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# Identify the Disease for the Crop using Image Processing and Artificial Neural Networks

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**Abstract:** ***In these years we get to know that, agriculture is the main source of national income for most developing countries. Thus, this is one of the important and main reason to be considered for the detection of plant disease, as disease is the main cause of rottening of fruits or vegetables or crops. Thus we can assume that if proper care is not taken regarding this thing then it leads to loss of money, time, quality, quantity, etc. Thus the main motive is to reduce the use of pesticides and thus yield a good crop and increase the production rate. Plant disease can be detected using image processing. Disease detection follows some steps like preprocessing of the image, feature extraction, classification, prediction of classified disease. Thus creating a recognition system can help in evaluating high precision image of the plant for proper cure and further prevention***

**Keywords:** digital image processing, plant pathology, mathematical statistics, image segmentation

## 1. Introduction

Agriculture, from many years have been associated with the cultivation of basic crops that are considered important for our diet and most important for our living. Agriculture is mostly compensating the economic growth of the country. It could be considered as the crucial part of society. Since many industries have been setup all across the world, we can say that industrialization and causes of it are destroying the path of agriculture. Globalization can be considered as another cause of low farming activity. The increase of population and need to cultivate crops accordingly and changes in climatic condition have cause a great impact in the production as changes in climatic conditions can also cause growth of various disease in plants. Thus our main aim would be to decrease the use of pesticides to decrease cultivation cost and save our environment. Now a days, data mining a powerful and widely used method can be used in plant disease prediction. Thus using data mining concepts with image processing it will be easy for us to recognize whether crop is infected or not, classify disease according to various issues and with the help of colors developed due to disease and thus suggesting various remedies for it based on severity of disease. Thus the research focuses on collecting of the data of diseases on plants and training a model for disease detection. Recent advanced technology has made the use of deep convolutional networks which helps in recognition, classification and also smart phone based size and color detection of leaves on plant for detection of disease.

## 2. Leaf Disease & Symptoms

- Symptoms may include a detail change in color, shape or function of the plant as it responds to the pathogen.
- Here we are discussing these diseases symptoms that should be keep in mind if the plant growth seems low
- The classification and detection of leaf diseases accurately is the key to prevent the agricultural loss
- Different plant leaf bears different diseases and have different symptoms
- In this section we are going to see basic concept of leaf diseases symptoms

### 2.1 Viral Disease Symptoms

- Among all plant leaf diseases, those caused by viruses are the most difficult to diagnosis.
- Viruses produce no clue signs that can be cleverly observed and often confused with nutrient deficiencies and herbicide injury.

Aphids, leafhoppers, whiteflies and cucumber beetles insects are common carrier of this disease, e.g. Mosaic virus, and look for yellow or green stripes or spots on foliage, as shown in fig. 1. Leaves might be wrinkled, curled and growth may be stunted

**Figure 1:** Viral Disease Symptoms

### 2.2 Bacterial Disease Symptoms

- Pathogenic bacteria cause many serious diseases of vegetables. They do not penetrate directly into plant tissue but need to enter through wounds or natural plant openings.
- Wounds can be caused by damage by insects, other

pathogens, and tools during operations such as pruning and picking
- The disease is characterised by tiny pale green spots which soon come into view as water - soaked.
- The injuries enlarge and then appear as dry dead spot as shown in fig. 2.

**Figure 2:** Bacterial Disease Symptoms

### 2.3 Fungal Disease Symptoms

- Plant leaf diseases, those caused by fungus are discussed below and shown in fig.3. E.g. Late blight caused by fungus.
- It first appears on lower, older leaves like gray-green spots, water-soaked.
- When fungal disease matures, these spots darken and then white fungal growth forms on the underside

**Figure 3:** Fungal Disease Symptoms

## 3. Literature Survey

- **Khirde et al.** has discussed some segmentation and feature extraction algorithm that can be used for the detection of plant diseases by using the image of their leaves.
- It is very difficult to detect the plant diseases manually due to requirement of excessive time, knowledge of plant diseases and very much amount of work.
- The author has divided the entire process of plant leaf diseases detection into five steps those are as follows:
  a) Image acquisition
  b) Pre-processing
  c) Segmentation
  d) Feature extraction
  e) Final classification of diseases
- Image acquisition used the transformation structure for RGB leaf image. Then image is pre-processed to remove the noise and enhance the image contrast.
- Segmentation is done for the partitioning of image into various feature part using k-means clustering, otsu filters etc. This segmented image is further used for feature extraction and then final classification is performed using various classification technique
- In this way, plant diseases can be efficiently identified.

