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ABSTRACT

The main purpose of this paper provides a survey on different plant disease detection techniques in the area of image processing and their comparison. As we know India is an agricultural country and most of its population depends on agriculture for their living. To make their lives comfortable and easy, it is important to focus in the area of farming with new technologies. By introducing new technologies, crop production can be enhanced to great extent. To overcome the problems related with plant and crop diseases, an automatic plant disease detection technique with the help of image processing and neural network approach can be used. There are many types of diseases found in plants. To detect these diseases there is requirement of different patterns. There are different classifications techniques exist such as Artificial Neural Network (ANN), Back Propagation (BP) Network, Support Vector Machine (SVM) and Radial Basis Function (RBF) Neural Network.

KEYWORDS:Image Processing, Neural Networks, Classification, Disease Detection, Feature Extraction.

INTRODUCTION

Agriculture is an important part of our country as about 70% of the population depends on the farming for their living. Due to loss in the production, many farmers attempt suicides which is a serious issue. This issue can be controlled to some extent by using new technologies that will help farmers to improve the harvesting [9].

An image comprises a set of points or picture elements stored as an array of numbers in a computer [6]. Image processing is the study of any algorithm that takes an image as input and returns an image as output. It includes image display and printing, image editing and manipulation, image enhancement, feature detection and image compression. Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image.

Plants have become an important source of energy, and play an important role in tackling many environmental issues such as global warming. There are several diseases that affect plants with the potential to cause devastating economical, social and ecological losses.

There are several ways to detect plant diseases. Some diseases cannot be detected with naked eyes, or those appear only when it is too late to act upon them. Traditional methods to identify and detect plant diseases are tiresome and time-consuming [4]. A common approach in this case is the use of remote sensing techniques that explore multi and hyper spectral image captures. The methods that adopt this approach often employ digital image processing tools to achieve their goals. Image processing technology in the agricultural research has made significant development. To recognize and classify fungi disease an automated system has been implemented using algorithm such as back propagation, PCA and ANN techniques of neural networks.

LITERATURE REVIEW

This review paper provides a survey on different plant disease detection techniques which are given in preceding papers. In this paper [8] Support Vector Machine (SVM) is implemented which contains two datasets-training dataset and train dataset. Here training image is compared with the stored image in the dataset. Then filtering is applied and both images will be compared. After that image masking will be done which will find healthy image, diseased image and histogram of the images. Finally healthy and diseased area will be compared and result will be shown in the percentage of fraction of disease with disease name mentioned.

In this paper [7] Spatial Gray-level Dependence Matrices (SGDM) method is used. Here input RGB image is first converted into Hue Saturation Value (HSV) format. Then green pixels are masked and removed. Then infected portion of the leaf is extracted. Now the infected region is segmented into patches of equal size. Patches with more than 50% of information are taken into consideration for analysis. SGDM is used to extract statistical texture features.

In this paper [2] Gabor filters and Artificial Neural Network (ANN) is used for the implementation. Firstly images are captured and an image database is created which is used for the classification. Images for detection firstly segmented and then feature extraction is applied using Gabor filter. Then recognition is done which is having two steps raining and classification. Classification is done using ANN.

In this paper [3] K-means Clustering method and Neural Network Approach is used. First of all a device independent colour space transformation structure is created which converts colour values into colour space. K-means clustering method is used to partition a leaf into four clusters in which one or more clusters can contain more than one disease. Then Color Co-occurrence Method (CCM) is used for feature extraction. Finally pre-trained Neural Network is used for classification which acts as a statistical classifier.

In this paper [1] automatic leaf recognition and leaf disease grading is done for various leaves of the plants. The proposed system has been classified into two phases:- (1) Training Phase, which includes Image Acquisition, Image Pre-Processing, Feature Extraction and Artificial Neural Network based training and (2) Testing Phase, which includes Test Image Acquisition, Test Image Pre-processing, Feature Extraction, K- means based Segmentation and Classification, Percentage Infection Calculation and Disease Grading using Fuzzy Logic Toolbox.

In this paper [13] a classifier is designed for fungal diseases detection in wheat plants by pattern recognition techniques. Unhealthy regions were segmented by Otsu thresholding method and morphological operators and their texture, colour and shape features were extracted. To reduce dimensionality of the features space, significant features are selected by minimal-redundancy-maximal-relevance criterion (mRMR) that is based on mutual information. A radial basis function (RBF) neural network was employed to classify wheat diseases.

TECHNIQUE

In digital image processing image is processed which is taken as input and will provide us the output results on extracted image. This work is done on remote way and can perform work multi times in short period of time. For detection of diseases artificial neural network approach has been used. And had many types of algorithms which can perform the detection of the diseases. Back propagation, support vector machine and principle component analysis are few algorithms of artificial neural network approach. These algorithms have a great thing of feature extraction which is further in three subparts that is shape, colour and texture [8]. Steps for the process are as:

Image Acquisition:

Images are acquired with the help of a digital camera. Images are in RGB form. Color transformation structure is - applied for RGB images of the plants in different techniques [10].

