Wheat Leaf Disease Detection Using Image Processing

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Abstract: **India is a agricultural based county where approx 70% of population depend on agriculture. Now a days the plant disease detection is very important because agriculture is the backbone of the county like india. Farmer is not aware what type of disease plant having and how to prevent them from these diseases. To overcome from these we are going to develop a technique in which we can able to detect plant disease using image processing technique. This includes following steps: image acquisition image pre-processing, feature extraction and at last we apply a classifier know as neural network.**

Key word: **GLCM, K-mean clustering, PNN**

I. INTRODUCTION

Agriculture is the backbone of indian economy and now a days many disease occur in plant and it impact very badly on farmer and indian economy. So detection of plant disease is very important. Detection of disease by naked eye is very inaccurate and it required lot of team effort and experts, which is much more expansive. So automatic leaf disease detection system is required. Automatic leaf disease detection system is very accurate and it take very less time to detect disease in plant.

In this process of leaf disease detection firstly we are going to acquired normal image by the means of any digital camera. Acquiring the leaf image is first step in leaf disease detection. Secondly we are going for pre-processing of image. In this we are going to enhance the image quality. After enhancing the image we divide the image in different cluster. In that green pixel are masked and only infected portion left. We did this masking because to get more accuracy. This process we can called it as segmentation. After segmentation we feature extraction is done. Then we do statistical analysis and at last we use a classifier. Classification is done. Classification is last step and it is done by using neural network.

II. BASIC STEPS

Leaf disease detection includes following steps-

1. RGB image acquisition.
2. Image pre-processing.
3. Apply k-mean clustering.
4. Masking green pixels.
5. Infected cluster is converted RGB to HIS.
6. SGDM matrix is generated.
7. GLCM function is called for calculation of features.
8. Computing texture statistics and apply neural network for classification.

Image acquisition
Image preprocessing
Image segmentation
Feature extraction
Statistical analysis
Classification base classifier

Healthy wheat leaf

Infected wheat leaf

1. Image acquisition & preprocessing:

In this process the image is acquired using digital camera from different sites. Input image what we captured is not always satisfying always there is some noise is added in that image, so for removal of noise and getting informative image we apply preprocessing technique. In this process firstly the image is enhanced after smoothing. While collecting image many information is collected which include noise. To remove noise we use different type of filtering techniques. Mainly this

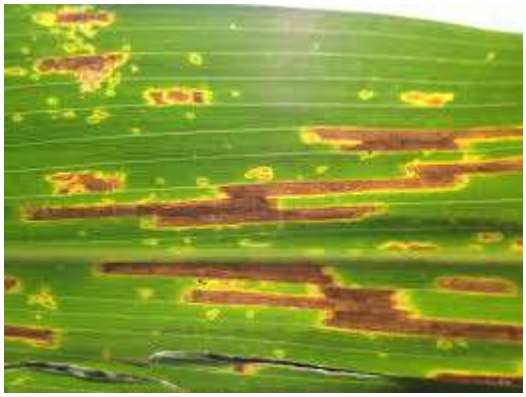
process contain three main steps clipping, smoothing and enhancement.

2. Image segmentation:

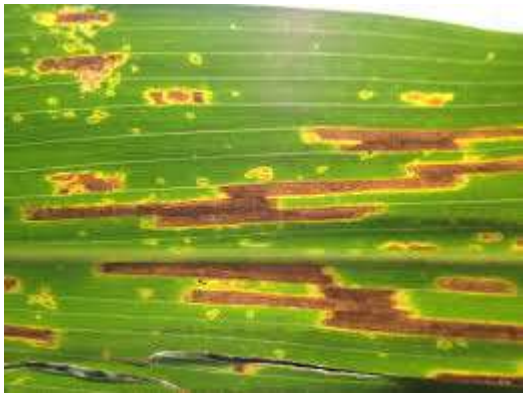
Image segmentation is the process of partition of image into different segments. It use to get some meaningful information from segmented image. Here we are using k-mean clustering. In this we are going to mask green pixels of image and remains with the infected portion of image.

The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed a priori. The main idea is to define k centroids, one for each cluster. These centroids should be placed in a cunning way because of different location causes different result. So, the better choice is to place them as much as possible far away from each other. The next step is to take each point belonging to a given data set and associate it to the nearest centroid. When no point is pending, the first step is completed and an early groupage is done. At this point we need to re-calculate k new centroids as barycenters of the clusters resulting from the previous step. After we have these k new centroids, a new binding has to be done between the same data set points and the nearest new centroid. A loop has been generated. As a result of this loop we may notice that the k centroids change their location step by step until no more changes are done. In other words centroids do not move any more.

A. Place a k points into the space represented by the object that are being clustered. These point represent initial group centroid.
B. Assign each object to the group that has the closest centroid.
C. When all have been assigned, recalculate the position of the K centroids.
D. Repeat step B and C until the centroid no longer move. This produces a separation of the objects into groups from which the matric to be minimised can be calculated.



ORIGINAL IMAGE



ENHANCED IMAGE

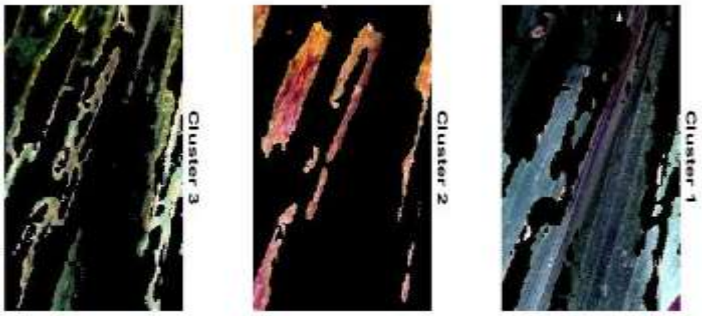


IMAGE AFTER K-MEAN CLUSTURING.

