Various Approaches for Plant Disease Detection

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Abstract- Plant diseases are quite natural because of environment and climate conditions. Diseases are often difficult to regulate. To scale back the loss timely detection of disease is necessary. Automated detection of plant leaf disease is advantageous because it reduces the expense and time required in monitoring large fields. This paper provides survey on various plant leaf disease classification techniques.

Indexed Terms- Deep Learning Techniques, Disease Identification, Image Processing, Machine Learning Techniques.

I. INTRODUCTION

The economic system of India is heavily reliant on agriculture, and plant leaf disease identification, classification, and reputation play a critical role in this domain. The quantity, excellent or manufacturing of the respective agricultural area particularly relies upon on the right care, now no longer imparting right care can reason large consequences on plants[7].

Fungi, bacteria, and viruses are responsible for the majority of plant diseases. Visual surveillance takes a long time to identify plant diseases and at the same time inaccurate and may be completed best in restrained areas. Using an automated detection method, on the other hand, will need far less effort, time, and offers better accuracy. In plants, few common diseases are Powdery mildew, Bacterial spot, Late blight, Early blight, mold, septora leaf spot, brown and yellow spots, early and late scorch and other fungal, viral and bacterial diseases [7,11].

We have surveyed numerous types of plant diseases detection techniques. There are two main approaches for detecting plant disease. Deep learning techniques and Machine learning techniques. Image processing isutilized to assess the color difference in the affected area affected region and to measure the region of disease. The primary objective of this work is to offer survey on various plant disease detection systems which can enhance agricultural production [11].

II. RELATED WORK

Several methods for detecting plant leaf disease have been proposed. In [1] a disease detection system for grape leaves is developed. For classifying leaves into healthy, rot, esca, and leaf blight, machine learning approaches such as Support Vector Machine (SVM), adaboost, and Random Forest were applied. The leaf is segmented from the background image using the grab cut segmentation approach. The segmentation is done using two separate ways in this case by using semi supervised technique and by global thresholding. Random Forest classifier is used in [2] for identification of sunflower leaf diseases. The primary goal of this study is to identify diseases like powdery mildew, bacterial leaf spot, downy mildewand black spot of sunflower leaves. The image is segmented using the K means + + clustering method and the watershed algorithm. Total of 19 feature values of colour and texture feature are used. A system for classifying grape leaves into healthy and non-healthy is proposed in [4], features like colour and texture are acquired from the leaf image and are classified by utilizing K-Nearest Neighbour (KNN) and Support Vector Machine (SVM).Plant leaf disease identification using K means segmentation and Multi SVM is proposed in [7].It has four steps, First RGB images are converted into HIS form next image is segmented by utilizing K-means clustering then color, texture and shape features are extracted and finally extracted features are given to multiclass SVM for the classification.

An overview of various disease classification algorithms which can be used to detect plant leaf disease and even an algorithm for image segmentation.is proposed in [11].The algorithms and methodologies were tested on crops such as jute, okra, grapes, and paddy.[14] uses a data set of bacterial spot, black rot, rust, and healthy leaves to train the resnet