Image Pre-processing:

Image pre-processing techniques are applied to remove noises and other unwanted objects from the images [10]. It includes shade correction, removing artifacts, image clipping, image smoothing, image enhancement formatting, filtering, binarization and edge detection [5, 10, 12].

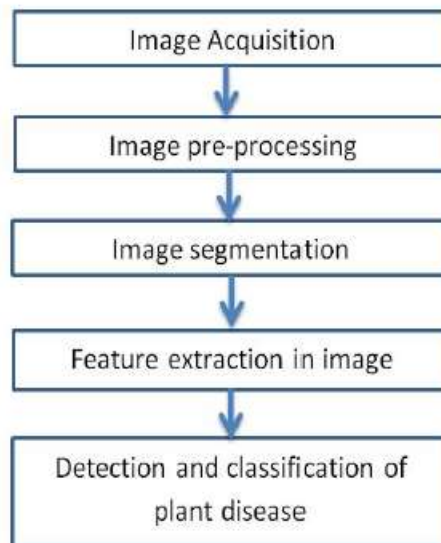


Fig1. Steps for the Plant Disease Detection

Image Segmentation:

Image segmentation means partitioning of an 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 [10].

K-means clustering is used to partition the leaf image into four clusters in which one or more clusters contain the disease in case when the leaf is infected by more than one disease. The k-means clustering algorithms tries to classify objects (pixels) based on a set of features into K number of classes. The classification is done by minimizing the sum of squares of distances between the objects and the corresponding cluster or class centroid [3].

Feature Extraction:

Feature extraction plays an important role for identification of an object. In many application of image processing feature extraction is used. Color, texture, morphology, edges etc. are the features which can be used in plant disease detection [10].

Color co-occurrence Method:

In this method both color and texture are taken into account to get an unique features for that image. For that the RGB image is converted into the HSI translation [10] . This method is used in [3] .

The CCM method involved three major steps. First, transformations of an RGB (Red, Green, Blue) color representation of an image to an equivalent HSI (Hue, Saturation, Intensity) color representation. Once this process is completed Color Co-occurrence Matrices from the HSI pixels is generated. Lastly, texture features from the CCM matrices are generated [5] .

mRMR Method:

A Max-Dependency, Max-Relevance and Min-Redundancy (mRMR) criteria is used for feature selection that is based on Mutual Information. Before using mRMR for continuous variables, first, must be discretized data and use the mRMR for discrete variables. Therefore data discretized based on their mean values and standard deviations (std) and thresholded at $\text{mean} \pm \alpha * \text{std}$, where the alpha value usually range from 0.5 to 2(in this study, $\alpha=0.5$) [13].

Classification:

In plant leaf classification leaf is classified based on its different morphological features. Some of the classification techniques used is Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, k-Nearest Neighbor Classifier. Plant leaf disease classification has wide application in Agriculture [11].

k-Nearest Neighbor:

k-Nearest Neighbor is a simple classifier in the machine learning techniques where the classification is achieved by identifying the nearest neighbors to a query examples and then make use of those neighbors for determination of the class of the query.

Support Vector Machine:

Support Vector machine (SVM) is a non-linear Classifier. This is a new trend in machine learning algorithm which is used in many pattern recognition problems, including texture classification. In SVM, the input data is non-linearly mapped to linearly separated data in some high dimensional space providing good classification performance. SVM maximizes the marginal distance between different classes. This method is used in [8].

ANN:

The feature vectors are considered as neurons in ANN. The output of the neuron is the function of weighted sum of the inputs. The back propagation algorithm, modified SOM; Multiclass Support vector machines can be used [10]. This method is used in [2].

Fuzzy Logic:

Fuzzy Logic classifiers are classification systems that make use of fuzzy sets or fuzzy logic which convert real-world data values into membership degrees through the use of the membership functions so that these rules then can be used for the classification process. This method has used in [1].

COMPARISON TABLE

Author	Year	Description	Outcome
Rajleen Kaur, et al [8]	2015	SVM is implemented.	Name of disease and disease area.
Prof. Sanjay B. Dhaygude, et al [7]	2013	SGDM is used to extract statistical texture features.	Presence of disease on plant leaf is evaluated.
Anand.H.Kulkarni, et al [2]	2012	Gabor filter and Artificial Neural Network (ANN) is used.	Accuracy of 91%.

Dheeb Al Bashish, et al [3]	2010	K-means Clustering method and Neural Network Approach is used.	Precision of 93%.
Aakansha Ratogi, et al [1]	2015	Automatic leaf recognition and leaf disease grading is done.	Percentage of infection and grading using fuzzy logic toolbox.
Zahra Sarayloo, et al [13]	2015	Otsu thresholding method and mRMR feature extraction method is used.	Classification of wheat diseases with the accuracy of 98.3%.

CONCLUSION

To detect and classify diseases of various plants, an accurate and successful method should be used and this can be done with the help of image processing and neural network approach. This paper reviewed various techniques which has been already used. These techniques are related to segmentation, feature extraction and classification. From these methods, identification and classification of various plant diseases has been accurately done. But there are still some chances for the improvements in the existing techniques.

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