area of research. In Maharashtra there is loss 45% of cotton farm due to diseases on cotton plant. If misidentification takes place then this leads to loss of work, money and leads to major problem to crop. We are going to make system which can easily, accurately identifies the disease on plant. In this leaf image acquisition takes place then we proposed to proceed for image analysis part in which we are doing preprocessing of image, thresholding of image is doing using K-main clustering algorithm. Different GLCM feature extraction of image taking place. Using this result of GLCM feature the diseased and normal leaf is identified. In classification process the comparison of processed leaf image and database of different diseased leaf and normal leaf takes place. After this what type of disease is occur on plant is identified then what kind of precaution has to be takes on that plant. This system can reduce farmers' effort in identifying the disease on plant and taking precaution about pest and disease.

2. DISEASE ON COTTON LEAF
The different disease on cotton plants are

i) Viral Diseases:

e.g. Leaf Roll, Leaf Curl, Leaf Crumple

ii) . Fungal Disease:

e.g. Leaf Spot, Anthracnose.

iii) Bacterial Disease:

e.g. Bacterial blight, Crown Gall.

Following are the images of different diseased leaf of cotton plant.

Figure 1: Leaf Spot

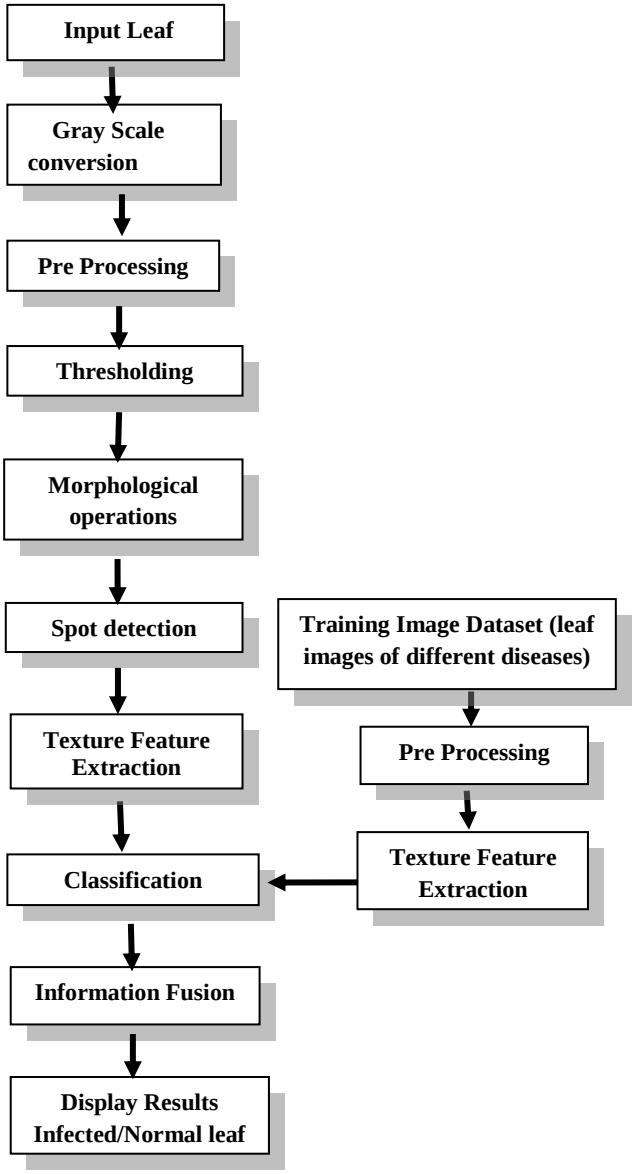
Figure 2: Gray Mildew

3. PROPOSED APPROACH
In this paper various leaf of cotton plants are collected then taking high resolution picture of leaf through camera for getting maximum accurate result and good efficiency. This images are used for analysis of different pest and diseases on leaf.

Following are the steps of image analysis.

1. RGB image acquisition.
2. Image resizing into standard resolution.
3. Convert the color image into grayscale image.
4. Segmentation of leaf.
5. Performing different morphological operation on leaf, like erosion, dilation.
6. Edge detection of leaf and detecting spot on leaf.
7. Different color, shape and feature are extracted.
8. Using vector machine classifier compute the statics of textures.
9. Compare this data with training image dataset.
10. Display the result of image.

4. ALGORITHM OF PROPOSED SYSTEM



4.1 Image Acquisition

The image of leaf is captured through camera having a high resolution of 16 megapixels cancels out all the errors. Light intensity can create problems with respect to clarity, which can be eliminated by placing the leaf at bright light. The captured image must be in JPEG format, RGB color space and a default resolution of

Figure 3: Diseased Leaf Image.