model, and then applies the transfer learning method to resnet to create a high-efficiency plant disease detection model. KNN based plant disease detection is proposed in [19] the first stage includes pre-processing, second stage includes leaf segmentation, third stage includes feature extraction and then classification is done in the fourth stage. These are the four phases that are used to classify the type of disease. Whereas pre-processing removes the noise, segmentation separates the damaged area of the leaf image. KNN algorithm is used to find solutions in both classification and regression. Multi-Support Vector Machine is utilized in [20] to classify the cotton leaf diseases, flaws in crops are determined by using automatic images of the crops at beginning stage. Image processing has been implemented to get the image of leaves at very beginning stages for the categorization of cotton leaf disease. In [3] an attempt is made to identify diseases present in the salad cucumber leaves. Alternaria leaf blight, leaf spot, bacterial wilt, cucumber mosaic virus (CMV), cucumber green mottle mosaic, leaf miner are frequent diseases which are found in salad cucumber. In this study, K-means clustering and Support Vector Machine (SVM) are employed to solve this problem.[5] describes a digital image processing-based system for detecting fungi-caused disease in maize leaves with the goal of segmentation of the maize leaf. Where the sobel operator is used to extract shape features. The disease is detected using a Multi-Support Vector Machine technique with a Radial Basis function. Binary classification technique based on SVM for improving the classification of the leaf diseases is proposed in [6]. First the input is taken in the form of RGB before being turned into LAB form. When the background light above the image varies, the HSI image does not change. The database now includes HSI image characteristics. For a larger space point, SVM is used for classification. Image analysis and classification strategies for the identification and categorization of leaf diseases are proposed in [8]. Plant leaf diseases are detected using image processing techniques. Pre-processing, segmentation, feature extraction, and classification are the four sections of the framework. GLCM is used to retrieve texture features, while SVM is used to classify them. In different stages of growth, fungal infections such as early and late blight have a significant impact on potato crops. [9] presents potato disease management approaches that are both efficient and automated. The images of leaves are taken and analysis is performed and then classified as healthy or unhealthy. Performance of classifiers SVM, Random Forest and the same test data set of potato leaves is used for ANN. Using k-means segmentation, the plant diseases are discovered and segmented in [10]. Color texture features were retrieved from segmented regions, and these extracted features were fed into ANN and SVM classifiers. The results are found more accurate in SVM. Linear characteristics and luminance image of leaf skeleton is detected in [12]. These diseases are discovered in grape leaves, and GLCM characteristics are extracted and used to categories the diseases. These diseases are identified using KNN classifier. Leaf disease detection in various obsolete fruits is proposed in [13]. Diseases such as orange humbling, for apple plants apple black rot, cedar rust and apple scab and for cherry plants powdery mildew and for grape leaf grape black measles, black rot, leaf blight and for peach plants bacterial spot and leaf scorch for strawberry plants are identified by using image processing and CNN classification. The impacted leaf area is detected using an adaptive snake model in [15]. First affected area should be segmented and after obtaining absolute segmentation the background should be removed through optimization and then Adaptive Snake approach should be applied to identify the disease. Identification of black measles disease in grape leaves is proposed in [16]. Here mathematical morphological operations followed by Global Thresholding are performed in order to accurately avoid the noisy pixels. Features extracted are given into SVM for classification. The Leaf GAN model is used in [17] to create training images for detecting grape leaf disease. For feature extraction, a classifier system based on a dense connection technique is also used. Atlast a deep regret loss function is applied. Random Forest based leaf diseases classification is proposed in [18]. Feature extraction method is applied on images for training the algorithm. Various machine learning algorithms are applied on training data to find the most accurate one.

III. GENERAL METHODOLOGY

Image acquisition, image pre-processing, segmentation, feature extraction and classification are

all part of the plant leaf disease detection process. Figure 1 depicts the overall flow of events.

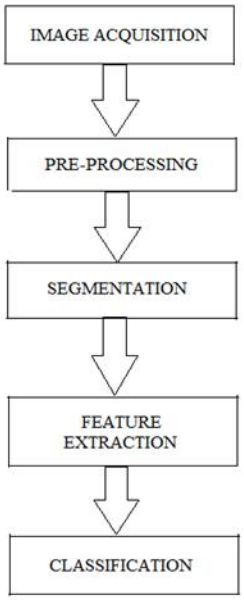

Figure1: Methodology overview.

A. Image Acquisition: The initial stage is image acquisition. This stage is vital for the remaining process. This is the step where plant leaf image is given as input for the system.

B. Pre-Processing: The second step is pre-processing. The system receives RGB image as input which will be converted into desired as required. Some features of the image will be enhanced for future processing.

C. Segmentation: Segmentation is an essential stage as it extracts the objects of our interest, for further processing. The division of an image into multiple components with the same or similar properties is known as image segmentation.

D. Feature Extraction: Feature extraction is critical for object identification. After performing the image segmentation, the disease portion from the plant is extracted. Texture, shape and color are some of the characteristics that can be utilized to detect disease in plants.

E. Classification: Finally, to train and test the datasets, classifiers are used. Support vector machine (SVM), Random forest, neural network and other classifiers may be used. These techniques are used to identify and classify plant diseases.

CONCLUSION

This paper has made an attempt to study various machine learning and deep learning method utilized by researchers to identify diseases. In plants, diseases are the main reason for less production of yield. In order to overcome that issue by utilizing deep learning and machine learning techniques different authors have proposed models that use these techniques and different datasets for accurate results. After exploring techniques, we can conclude that there are variety of methods for detecting plant diseases and each technique has some advantages and limitations.

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