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Leaf Disease Detection Using K-Means Clustering And Fuzzy Logic Classifier

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ABSTRACT:

Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. The work discussed the methods used for the detection of plant diseases using their leaves images. In future the entire system is to be implemented in hardware and Io T based Plant Motoring System will also be implemented.

1. INTRODUCTION

Figure 1: Non-Infected Fresh Leaf

India is a cultivated country and about 70% of the population depends on agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for plant. Disease on plant leads to the significant reduction in both the quality and quantity of agricultural products. The studies of plant disease refer to the studies of visually observable patterns on the plants. Monitoring of health and disease on plant plays an important role in successful cultivation of crops in the farm. In early days, the monitoring and analysis of plant diseases were done manually by the expertise person in that field. This requires tremendous amount of work and also requires excessive processing time. The image processing techniques can be used in the plant disease detection. In most of the cases disease symptoms are seen on the leaves, stem and fruit. The plant leaf for the detection of disease is considered which shows the disease symptoms. At the same time, in some countries, farmers don't have proper facilities or even idea that they can contact to experts. Due to which consulting experts even cost high as well as time consuming too. In such condition the suggested technique proves to be beneficial in monitoring large fields of crops. And automatic detection of the diseases by just seeing the symptoms on the plant leaves makes it easier as well as cheaper. Image processing

is the technique which is used for measuring affected area of disease, and to determine the difference in the colour of the affected area.

2. LITERATURE SURVEY

Paper	Methodology	Future Work
[1] Detection And Classification Of Plant Leaf Diseases Using Image Processing Techniques: A Review	Review of ANN, SVM, PNN,SELF ORG MAPS AND FUZZY LOGIC	In neural network it's difficult to understand structure of algorithm and to determine optimal parameters when training data is not linearly separable.
[2] Agricultural Plant Leaf Disease Detection Using Image Processing	Vision-based detection algorithmwith Masking the green-pixels and Color Co-occurrence Method.	NN's can be used to increase the recognition rate of classification process.
[3] An Application Of K-Means Clustering And Artificial Intelligence In Pattern Recognition For Crop Diseases	K-means clustering algorithm with Neural networks for automatic detection of leaves diseases.	Artificial Neural Network and Fuzzy Logic with other soft computing technique can be used to classify the crop diseases.
[4] Detection Of Unhealthy Region Of Plant Leaves And Classification Of Plant Leaf Diseases Using Texture Features	Color co-occurrence method with SVM classifier.	The training samples can be increased and shape feature and color feature along with the optimal features can be given as input condition of disease identification.
[5] Applying Image Processing Technique To Detect Plant Diseases	Gabor filter for feature extraction and ANN classifier for classification.	Recognition rate can be increased.
[6] Remote Area Plant Disease Detection Using Image Processing	Texture segmentation by co-occurrence matrix method and K-means Clustering Technique.	Bayes classifier, K-means clustering and principal component classifier can be used to classify various plant diseases.
[7] Advances In Image Processing For Detection Of Plant Diseases	The color co-occurrence texture analysis method was developed through the use of Spatial Gray level Dependence Matrices	Better result of detection can be obtained with the large database and advance feature of color extraction
[8] Leaf Disease Severity Measurement Using Image Processing	Simple threshold and Triangle thresholding segmentation methods	Nil

[9] Color Transform Based Approach For Disease Spot Detection On Plant Leaf	Median filter is used for image smoothing and threshold can be calculated by applying Otsu method	Disease spot area can be computed for assessment of loss in agriculture crop. Disease can be classified by calculating dimensions of disease spot.
[10] Image Processing Techniques For Detection Of Leaf Disease	survey of different techniques for leaf disease detection	development of hybrid algorithms & neural networks in order to increase the recognition rate of final classification process

2.1 Types Of Plant Diseases

Image Analysis Can Be Applied For The Following Purposes:

1. To detect diseased leaf, stem, fruit.
2. To quantify affected area by disease.
3. To find the boundaries of the affected area.
4. To determine the colour of the affected area.
5. To determine size & shape of leaf.
6. To identify the Object correctly. Etc.