3. Feature extraction:

Feature extraction plays a vital role in the identification of an objects. Feature extraction is used in many application of image processing. Some of the important feature which are used in plant disease detection are colour, texture, morphological, edge etc. among all these feature the most effective feature are morphological. It give the best result. It this process we use colour co-occurrence method.

A. Colour co-occurrence method:
In this method the RGB image is converted into HIS.

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

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

$$S\ (\text{saturation}) = 1 - \frac{3}{R+G+B}[\min(RGB)]$$

$$I\ (\text{intensity}) = \frac{1}{3}(R+G+B)$$

After RGB to HIS conversion texture statics is calculated by SGDM matrix and using GLCM function the feature is calculated.

4. Statistical analysis:

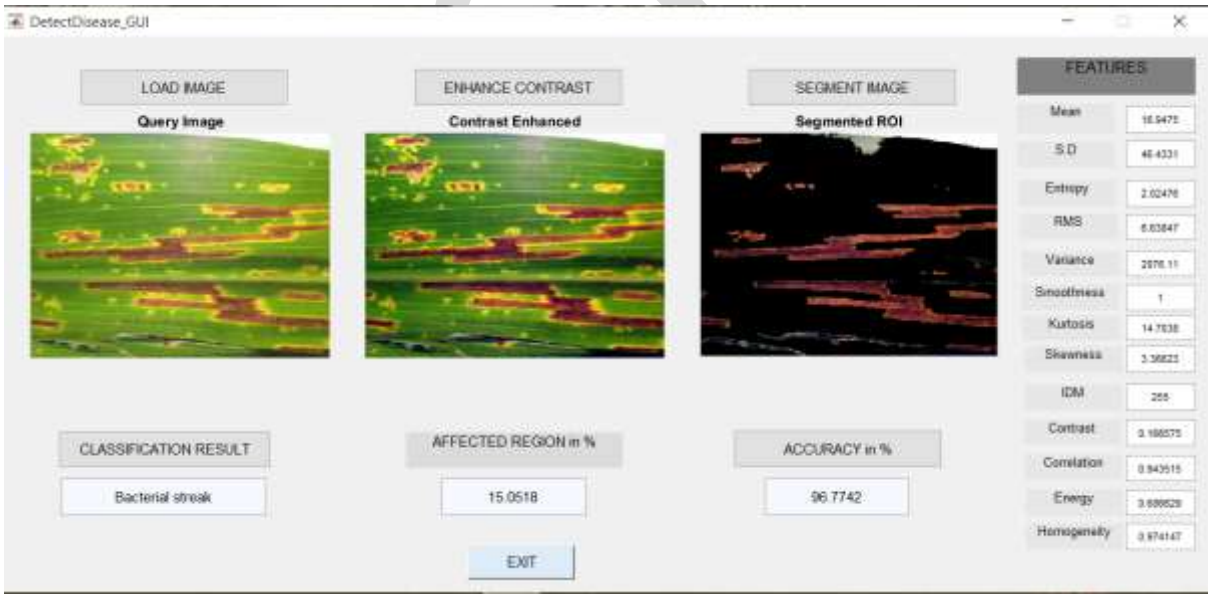
After converting RGB leaf into HSI colour specification each pixel map is use to create colour co-occurrence matrices. So there specially three matrix is generated each individually for H, S, and I. However by using MATlab function the i.e GLCM the gray level co-occurrence matrix is generated. And we get different features value i.e value for contrast, energy, homogeneity, correlation etc.

5. Classification base classifier:

Lastly the classification tool is used for the automatic detection of plant disease. Here the classifier is used is PNN (probabilistic neural network). It is the main classification tool.it is a feed forward network which is widely used in pattern recognition problems and classification. PNN is mainly consist of four layers first is input layer second is pattern layer third one is summation layer and the last is output layer. The first layer shows the input pattern with *n* features. The number of nodes in the pattern layer is equal to the number of training instances. The number of nodes in the summation layer is equal to the number of classes in the training instances. The input layer is fully connected to the pattern layer. The input layer does not perform any computation and simply distributes the input to the neurons in the pattern layer. The pattern layer is semi- connected to the summation layer. Each group of training instances corresponding to each class is just connected to one node in the summation class. In other words, the summation units simply sum the inputs from the pattern units that correspond to the category from which the training pattern was selected. And the main advantage of using this PNN is it has very fast training process.

III. EXPERIMENTAL RESULTS

By using above procedure and classification tools the results what we are getting are shown in diagram below. In this fist infected wheat leaf is loaded by using load image. Then the image is enhanced to reduce the noise from the image and after that segmentation is done using k-mean clustering. Then infected portion of leaf is extracted by masking green pixel values and different feature of that infected area is calculated using GLCM matrix. After that classification tools is used which indicate the disease name. the affected region and accuracy is calculated.



IV. CONCLUSION AND FUTURE WORK

The above study for the plant disease detection using image processing technique is done by using important tools like k-mean clustering, GLCM and PNN. Some of the challenges are we have to detect plant disease as soon as possible. In early stage of disease we have to detect the disease, for this purpose we have to monitor the plant continuously. In future work we use large number of data as training purpose in neural network. As we increase the training data the accuracy of system will be high. And future we can use fuzzy logic as a classification tools and the we can compare the accuracy rate and speed of system.

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