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Plant Disease Detection using Image Processing

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***Abstract*: Agriculture is the backbone of India. Identifying the plant diseases to improve the quality, quantity & yield by preventing losses in the agricultural product. The studies of the plant diseases means observable or visual symptoms seen in the plants Maintaining health & detecting disease on plant is very critical. It requires hard work, experience, in plant diseases & it requires much time to process, hence image processing is used for detection of plant diseases. Plants are one of the major resources to avoid the global warming in the world. In this paper, image processing form techniques are used to detecting the plant leaf diseases. The objective of this work is to implementing the image analysis & classification form techniques for detection of several leaf diseases and classification. The proposed framework consists of four parts. They are: (1) Preprocessing of Image (2) Segmentation using K-means clustering to check the diseased areas (3) feature extraction & (4) Classification of diseases.**

***Keywords*: plant disease detection, leaf disease detection; SVM, K-Means Segmentation; Image processing; segmentation; classification; feature extraction.**

1. Introduction

In India 67% of the population depends on agriculture. Farmers have large range of diversity and land for selecting various suitable crops; they can find suitable pesticide for plants. Plant disease leads to the reduction in both quality and quantity of agricultural products. Parental herb ginseng belongs to appeals araliaceous.

The dry root and rhizome can be used as medicine. In most of the cases symptoms are seen on the leaves, stem and fruit. Various diseases occur in different parts of the plant can be identified by observing the change in symptoms, spots, colour etc. The less time consuming and automatic diagnosis technique is the major requirement in agriculture to improve the crop production rate. Image processing approaches have been used to solve the different problems based on agriculture applications like to detect disease leaf, stem, and fruit.

There are 3 steps to detect the pepper for extraction:

1) Identifying the strings of pepper fruit from the natural scene by appropriate colour model.
2) Identifying the pepper fruits through the colour co-occurrence method.
3) Obtaining the fruit by comparing the pre-captured image and the original image.

The disease detection of the affected pepper plant is done using image processing techniques. Disease on plants leads to the significant reduction in both quality and quantity of agricultural products.

The image processing technique can be used in the plant disease detection. In most of the cases, the disease symptoms are seen on the leaves. Hence plant leaf is considered for the detection of disease.

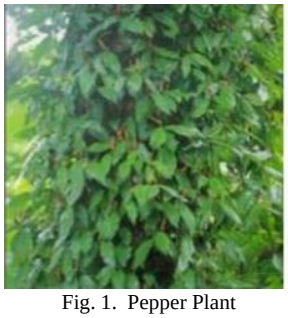
Fig. 1. Pepper Plant


Fig. 2. Pepper Fruit


Fig. 3. Disease affected plant

2. Image processing techniques

Numerous image processing techniques has been described in literature to detect the leaf disease. The block diagram of leaf disease detection system using image processing is given in Figure 4. The leaf database consist unhealthy and healthy leaves, which are captured from digital camera.

In image acquisition process, initially unhealthy and healthy leaves are processed. These unhealthy and healthy leaves dataset is called the training dataset. The train images of leaves store in black box to avoid variation in light intensities or putting in white box with light source at 45 degrees to reduce the reflection and better brightness. Once training dataset has been processed, and then append the test leaf image. Further image analysis for more suitable display, image enhancement process applied.

The image enhancement methods are as follows:

- Filtering with morphological operators
- Histogram equalization
- Wiener filter for Noise elimination

- Linear contrast adjustment
- Median filtering
- Unsharp mask filtering
- Decorrelation stretch

Noise could be introduced during the image acquisition process or electronic transmission of the images.

Noisy image changes the pixel values of the original that affected the real image intensities.

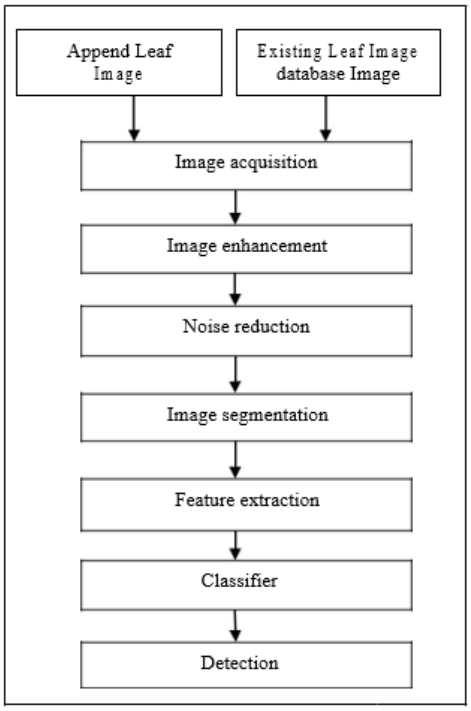

Fig. 4. Block diagram of leaf disease detection system using image processing

A. Leaf disease detection system using image processing techniques

Crops production rate are directly proportional to the healthy crops. Diagnosis and appropriate treatment of crop disease is the first essential requirement of the crop production process.