4.2 Preprocessing of image

The RGB image is subtracting the background of image. This image is converted into grayscale image and then binarisation of image. In preprocessing steps rounding of pixels values done. Then anding the image with original RGB image

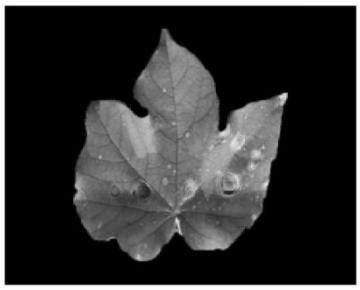


Figure 4: Background subtracted image.

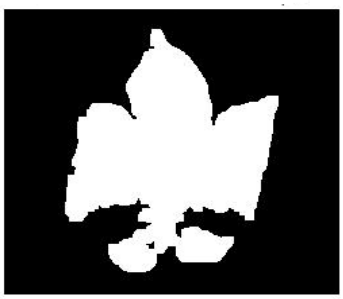


Figure 5: Preprocessing of image.

Figure 6: Anding the RGB image with preprocessed image

4.3 Color conversion

In this process the anding RGB image output is converted into HSV image i.e. Hue, Saturation and value. HSV image is then converted into LAB image. LAB is used for color spacing in defected leaf like Luminance at different position and Brightness of different spots on leaf. A and B are chromatic components.

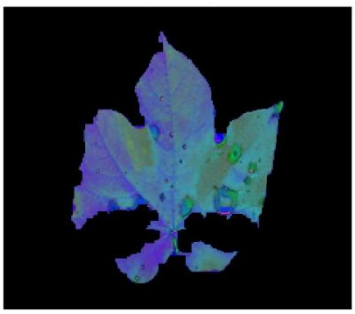


Figure 7: HSV image

Figure 8: LAB image

4.4 Spot Detection

For spot detection use the K means clustering algorithm. In K means clustering algorithm we use the Euclidean distance method for calculating the distance between the different cluster that are form in it.

Figure 9: Spot Detection

4.5 Disease Analysis

In disease analysis we perform the feature extraction of image. For extraction of images we use GLCM method i.e. Gray Level Co-occurrence Matrix. In this we extract four different features like contrast, correlation, energy and homogeneity.

1. Contrast = Returns a measure of the intensity contrast between a pixel and its neighbor over the whole image. Range = [0 (size (GLCM, 1)-1) ^2] Contrast is 0 for a constant image.

$$Contrast = \sum_{i,j=0}^{N-1} (i,j)(i,j)\text{^}2$$

2. Energy= Returns the sum of squared elements in the GLCM. Range = [0 1] Energy is 1 for a constant image.

$$Energy = \sum_{i,j=0}^{N-1} C(i,j)\text{^}2$$

3. Homogeneity=Returns a value that measures the closeness of the distribution a\of element in the GLCM to the GLCM diagonal. Range = [0 1] Homogeneity is 1 for a diagonal GLCM.

$$Homogeneity = \sum_{i,j=0}^{N-1} C(i,j)/(1+(i-j)\text{^}2$$

4. Correlation = Returns a measure of how correlated a pixel is to its neighbor over the whole image. Range = [-1 1] Correlation is 1 or -1 for a perfectly positively or negatively correlated image. Correlation is Nan for a constant.

$$Correlation = \sum_{i,j=0}^{N-1} \{i \times j\} \times C(i,j) - \{\mu x - \mu y\} / \sigma x \times \sigma y$$

5. RESULT

As shown in table 1 is the result of normal leaf image of different cotton plant in which the contrast of different leaf is between 0.030to 0.09. Correlation is in between 0.3 to 0.5.Energy is in between 0.9 tp1.0.

Table 1: Normal leaf image analysis

Normal	LEAF 1	LEAF 2	LEAF 3
CONTRAST	0.0897	0.0503	0.0455
CORRELATION	0.3565	0.4571	0.4124
ENERGY	0.9876	0.9857	0.9962
HOMOGENITY	0.9609	0.9756	0.9810

Table 2: Diseased leaf image analysis

Diseased	LEAF 1	LEAF 2	LEAF 3
CONTRAST	0.1644	0.1627	0.1491
CORRELATION	0.2068	0.2051	0.2136
ENERGY	0.4888	0.5736	0.5834
HOMOGENITY	0.9723	0.9310	0.9333

As shown in table 2 is the result of diseased leaf image of different cotton plant in which the contrast of different leaf is between 0.1400 to 0.1600. Correlation is in between 0.2000 to 0.2500. Energy is in between 0.4 t0 0.5.

From above the result analysis we conclude that diseased leaf image contrast and correlation is more than normal leaf .hence we conclude that images are defected.

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