Survey on Crop Disease Analysis using Soft Computing and Image Processing Techniques

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Abstract
Early disease detection is a major challenge in agriculture. It is beneficial for the social and economical aspects of the environment as well as for the economic aspects of the famers. The recent trends in the information lead to the development and usage of many techniques which can be directly used in the field of agriculture for the purpose of accurate early disease detection. The main objective of the paper is to focus on the area of plant pathology detection and classification only. The proposed algorithm begins with digital image of the infected or non-infected plants being acquired and on which the process of image processing is performed. Then the disease infected region are differentiated from the non-infected regions using methods such as segmentation, feature extraction and neural network based classification.

Keywords
Image processing, feature extraction, soft computing, Image acquisition, Image preprocessing, neural network.

1 Introduction

The agricultural land mass is more than just being a feeding source in today's world. Indian economy is highly dependent on agricultural productivity. Therefore in field of agriculture, early detection of disease in plants plays an important role. To detect a plant disease in very initial stage, use of automatic disease detection technique is beneficial. In India, farmers suffer a lot when quality and quantity of crops affected due to these diseases and as a result it affects the social as well as economical status of not only the farmers but also the whole country. The existing method for plant disease detection is simply naked eye observation by domain experts through which identification and detection of plant diseases is done. But this is impractical for large field and time consuming. At the same time, in some countries, farmers do not 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 conditions,[1,2] the suggested technique proves to be beneficial in monitoring large fields of crops. Automatic detection of the diseases by just analyzing the

symptoms from images of the plant leaves makes it easier to detect the diseases in an early stage and to prevent crop loss.
The image processing technique can be used in agricultural applications for different purposes like, to detect diseases in leaf, stem, fruit, to quantify affected area by disease, to find the shapes of affected areas, to determine color of affected areas [3, 4, 5].

2 Proposed technique

The methodological analysis of the present work is shown in figure 1. The work commences with clicking images using cameras or scanners with a fixed background to reduce the effect of noise. These images are made to undergo some pre-processing steps like filtering and segmentation to get the area of interest. Then different texture and color features are extracted from the processed images. Finally, the feature values are given as inputs to the ANN classifier to classify the given image.
The image processing can be used in agricultural applications for following purposes:

A. Image Acquisition: The first step is to capture the sample images using high quality camera form a fixed distance with a fixed background.

B. Image Pre-processing: In this step the acquired images are pre-processed before feature extraction. First the background of all the captured RGB images is made white to reduce computational complexities. Then the images are pre-processed using different techniques like image enhancement, image segmentation etc. Image segmentation is the process to simplify an image representation into something more meaningful and easier to analyze. It is used to extract the area of interest from the RGB images.

C. Image Database: The next step is to create a database that consists of all the images that would be required during training and testing purposes. The construction of an image database is clearly dependent on the application. [7] Such databases consisting of images facilitates better efficiency and simplification of the classifier.

D. Feature Extraction: In this step different color, shape and texture based features are extracted. Since the captured images are of different sizes, resizing those images may lead to loss of some valuable information. For this reason all the extracted features are made size invariant. [9]

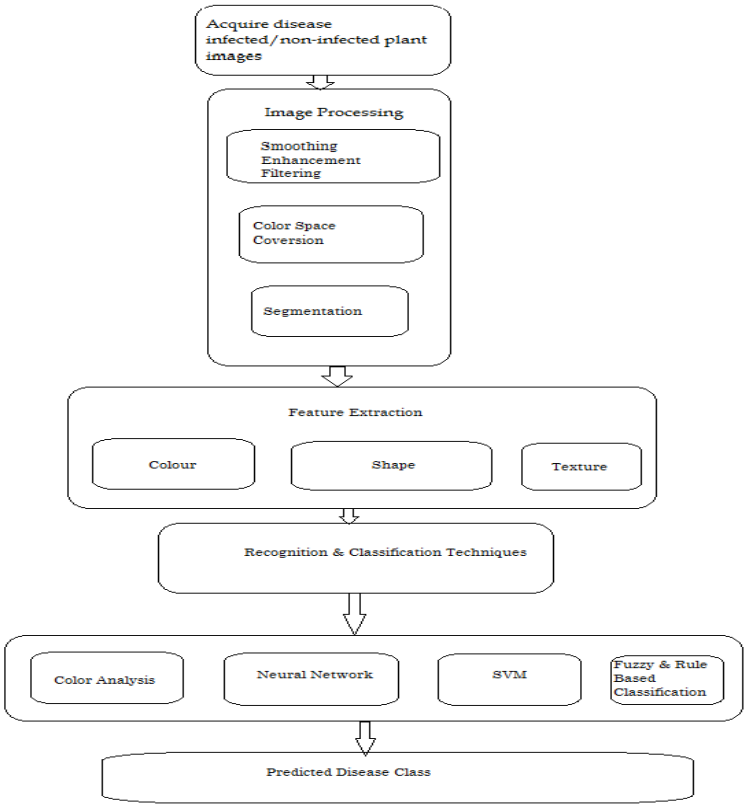

Fig 1: Flow chart of disease detection techniques.

E. Dominating Feature Set Selection: Depending on the type of disease and symptoms of the disease a number of features are extracted which may help to detect or classify the disease from the others. But it may happen that some of the extracted features do not contribute in deciding the type of disease or to classify the diseases. Taking those features in to consideration for decision may degrade the performance. For this reason dominating feature set is selected from the set of extracted features.

F. Detection & Classification: This method consists of two phases, (i) Training (ii) Testing. The first step is to divide the dataset in to sub-datasets which are individually required during training and testing phase for the developed system. In training phase, the selected feature values of the images are given as input to the classifiers such as Artificial Neural Networks and then the system is trained. In testing phase, the selected feature values taken from the examined images are given as an input to the system for detection and classification. An Artificial Neural Network(ANN) is an information processing paradigm which is based on the working of nervous system in our body. The key element of this paradigm is the novel

structure of the information processing system. It is consists of a high number of interconnecting processed elements called neurons, which work in together to complete a specific assigned task. ANNs, like people, learn by example. An ANN can be used to perform specific application, such as pattern recognition or data classification.

G. Analysis of the Existing Methods

In this section Table 1 shows the results of different techniques used to detect different diseases along with their experimental results as reported.

Table 1: Results of different existing methods

SL NO.	Techniques Used	Experimental Results
1	Baye's and SVM classifier , mean filtering technique and Otsu's algorithm [4]	Baye's – 68.1 % SVM – 79.5% accuracy
2	SVM method [3]	Accuracy 97.2 % on rice plant
3	Color co-occurrence and SVM classifier [3]	94% accuracy on 500 Plant leaves disease
4	K-mean and Otsu's method [2]	Accuracy between 83% to 94%
5	Fuzzy C-means [7]	63.5%
6	Eigen feature Regularization and Extraction Techniques [8]	Accuracy of 90% detection on fungal disease

3 Conclusions

The contributions of expert systems in the field of agricultural sciences are growing tremendously. To wind up all the information discussed above, it is an accurate technique for automatic detection and classification of plant diseases. From the above discussion it may be noted that using SVM and ANN for classification purposes provides better result with respect to other methods. Image pre-processing, feature extraction and feature selection plays a vital role in improving the performance of the expert systems. The work may be extended using different crops and different diseases of particular crops.

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