The farmer' s wrong diagnosis of crop disease causes pesticides spray improperly. The different image processing techniques are significantly used to observe the crop growth progress and disease diagnosis. The plant diseases occur in different parts of the plant. Generally, disease plant leaves change their colour, shape, size, texture etc. Hence, diagnosis and proper treatment suggestions of plant disease can be determine by using image processing techniques.

Image should be noise free for processing. Hence, noise reduction techniques and image enhancement are required for desirable processing.

Image segmentation and classification technique for finding the plant leaf diseases with very less computational efforts. This method can be identified the plant diseases at early stage or the initial stage.

3. Proposed method

The overview of the proposed methodology is shown in Figure 5.

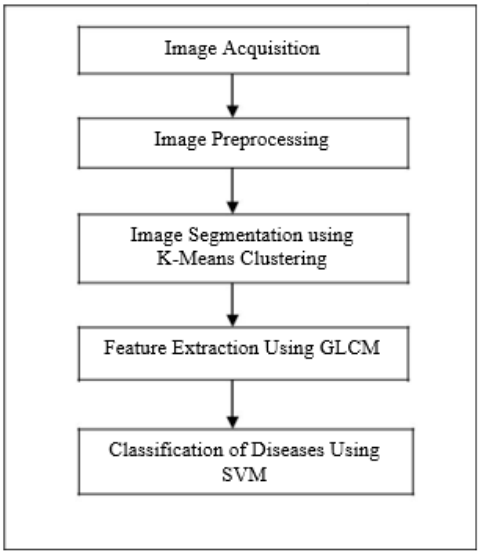

Fig. 5. Overview of the proposed method

A. Image Acquisition

The input image is then resized to 256x256 pixels. The construction of an image database depends on the required application. The image database has to be carefully constructed in that it generally decides the efficiency of the classifier and performance of the proposed method.

B. Image Pre-Processing

Image pre-processing is common name for operations with Images at the lowest level of abstraction both input & output are intensity images.

The aim of pre-processing is an improvement of the image data that suppress unwanted distortions or enhances some image features important for further processing.

To remove noise in image or other object removal, different pre-processing techniques is considered. Image clipping i.e. the image of the leaf is cropped to get the desired image region. Image smoothing is done using the smoothing filter.

C. Image Segmentation

Image segmentation is the process used to simplify the representation of an image into meaningful form, such as to highlight object of interest from background. Segmentation means the image will be divided into many parts having same features with some similarities. The segmentation can be done using various methods.

D. Feature Extraction

Identification of an object is done by using this method. Feature extraction of plants is done by using application of image processing. Color, texture, morphology, edges etc. are the features which can be used in detection of disease in plants.

After segmentation, the GLCM features are extracted from

the image. The GLCM functions characterize the texture of images by computing the spatial relationship among the pixels in the images.

E. Classification using Support Vector Machine (SVM)

The classification of images by using of neural network is done after the feature extraction method.

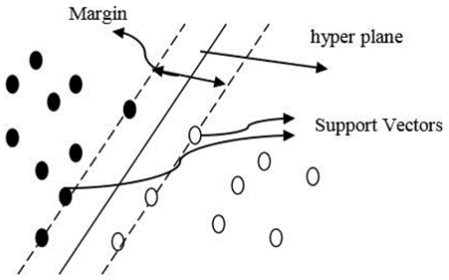

Fig. 6. Support Vector Machine Classifier

Support Vector Machine is kernel-based supervised learning algorithm used as a classification tool. The training algorithm of SVM maximizes the margin between the training data and class boundary. The resulting decision function depends only on the training data called support vectors, which are closest to the decision boundary as shown in Figure 6.

It is effective in high dimensional space where number of dimensions is greater than the number of training data. SVM transforms data from input space into a high-dimensional feature space using kernel function. The idea of support vector machine is to create a hyper plane in between data sets to indicate which class it belongs to.

The feature vectors of the database images are divided into training vectors and testing vectors. The classifier is trained on the training sets and applies it to classify the testing set. The performance of the classifier is measured by comparing the predicted labels and actual values.

4. Conclusion and future work

A method form for detection and classification of leaf diseases is implemented. The segmentation form of the diseased part is done. It's using K-Means segmentation. Then, GLCM texture features are extracted and classification is done using SVM.

The method is checked for detection of diseases in several leaves. Future work is to be carried out for classification of diseases in different plant species and to developing the classification accuracy.

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