Plant Disease Detection using Image Processing: A Review

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***Abstract*— Plant diseases cause major losses in terms of production, economy, quality and quantity of agricultural products. Since a large portion of Indian economy is dependent on agricultural yield, there is a need to control the loss incurred by plant diseases. The plants need to be monitored from a very initial stage of their life-cycle to avoid such diseases. In olden days identification is done manually by the experienced people but due to the so many environmental changes the prediction is becoming tough. So we can use image processing techniques for identification of plant disease. Generally we can observe the symptoms of disease on leafs, stems, flowers etc. So here we use leafs for identification of disease affected plants. This paper reviews the potential of the different classification techniques that can be used for plant leaf diseases classification. Crop protection in large frames is done by using computerized image processing technique that can detect diseased leaf using colour information of leaves. There are so many classification techniques such as Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic. Selecting a classification method is always a difficult task because the quality of result can vary for different input data. Plant leaf disease classifications have wide applications in various fields such as in biological research, in Agriculture etc. This paper provides an overview of different classification techniques used for plant leaf disease classification.**

Keywords— Image processing, Plant Disease detection, Classification, SVM, GLCM.

I. INTRODUCTION

In developing countries like India, the economy is mainly depends on agriculture. Due to plant diseases the quality and quantity of agriculture product is reduced. Diseases to the plants caused mainly by the fungi and bacteria and the lifecycle of micro-organism is unable to predict. Some of the plant disease do not have visibility during early stage it only appears at that final stage. The purpose of agriculture is not only to feed ever growing population but it is an important source of energy and a solution to solve the problem of global warming. Plant disease diagnose is very important in earlier stage in order to cure and control the disease. In this method experts are involved who have the ability to detect the changes in leaf color. Many times different experts identify the same disease as the different disease. This method is expensive as it requires continuous monitoring of experts.

At present, the diagnosis of crops diseases mostly depends on manual recognition, but some problem occurs, on the one hand, it can be mistakenly diagnosed by farmers because they usually judge the symptoms by their experiences. On the other hand, the disease treatment may be dallied over because the technician or expert can't go to the locale to diagnose in good time. Relative to the person's vision, computer image processing technique take on some characteristics such as speediness, huge information and distinguish small diversity which can't be distinguished by person's eyes, so image processing technique can help farmers to judge the reasons and severity of crop diseases, and it takes on important theoretical and practical significance for improving the automatic management of crop.

Digital image processing consists of various methods with the help of computer Aided Diagnosis tool in order to avoid factors such as noise and distorted signal in entire process. Image processing is an important factors in agriculture which is used to analyse the plant disease with greater accuracy. In order to find out plant diseases at early stage which is extremely effective to do Identification and Recognition. The harm caused by developing, re-rising and far reaching species is critical in plant frameworks and prompts potential misfortune monetarily. The infections are spreading overall making harm the ordinary working of the plant and furthermore harming the money related condition by fundamentally diminishing the amount of plants. Depending on the applications, many systems have been proposed to solve or at least to reduce the problems, by making use of image processing, pattern recognition and some automatic classification tools.

II. LITERATURE REVIEW

Ajay A. Gurjar et al. (2012**)** proposed an approach that regularizes and extracts eigenfeature from cotton leaf image [1]. Scatter matrix is developed which is within class type, now this matrix is decomposed .into various subspaces, related to various diseases This technology gives more accuracy than other detection feature technology.

Devaraj et al. (2019) presented that farming was not just a technique as it was the main source of food for ever growing population [4]. Almost 70% of the total population of Asian nations was dependent on agriculture for their livelihood. However, different types of diseases reduced the quality of crop. The major purpose of this work was to develop a software system for the automatic classification and detection of disease.

Diptesh Majumdar et al. (2015) proposed in this paper the detection of the rust in the plants an early detection and recognition techniques [5]. Timely administration choices are facilitated for proper evaluation. In order to automate the process and to detect the infectious disease easily an integrated image processing and analysis system has been developed .All this is done under the light of artificial neural network (ANN).

Geng Ying et al. (2008) presented an approach for recognition of crop disease, the author studied the methods of image processing [6]. For that purpose they used cucumber powdery mildew, speckle and downy mildews as study samples and to relate the details of effect of simple and medium filter.