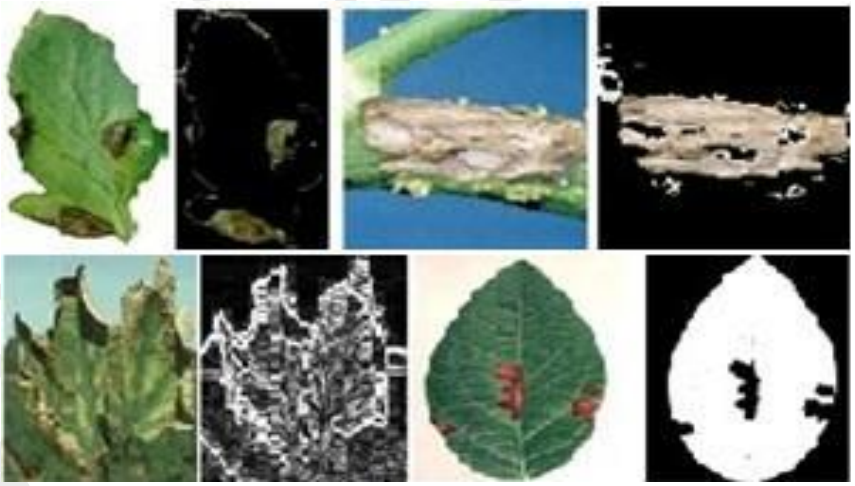

Figure 3: Image Analysis

Various Types of Leaf Spot Diseases:

- Bacterial
- Fungal
- Viral

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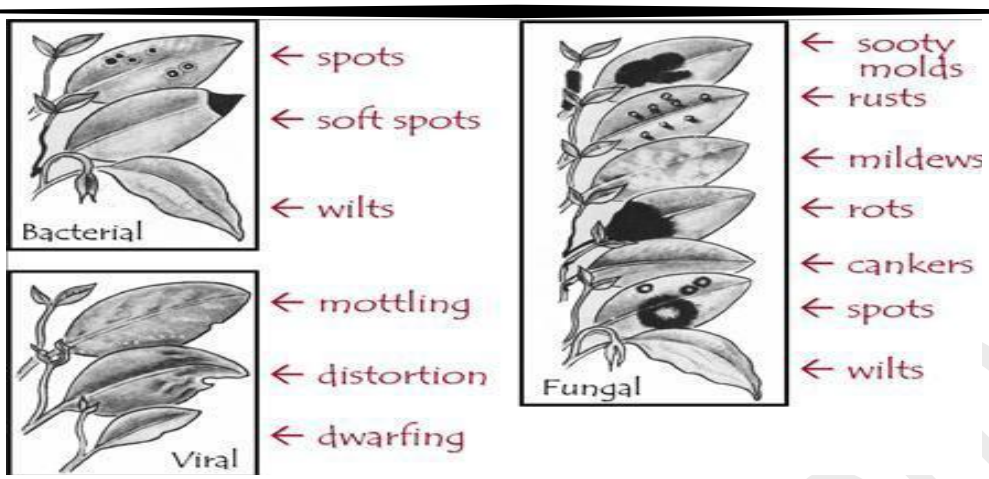


Figure 4: Various Types of Diseases

Most leaf diseases are caused by fungi, bacteria and viruses.

- Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures.
- Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fission.
- Viruses are extremely tiny particles consisting of protein and genetic material with no associated protein.

