Development of Hybrid Technique for Plant Disease Detection using Singular Value Decomposition and Principal Component Analysis

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***Abstract* -** The image processing is the technique which is applied to process the digital information from the images. The plant disease detection is the technique which is applied to detect disease from the input images. In this work, technique is applied which is based on textural feature extraction, segmentation and classification. The glcm algorithm is applied which extract textural features from the image. The k-mean clustering algorithm is applied which segment input image. The SVM classifier is applied in the existing algorithm which will classify the input image into two classes. To improve performance of existing algorithm the SVM classifier will be replaced with KNN classification. This leads to improve accuracy of detection and also leads to classify data into multiple classes

I. INTRODUCTION

Image Processing - Image processing aims to improve the image data that suppress the distortions as well as enhances some features. It includes image resampling, image enhancement and noise removal. Noise is the result of errors in image acquisition.

Plant Diseases Detection in Plant - There are several diseases that affect plants with various losses. In this context, diagnosing diseases in an accurate and timely way is of the vital importance.

There are several ways to detect plant pathologies. Plant disease detection involves steps like Image processing, Image segmentation and feature extraction. Some diseases do not have any visible symptoms associated, or those appear only when it is too late to act. In those cases, normally some kind of sophisticated analysis, usually by means of powerful microscopes, is necessary. In other cases, the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans. The naked eye observation method is generally used to decide diseases severity in the production practice but results are subjective and it is not possible to measure the disease extent precisely. Back propagation, SVD, PCA are several algorithms of neural network which are used to recognize and classify various fungi diseases. Classifiers of Plant disease detection are as follows:

A. k-nearest neighbor

It is the simplest technique in which we identify the neighbors and determine to which class the points belong. A minimum distance is calculated between the points and other given points. As a classifier nearest neighbor does not need any training process. This method is mostly used in recognition processes. If k=1, sample is assigned to the class. The main disadvantage of this classifier is that only classification id done with the help of training data.

B. Suppport Vector Machine(SVM)

It is a nonlinear classifier used in pattern recognition problems. It provides good classification performance by non-linearly mapping input data to linearly separated data in some high dimensional space. It determines the hyper plane which divides the two classes. Hyper plane is determined by the samples closest to the margin. SVMs are also used for the multiclass classification

Main advantages of SVM are:

- It has high prediction accuracy.
- Its working is cumbersome when it contains errors.
- Complexity of SVM doesn't depend on the dimensionality of input space.

Drawbacks of SVM:

- It involves long training time.
- The large number of support vectors are used.

C. Artificial Neural Networks

Artificial Neural Networks are electronic models based on the neural structure of the brain. The brain basically learns from experience. It is natural proof that some problems that are beyond the scope of current computers are indeed solved by small energy efficient packages. This brain modeling also promises a less technical way to develop machine solutions. One of the most common applications of NNs is in image processing. Some examples would be: identifying hand-written characters; matching a photograph of a person's face with a different photo in a database; performing data compression on an image with minimal loss of content. Other applications could be: voice recognition, RADAR signature analysis, stock market prediction. All of these problems involve large amounts of data, and complex relationships between the different parameters. In principle, back propagation is used to train networks with any number of hidden units. In fact, the network does not have to be

organized in layers - any pattern of connectivity that permits a partial ordering of the nodes from input to output is allowed. In other words, there must be a way to order the units such that all connections go from the input to the output. Connection pattern must not contain any cycles. Networks that respect this constraint are called feed forward networks; their connection pattern forms a directed acyclic graph.

D. Self-organizing map

This map is based on unsupervised learning. It was developed by professor Kohonen. They use neighborhood function to preserve the properties of input space. It contains components called nodes. The nodes are arranged in Two-dimensional space in a rectangular grid. We have to find the node with smallest distance weight vector.

E. Probalistic neural networks(PNNs)

It is a feed forward neural network. It is mainly used in classification problems. The first layer calculates the distance from input vector to training vector. The second layer sums the output and produces the net output. The main disadvantage is storage space.

F. Fuzzy logic

This classifier make use of the Fuzzy sets. They have very high speed and they are preferred in cases where there is limited precision in the data values. The fuzzy technique and the problem decides the representation and processing. It has three main steps: image fuzzification, modification of membership values, image defuzzification. The main drawback is that it gives poor performance when there is limited amount of information

Principal Component Analysis (PCA) - PCA finds a linear projection of high dimensional data into a lower dimensional subspace such as: The variance retained is maximized. The least square reconstruction error is minimized. Principal component analysis (PCA) is a widely used dimensionality reduction technique in data analysis. Its popularity comes from three important properties. First, it is the optimal linear scheme for compressing a set of high dimensional vectors into a set of lower dimensional vectors and then reconstructing. Second, we compute the model parameters directly from the data third, compression and decompression are easy operations to perform given the model parameters – they require only matrix multiplications.

Radial basis function - Radial basis functions are feed-forward networks .The hidden layer performs a non-linear transformation of input space. The resulting hidden space is typically of higher dimensionality than the input space – The output layer performs linear regression .These are real-valued function whose value depends only on the distance from the origin. . RBFs are also used as a kernel

Algorithm steps

1. Choose the centers randomly from the training set.
2. Compute the spread for the RBF function using the normalization method.
3. Find the weights using the pseudo-inverse method.