Herbon et al. (2018) used different techniques for detecting the leaves' infections in automatic manner [7]. Early and precise recognition of plant infections was imperative for crop quality and production. The cost of plant diseases and usage of unnecessary pesticides could be reduced by well-timed discovery and interfering. Here, the images of various leaves were collected. In order to fetch valuable attributes from the leaf pictures, an approach named Transfer learning technique had been implemented.

Prakash et al. (2017) used various image processing approaches to identify plant diseases [10]. Using picture scrutiny and classification algorithms to detect and classify leaf diseases was the main purpose of this work. K-means clustering algorithm was used for segmenting leaf image to identify infectious regions. Gray-Level Co-Occurrence Matrix (GLCM) features were used for extracting texture features. A classifier named Support Vector Machine (SVM) was used for classification purpose.

Rajleen Kaur et al. (2015) proposed in this paper SVM classifier that has been utilized for the detection of plant disease [12]. To overcome the issues of detection accuracy and in neural network approach support vector machine approach is utilized. The automatic detection of the disease in the plants, leaf and crops are proposed in this paper. The proposed SVM has two following data sets such as training dataset and train dataset.

Sachin D. Khirade et al. (2015) proposed in this paper the prevention of the plant diseases as it lead to economical growth of the overall nation, as infectious disease degrades the quality of the food and yield losses in the agricultural field [13]. It increases the quantity and the quality of the agricultural product. The basis of the sustainable agriculture is the detection of the disease as well health monitoring. It is not possible for human to monitor day and night and note all the changes that are occurred in the plants as it consume excessive processing time.

Sukhvir Kaur et al. (2018) proposed development of automatic disease detection and classification system is significantly explored in precision agriculture [15]. A rule based semi-automatic system using concepts of k-means is designed and implemented to distinguish healthy leaves from diseased leaves. Experiments are performed by separately utilizing colour features, texture features, and their combinations to train three models based on support vector machine classifier.

Stephen Gang Wu et al. (2007) introduced a neural network approach for plant leaf recognition [16]. The computer can automatically classify 32kinds of plants via the leaf images loaded from digital cameras or scanners. PNN is adopted for it has fast speed on training and simple structure. 12 features are extracted and processed by PCA to form the input vector of PNN.

Table I.
Comparison of different techniques

S.No.	Author's Name	Detection Algorithms	Results
1	Sukhvir Kaur et al.	K-means clustering and SVM Classifier	• The proposed system utilises three SVM classifiers. • A rule based semi-automatic system using concepts of k-means is designed and implemented to distinguish healthy leaves from diseased leaves. In addition, a diseased leaf is classified into one of the three categories (downy mildew, frog eye, and Septoria leaf blight). • Average classification accuracy reported is ~90%.
2	S. Phadikar et al.	Baye's and SVM classifier , mean fiitering technique and Otsu's algorithm	• Proposed an approach for classifying different types of rice diseases by extracting features from the infected regions of the rice plant images important features are selected using rough set theory (RST) to minimize the loss of information. • Baye's – 68.1 % SVM – 79.5% accuracy.
3	Stephen Gang Wu et al.	Probablistics Neural Networks (PNN)	• Employed Probabilistic Neural Network(PNN) with image and data processing techniques to shape matching classification . • Compared to other approaches, the algorithm is an accurate artificial intelligence approach which is fast in execution and easy in implementation. • Accuracy of 90% on 32 kinds of plants.
4	Geng Yao et al.	SVM method	• Using the method of image processing, an approach is presented for the recognition of crop disease. • Accuracy of 97.2 % on rice disease plant.
5	Ajay A. Gurjar et al.	Eign feature Regularization and Extraction Techniques	• Provided an approach that regularizes and extracts eigenfeature from cotton leaf image. • Accuracy of 90% detection on fungal disease.

III. TECHNIQUES ON IMAGE PROCESSING

Neural Networks:

This is the strategy to segmentation of the photographs into leaf and background within the following variety of size and color options are extracted from each the RGB and HSI representations of the image. Those parameters are finally fed to neural networks and applied mathematics classifiers that are accustomed confirm the plant condition. The method uses many color representations throughout its execution. The separation between leaves and background is performed by an MLP neural network, that is including a color library designed a priori by suggests that of an unsupervised self-organizing map (SOM). The colors gift on the leaves are then clustered. A genetic algorithmic program determines the quantity of clusters to be adopted in every case.