3. BASIC STEPS FOR DISEASE DETECTION

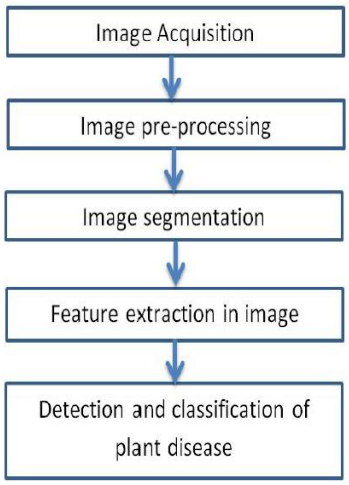
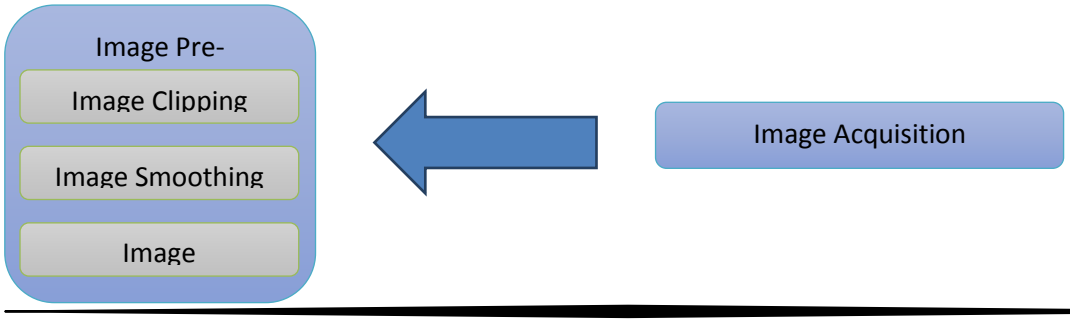
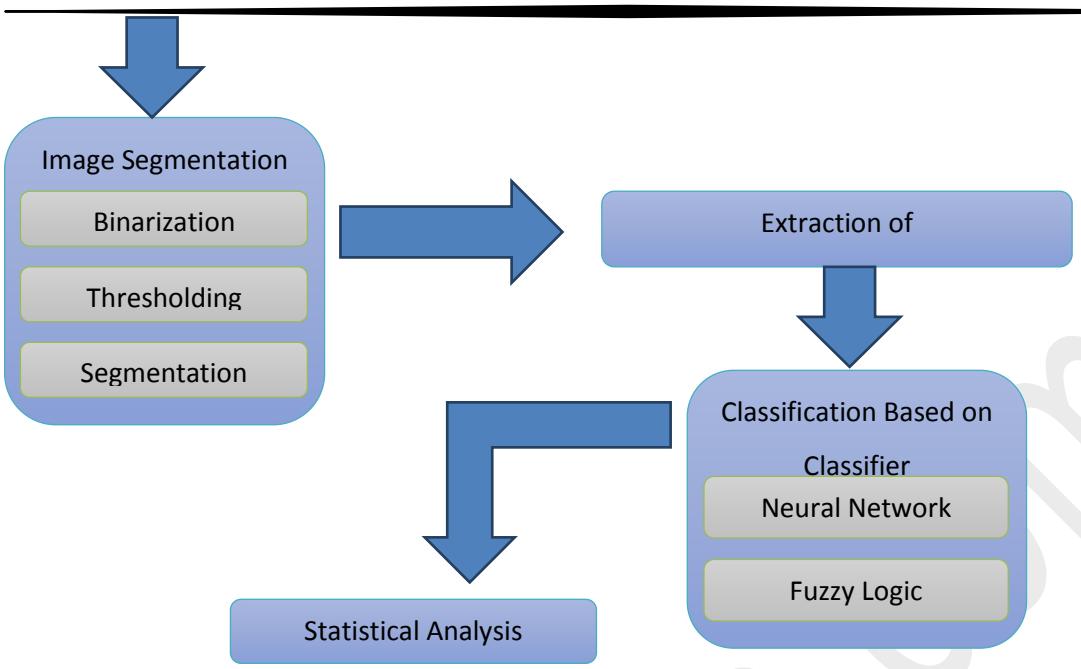


Figure 5: Basic Steps for Plant Disease Detection and Classification

Processes Work





Digital Image Processing

1) Image Acquisition

The digital images are acquired from the environment referring different sites. Image pre-processing is a prophase relative to feature extraction and image recognizing. Many way to collect the images means we can visit the agricultural research units. In this research work the help of the research centres is taking which is working in agriculture department.

2) Image Pre-Processing

Image pre-processing is a prophase relative to feature extraction and image recognizing. The images which have input are always not satisfactory regardless of what image acquisition devices are adopted. For e.g., there are noises in the image, the region of interest in the image is not clear or other objects' interference exist in the image and so on. Different pre-processing methods should be chosen for different image applications.

3) Image Segmentation

The image will be segmented into different parts according to the region of interest. Purpose of image segmentation is to divide the image into some meaningful regions. Simply to say, image segmentation means to separate the object from background for following processing in an image. It contains Thresholding, Binarization, and Segmentation.

4) Extraction of Features

When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduce drepresentation instead of the full size input.

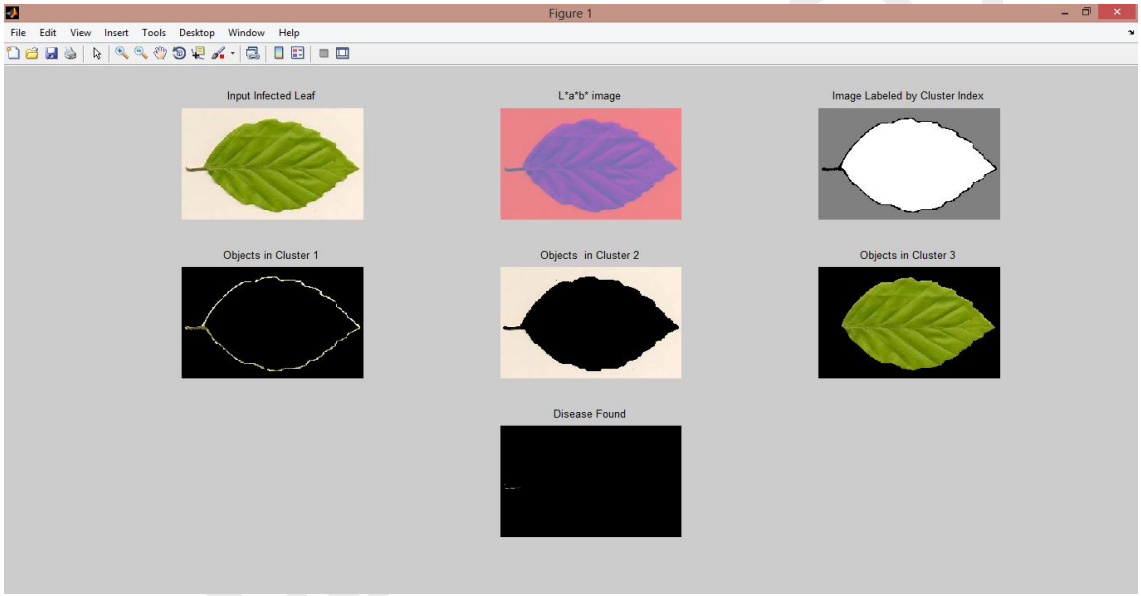
Classification based on a classifier: We are using Artificial Intelligence Techniques to solve the problem. We are going to classify it with the original existing work. Artificial Neural Network and Fuzzy Logic can be used to classify the plant diseases.

