Recognition of Unhealthy Plant Leaves Using Naive Bayes Classifier

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Abstract. India is a country and around 70% of our population relies on development. 33% of our national pay starts from agribusiness. So to identify the plant diseases is a difficult way in the agriculture field. Major part of the plant diseases are brought about by the assault of microorganisms, developments, contamination, etc. In case proper consideration isn't taken around there, it will cause genuine consequences for plants and unfavorably influences the efficiency and quality. To perceive the plant diseases a brisk customized way is needed. The main aim of this project is to spot the unhealthy plant leaves. In this task, MATLAB tool is used for measuring affected area of disease and to determine the colour of the diseases. So this task takes less measure of time and get more efficiency. Here, this project is proposed with a thought of identifying unhealthy region of plant leaves using classifier technique. The classifier technique can be used to classify the leaves and the classified results can be seen in simulation.

Keywords: Image Processing, MATLAB, Texture features, Classifier

1. Introduction
Agriculture plays an important role as an energy source and also the solution for the problem of global warming can be achieved. Plant infection affects both quantity and quality of crop production very badly. Plant infection should be detected as early as possible for efficient controlling of disease. In general the naked eye method is used in order to classify the diseases. Experts who have the capability to detect the changes in leaf color are involved in this method. One of the important tasks for increasing economic growth and plant productivity is to detect and classify unhealthy region of plant leaves. With the digital camera the images of the leaves are captured, using the histogram equalization technique the captured images are preprocessed, the affected part of the leaves are detected using the techniques of color transformation and segmentation. Naïve bayes classifier can be used to classify the affected leaves. The segmentation of the leaf and affected area can be done using principal component analysis. The unhealthy region can be recognized and identified using the image processing technique. K means clustering for segmentation method, probabilistic neural network, artificial neural network, SGLDM and GLCM for texture feature analysis are the methods that are used effectively for detection and classification of plant leaf diseases[1]. As far as calculation is considered SVM is quite complex, it is cost defective and inaccurate increase of wrong inputs. The computational cost can be reduced using KNN algorithm. It has been effectively proved that the results obtained via KNN classifier is better than SVM algorithm and accuracy rate of KNN is quite high [2]. An enhancement on different methods such as Kth-Nearest Neighbor with Neural Network and Naïve Bayes are compared and hybrid in classification of image analysis to improve grading and accuracy of result [3]. For class prediction KNN method seems to be well suited and simplest. In SVM it becomes difficult to determine optimal parameters if the training data is not linearly separable, and SVM is more difficult to implement and understand. Lack of robustness to noisy data and being a slow learner are the main drawbacks of KNN algorithm [4].
2. Existing System
The existing method presents the technique of genetic algorithm with Otsu segmentation. The Otsu’s segmentation is used to spot the affected diseases using various image parameters. The step by step procedure of existing system is as follows: Image acquisition is the first step, capture an image using digital camera. Next step is the image conversion process, the RGB image can be converted into HSI image. After that process to mask only the green pixel image. The remaining portion of the image can be removal of masked green pixels. Next step the segmentation part, use Otsu’s segmentation technique. It is used to separate the affected parts using different parameters. Take more affected segmentation part for further segmentation. To compute the texture features by using genetic algorithm. Get the valuable portions to classify the leaf diseases i.e the leaf can be normal or abnormal. The detection accuracy is 94% by using genetic algorithm technique and disadvantage of this method is time complexity and coding can be complex to get it.

3. Proposed Methodology
First, the leaf image can captured using a digital camera. The acquired images can be applied to image processing techniques to extract images for further analysis. After that, the classifier can be used to classify the leaves (i.e. the leaves can be normal or abnormal).

Figure 1 presents the block diagram of proposed approach:

![Block diagram of Proposed System](image)

In the first step, the sample leaf of RGB image has been taken. The procedure of the proposed system is as follows:
1. Image acquisition.
2. RGB image converted into HSI format
3. Image Enhancement
4. Segmentation using PCA
5. Feature extraction
6. Classification using Naïve Bayes

3.1 Image acquisition
Image Acquisition is the process in which acquired image has been converted to the desired output format. For this application an analog input image is first captured and then converted to the digital image for further processing.