II. REVIEW OF LITERATURE

Mr.Nitin P.Kumbhar, "Agricultural plant Leaf Disease Detection Using Image Processing", 2013 - In this paper they introduced [1] the detection of plant leaf is a very important factor. Most plant diseases are caused by fungi, bacteria, and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells .The developed processing scheme consists of four main steps, first a color transformation for the input RGB image is created, this RGB is converted to HSI because RGB Then green pixels are masked and removed using specific threshold value, then the image is segmented and the useful segments are extracted, finally the texture statistics is found Finally the presence of diseases on the plant leaf is evaluated.

Mr. Pramod S. landge et.al , "Automatic Detection and Classification of Plant Disease through Image Processing", 2013 - In this paper they proposed [2] and found a software solution for automatic detection and classification of plant diseases through Image Processing. Farmers in rural India have minimal access to agricultural experts, who can inspect crop images and render advice. Delayed expert responses to queries often reach farmers too late. This paper addresses this problem with the objective of developing image processing algorithms that can recognize problems in crops from images, based on colour, texture and shape to automatically detect diseases or other conditions that might affect crops and give the fast and accurate solutions to the farmer with the help of SMS. The design and implementation of these technologies will greatly aid in selective chemical application, reducing costs and thus leading to improved productivity, as well as improved produce.

Anand.H.Kulkarni and Ashwin Patil R. K, "Applying image processing technique to detect plant diseases", 2012 - In this paper they proposed [3] a methodology for detecting plant diseases early and accurately, using diverse image processing techniques. Farmers experience great difficulties in changing from one disease control policy to another. Relying

on pure naked-eye observation to detect and classify diseases can be expensive various plant diseases pose a great threat to the agricultural sector by reducing the life of the plants. The present work is aimed to develop a simple disease detection system for plant diseases. The work begins with capturing the images. Filtered and segmented using Gabor filter. Then, texture and color features are extracted from the result of segmentation. Experimental results showed that classification performance by ANN taking feature set is better with an accuracy of 91%. In this project work the area of plant diseases recognition is introduced. The system developed is for plant diseases recognition.Therefore proposed approach which is based on Gabor filter for feature extraction and ANN classifier for classification got a better results and recognition rate up to 91%. An ANN based classifier is adopted which uses the combination of color and texture features to recognize and classify different plant diseases. The results are encouraging and promise the development of a good machine vision system in the area of recognition and classification of plant diseases. The proposed approach can significantly support in recognizing normal and affected produce.

Haiguang Wang, Guanlin Li, Zhanhong Ma, Xiaolong Li, "Image Recognition of Plant Diseases Based on Backpropagation Networks", 2012 - In this paper they proposed [5] to achieve automatic diagnosis of plant diseases and improve the image recognition accuracy of plant diseases, two kinds of grape diseases (grape downy mildew and grape powdery mildew) and two kinds of wheat diseases (wheat stripe rust and wheat leaf rust) were selected as research objects, and the image recognition of the diseases was conducted based on image processing and pattern recognition. It also included image compression image cropping, image denoising. Back propagation networks were used to identify the grape diseases and wheat disease the accuracy achieved during detection was 100% and the dimensions of the features were reduced using PCA.

Piyush Chaudhary et.al "Color Transform Based Approach for Disease Spot Detection on Plant Leaf", 2012 - In this paper, they proposed [6] an algorithm for disease spot segmentation .This is the first and important phase for automatic detection and classification of plant diseases. Disease spots are different in color but not in intensity, in comparison with plant leaf color. So we color transform of RGB image can be used for better segmentation of disease spots. Image smoothing is done by median filter. Finally Ostu method is applied to detect disease spot.

TOPIC NAME	YEAR	DESCRIPTION	CONCLUSION
Agricultural plant Leaf Disease Detection Using Image Processing	**2013**	.The developed processing scheme consists of four main steps, first a color transformation for the input RGB image is created, this RGB is converted to HSI because RGB	Texture statistics is found Finally the presence of diseases on the plant leaf is evaluated.
Automatic Detection and Classification of Plant Disease through Image Processing	**2013**	This paper addresses this processing algorithms that can recognize problems in crops from images, based on colour, texture and shape to automatically detect well as improved produce.problem with the objective of developing image	The design and implementation of these technologies will greatly aid in selective chemical application, reducing costs and thus leading to improved productivity, as well as improved produce.
Applying image processing technique to detect plant diseases	**2012**	The present work is aimed to develop a simple disease detection system for plant diseases. The work begins with capturing the images. Filtered and segmented using Gabor filter. Then, texture and color features are extracted from the result of segmentation	The results are encouraging and promise the development of a good machine vision system in the area of recognition and classification of plant diseases. The proposed approach can significantly support in recognizing normal and affected produce..
"Image Recognition of Plant Diseases Based on Backpropagation Networks",	**2012**	It also included image compression image cropping,image denoising.Back propagation networks were used to identify the grape diseases and wheat diseasethe accuracy achieved during detection was 100% and the dimensions of the features were reduced using PCA	.Disease detection accuracy was 100%
"Color Transform Based Approach for Disease Spot Detection on Plant Leaf",	**2012**	In this paper, they proposed an algorithm for disease spot segmentation So we color transform of RGB image can be used for better segmentation of disease spots. Image smoothing is done by median filter. Finally Ostu method is applied to detect disease spot. segmentation.	It introduced improved method of disease detection.

III. REFRENCES

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