5) Statistical Analysis

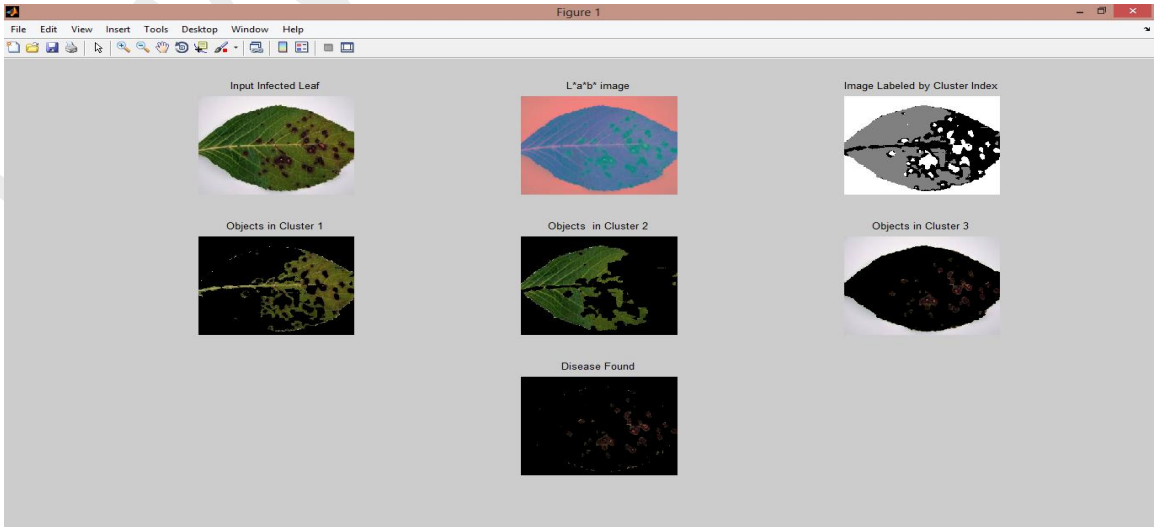
By comparing the classification results of ANN and Fuzzy Logic Technique. These analyzes , which system is better in sense of Accuracy, Speed, User friendly, easily adaptable topology of the network changes, a new sequence number is necessary before the network re-converges; thus, DSDV between nodes by sending full dumps infrequently and smaller incremental updates more frequently. Whenever there is not suitable for highly dynamic networks. (As in all distance-vector protocols, this doesnot perturb traffic in regions of the network that are not concerned by the topology change.

Non-Infected Leaf Followed By Output Segmented Images:

Output Segmented Image of Sample Non-Infected Leaf



Infected Leaf Followed By Output Segmented Images:



Output Segmented Image of Sample Infected Leaf

4. CONCLUSION:

From the study of the above techniques I come up with following conclusion.

A. By using Image Processing we can detect the infected part of a leaf and carry out the desired action to prevent the plant from destroying.
B. From the above classification techniques:
   i. The k-nearest-neighbour method is perhaps the simplest of all algorithms for predicting the class of a test example. An obvious disadvantage of the k-NN method is the time complexity of making predictions. Additionally, neural networks are tolerant to noisy inputs. But in neural network it's difficult to understand structure of algorithm.
   ii. SVM was found competitive with the best available machine learning algorithms in classifying high-dimensional data sets. In SVM computational complexity is reduced to quadratic optimization problem and it's easy to control complexity of decision rule and frequency of error. Drawback of SVM is it's difficult to determine optimal parameters when training data is not linearly separable. Also SVM is more complex to understand and implement.

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