Fuzzy classifier:
The method tries to spot four totally different organic process deficiencies in feather palm plants. The image is segmental consistent with color similarities, however the authors didn't offer any detail on however this can be done. Once the segmentation, variety of color and texture options are extracted and submitted to a fuzzy classifier, which, rather than outputting the deficiencies themselves, reveals the amounts of fertilizers that ought to be accustomed correct those deficiencies.
Color analysis:
The method aims to sight and discriminate among four sorts of mineral deficiencies (nitrogen, phosphorus, potassium and magnesium). The tests were performed victimization fava bean, pea and yellow lupine leaves. Before the color analysis, the photographs are born-again to the HSI and L*a*b* color areas. The color variations between healthy leaves and also the leaves underneath take a look at then confirm the presence or absence of the deficiencies. Geometer distances calculated in each color areas quantify those variations.
Feature-based rules:
Methods to spot and label 3 totally different types of diseases that have an effect on paddy crops. As in several different strategies, the segmentation of healthy and morbid regions is performed by suggests that of threshold. The authors tested two types of threshold. Otsu's and native entropy, with the most effective results being achieved by the latter one. Afterwards, variety of form and color options are extracted. Those options are the premise for a collection of rules that confirm the sickness that most closely fits the characteristics of the chosen region.

IV. METHODOLOGY

Digital signal processing is the methodology to achieve fast and accurate result about the plant leaf diseases. It will reduce many agricultural aspect and improve productivity by detecting the appropriate diseases. For diseases detection, image of an infected leaf should examine through the set of procedures. Input image should pre-processed then its feature should be extracted according to the dataset. After then some classifier techniques should be used to classify the diseases according to the specific data set.

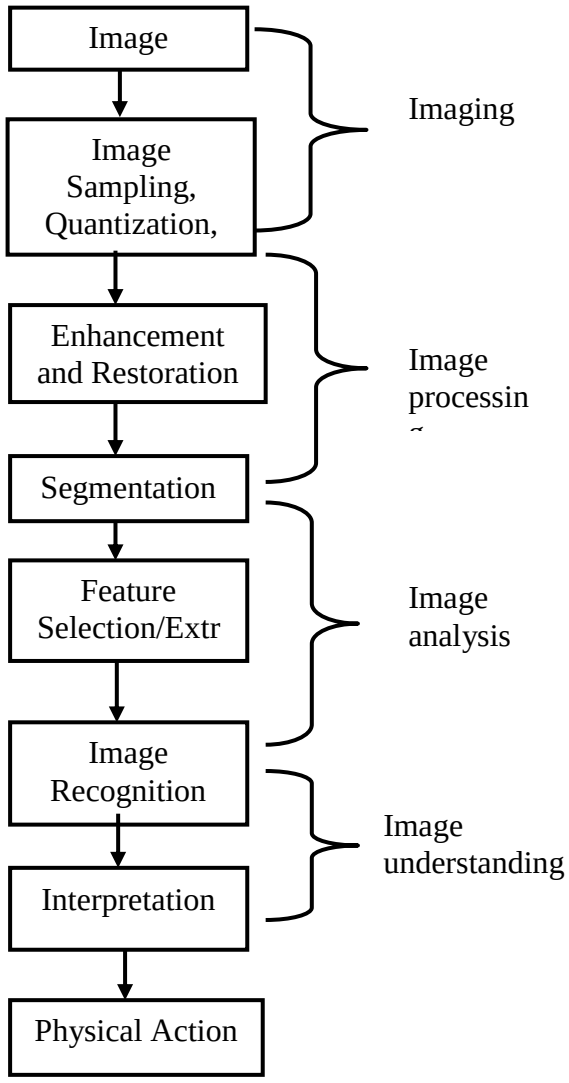

Fig. I Image processing block diagram

V. CONCLUSIONS

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 reviews and summarizes various techniques of plant disease detection using image processing that have been used by a number of researchers in the past few years. These techniques are used to detect if the leaves are healthy or diseased. This review paper concludes that these disease detection techniques have the ability besides having some limitations. Therefore, there is a lot that can still be done in this field for enhancement of the existing works.

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