3.2 Colour transformation
The input RGB image can be subtracted from the background image. Then subtracted image can be converted into Hue Saturation Intensity (HSI). It is a human perception colour. It is a good method for colour transformation.

3.3 Image Enhancement
Image Enhancement is a sub field of image processing and its process is to improve the appearance of
an image, to highlight important features of an image, and to make this image more suitable for use in a particular application (e.g. make certain features easier to see by modifying the colors or intensities).

3.4 Segmentation using PCA
Image segmentation is the process of subdividing the image into its constituent parts of interest. There are several methods of image segmentation like thresholding, region based methods, morphological operation and soft computing techniques, Principal Component Analysis. The choice of set of rules typically depends on the problem being solved. The main idea of Principal Component Analysis (PCA) is to reduce the dimensionality of features correlated with each other, both closely or gently, while maintaining the information without affect the data.

3.5 Feature Extraction
Extraction of features plays a major role in classifying an image. Feature extraction of image can be used in various applications. Various image features including colour, morphology, texture, edges etc. can be used in the classification of plant disease, texture refers to distribution of color in the image, the hardness, the roughness of the image. Colour, texture and morphology are considered as a feature for disease detection. In this paper they found that the result of texture is better than the other characteristics. It can use for identifying the infected plant leaf of classification plant image.

3.6 Classification using Naïve Bayes
The Naïve Bayes is based on Bayes’ Theorem with an assumption of independence among predictors. In simple terms, a Naïve Bayes classifier depends only on a particular feature in a class and it does not depend on any other feature. For example if the color of a fruit is found to be red, the diameter of about 3 inches and round in shape then the fruit may be considered to be an apple. In spite of independency among all the features, all the features contribute for the identification of the fruit and so it is known as ‘Naïve’. Naive bayes model is easy to construct and above all useful for very large data sets.

4. Result and Discussion
The sample leaf images are acquired using digital camera. The acquired leaf images is in RGB format. The Original RGB leaf images are converted into HSI format. By adjusting the image intensity the image contrast can be improved for the purpose of enhancement using histogram.

The figure 2 and figure 3 shows the result of histogram and image enhancement:

![Figure 2. Histogram image](image1.png)  ![Figure 3. Enhanced image](image2.png)

Image Segmentation is the process that is used to segment the object of interest from background. The following results are the PCA segmentation technique:
Feature extraction is the process to reduce image data by measuring certain features or properties of each segmented region such as color, shape or texture. This will be done in two steps, vessel trace and vessel black and white.

The following result are the feature extraction image:

The classification is done using Naive Bayes classifier technique. The classification gain obtained by normal pixel value is 49.37% and the affected pixel value is 51.04%. The uncovering accuracy is improved to 97% by using classifier.

The table shows the result of classification of normal pixel value and affected pixel value:

| Image type         | Normal pixel value | Affected pixel value | Success rate% |
|--------------------|--------------------|----------------------|---------------|
| Aster yellows      | 35.33%             | 65.28%               | 84%           |
| Brown Spot image   | 49.37%             | 51.04%               | 98%           |
| Powdery Mildew     | 44.31%             | 56.49%               | 94%           |
| Blight             | 40.83%             | 60.43%               | 79%           |
| Leaf Curl          | 42.45%             | 58.13%               | 95%           |

The figure 7 shows the graphical representation of various type of plant leaves of normal pixel value and affected pixel value:
Conclusion and Future work

In this paper the Naïve Bayes classifier is used to detect unhealthy regions of plant leaves and also to classify them. Initially the leaf images are collected, color converted, segmented, feature extracted and finally the plant disease is classified. The accuracy of result obtained is about 97%. In future it is expected to develop further high level algorithms so that the accuracy of the disease classification can be improved.

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