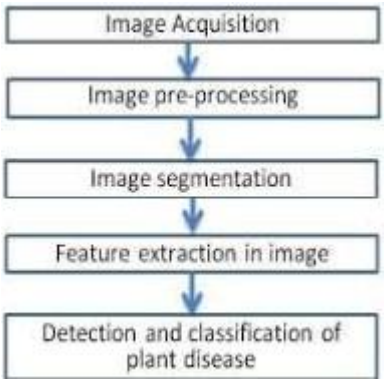
- **Sannakki et al.** Has used feed forward back propagation Neural Network based technique for the diagnosis and classification of diseases in grape leaf.
- Author has used the images of grape leaf with complex background for the diagnosis as input. Further anisotropic diffusion is used to remove the noise of the image which is further segmented using k-means clustering.
- Finally results are observed using neural networks. Results are experimented on downy mildew and powdery mildew images with simulation in MATLAB
- Confusion matrix is considered with the true positive and false positive parameters for the validation of results
- The author claims to have accuracy of almost 100% if used hue feature alone

- **Kutty et al.** Has used the neural network based system to classify the watermelon leaf diseases of Downey Mildew and Anthraconse.
- Author has calculated the true positive rate, true negative rate and overall accuracy for the efficiency of the proposed concept this classification is based on the color feature extraction from RGB color model which is obtained from the identified pixels in the region of interest.
- The overall performance is depicted with ROC curve having AUC value of 0.5. the true classification result also depicts the value of 75.9%

- **Rothe et al.** Has proposed pattern recognition techniques for the detection and classification of cotton leaf diseases of Alternarnia, Myrothecium and Bacterial Blight.
- The dataset images are taken from the field of Central Institute of Cotton Research Nagpur.
- Active contour based segmentation algorithm is used for the isolation of diseased spots.
- Author has also suggested some feature directions to the similar concept for the crops of wheat, orange, citrus and maize etc

## 4. Propose Work Flow

Plant leaf disease detection includes some basic step of image processing to detect & classify plant leaf disease. These steps are image acquisition, image pre-processing, image segmentation, feature extraction, classification and leaf disease detection. These steps are described as below in figure 1.




### 4.1 Image Acquisition

The first stage of any vision system is the image acquisition. Image acquisition involves the steps to obtain the plant leaf and captured the high quality images through the camera. Images are acquired from the internet or agriculture field. The efficiency of the concept depends upon the quality of database images. This image is in RGB (Red, Green, and Blue) form.

### 4.2 Image Pre-Processing

Image pre-processing involves the steps of image enhancement, RGB to Lab conversion, filtering etc. Here, image enhancement is carried out for increasing the contrast. Image smoothing is done using the filtering techniques. There are different types of filtering techniques available in image processing like median filter, average filter, Gaussian filter etc.

### 4.3 Image Segmentation

Image segmentation means partitioning of image into various parts of same features or having some similarity. The segmentation can be done using various methods like otsu' method, k-means clustering, converting RGB image into HIS model etc. The K-means clustering is used for classification of object based on a set of features into K number of classes. The classification of object is done by minimizing the sum of the squares of the distance between the object and the corresponding cluster

### 4.4 Feature Extraction

Feature extraction plays an important role for identification of an object. After performing the image segmentation the disease portion from the image is extracted. In many application of image processing feature extraction is used. Color, texture, shape, edges, morphology are the features which can be used in plant disease detection. Color features are extracted by various methods, such as Color histogram, Color moments and Color structure descriptor. Grey Level Co-occurrence Matrix (GLCM) method is used for extraction of texture features.

### 4.4 Classification & Detection of Diseases

Finally, classifiers are used for the training and testing of the datasets. These classifiers may be support vector machine (SVM), k-nearest neighbour, neural network, fuzzy logic based etc. These methods are used to classify and detect the leaf diseases.

## 5. Future Scope

For mobile apps which is useful for farmers as proper guide to do agriculture. In future we can do the disease detection techniques using various parts of the crops or plants like stem, flower, root.

## 6. Conclusion

Agriculture is mostly compensating the economic development of the nation. It is considered as the vital part of society. Thus the main aim of proposed work is to decrease the use of pesticides to decrease cultivation cost and save our environment. By using data mining concepts with image processing it will be simple to recognize whether crop is infected or not, which type of diseases, what can be the solution for the same. This paper has various methods for the Identification and classification of plant leaf diseases like pattern recognition method, back propagation, neural network, support vector machine etc. The proposed work also discusses the basic concept of plant leaf disease detection and various leaf diseases symptoms.

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