Grenze International Journal of Engineering and Technology, June Issue

Plant Disease Detection using Image Processing & Neural Network Approach

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***Abstract*— Farmers' lives are significantly influenced by agriculture. Often manual illness identification requires more labour and takes a lot of time. among the most important facts include disease assault, which inhibits plant growth. Research on agriculture as a whole demonstrates that a variety of plant diseases may result in a decrease in the quality and quantity of agricultural goods. When compared to a manual method, a machine learning approach makes it easier to identify certain disorders. So, it is possible to identify the impacted leaf photos using machine learning techniques. Several image processing techniques will be used to process the images that the camera captures. These methods will aid in the detection of plant diseases, enhancing plant productivity. This survey paper explains how to identify plant diseases using a machine learning approach and goes into great detail regarding the various methods for disease classification and identification.**

***Keywords*: - Image Processing, Neural Networks, Classification, Disease Detection, Feature Extraction.**

I. INTRODUCTION

One of the major sources of income for farmers is agriculture. Although they can grow a wide variety of plants, illnesses impede plant growth. Attacks from diseases are one of the main causes of plant extinction. Plant productivity may be reduced by a disease attack by 10% to 95%. Currently, there are several methods for eliminating plant illnesses, including mechanical cultivation, hand removal of the afflicted plants, and the use of various pesticides. Using the assistance of an agricultural specialist is the simple technique to identify plant sickness. However, this manual approach of disease identification is difficult and time-consuming. The next method is to apply pesticides, although overusing them might lower plant quality while increasing plant growth. Yet, applying more pesticide on plants without first analysing how much of a particular pesticide is required for that crop can have negative effects on both the environment and human health. It is possible to restrict the spread of plant diseases by classifying healthy and diseased plants using digital image processing and machine learning techniques, thereby avoiding the overuse of pesticides. Automatically identifying plant illnesses is a crucial topic since it allows farmers to monitor vast fields of plants and spot diseases using machine learning techniques. Manual illness diagnosis is less accurate and time-consuming when compared to image processing techniques using a machine learning approach.
Figure 1. shows various photos of ill plants. Instead of having to identify the disease manually, machine learning and image processing techniques make this task much easier.

Grenze ID: 01.GIJET.9.2.362

Fig 1: Diseased Plant Leaves

According to F Ahmed in 2012, one of the main issues in the majority of agricultural systems is to stop the proliferation of Unwanted Plants. The majority of the time, removing unwanted plants from agricultural fields requires the use of chemical herbicides, which may result in extremely high productivity but have negative effects on the environment and human health. The Development of autonomous vision-guided agricultural equipment for site-specific herbicide application could result from the ability to identify and categorise plants and unwanted plants in digital imagery.

Pomegranates are one of the fruits that are grown in huge quantities in various Indian states and are one of the fruits that provide the most profit, according to Mrunmayee Dhakte in 2015. But for a variety of causes, plants become afflicted with different diseases, which decimates the harvest. The article suggests using neural networks and image processing to address the primary phytopathology problems. This method makes use of k-means machine learning and GLCM feature extraction algorithms. This technology has a 90% accuracy rate for illness detection.

In 2013, Suhaili Beeran Kutty thought about using an artificial neural network (ANN) based approach to categorise the Downney Mildew and Anthracnose watermelon leaf diseases. Based on the RGB colour model's colour feature extraction from the region of interest's recognised pixels, this categorization is made. The study's findings demonstrated that the leaf disease's RGB colour component provided 75.9% accuracy.

According to Godliver Owomugisha in 2014 [3], agricultural disease identification for some crops is one use of machine learning that has been used in agriculture as well as other fields.

Crop diseases are the primary danger to food security, according to Sharada P. Mohanty in 2016, however quick diagnosis of these diseases is still challenging in many regions of the world due to a lack of the necessary infrastructure. Smartphone-assisted disease diagnosis has been made possible by recent advancements in computer science made possible by deep learning and the growing use of smartphones worldwide. 99.35% accuracy is achieved by the trained model.

Improvements in automated and high throughput imaging have led to an avalanche of high-resolution photographs and sensor data of plants, according to Arti Singh in 2016. Machine learning techniques must be used to identify features and assimilate data in order to extract patterns from this set of data. Identification, classification, quantification, and prediction are some of the processes where machine learning techniques can be used.

This paper performs automatic leaf recognition and leaf disease grading for a variety of plant leaves. Two phases have been identified for the proposed system: - (1) Training Phase: Image Acquisition, Image Pre-Processing, Feature Extraction, and Training with Artificial Neural Networks; (2) Testing Phase: Test Image Acquisition, Test Image Pre-processing, Feature Extraction, K-Means Based Segmentation and Classification, Percentage Infection Calculation, and Disease Grading with Fuzzy Logic Toolbox.

In this paper, the implementation makes use of Gabor filters and Artificial Neural Networks (ANN). In order to classify the photos, an image database must first be constructed after each image capture. Pictures used for

detection are first segmented, and then a Gabor filter is used to extract features. Then recognition, which involves the two phases of raining and classification, is completed. Use of ANN is used for classification.

III. TECHNIQUES

In digital image processing, a picture that is taken as input is processed, giving us the findings on an extracted image as the output. This task is accomplished remotely and can be completed multiple times in a short amount of time. Artificial neural networks have been used to detect diseases. It featured a wide variety of algorithms for doing disease identification. Some algorithms used in the artificial neural network approach include back propagation, support vector machines, and principal component analysis. These algorithms are great at extracting features, which are further divided into shape, colour, and texture [8]. The procedure' steps are as follows:

A. Image Acquisition

A digital camera is used to capture images. Pictures are shown in RGB. Several strategies are used to apply the colour transformation structure for the RGB photos of the plants.

B. Image Pre-Processing

To remove noise and other undesired elements from the photos, image pre-processing techniques are used. Shade correction, artefact removal, image clipping, smoothing, formatting, filtering, binarization, and edge detection are all included.

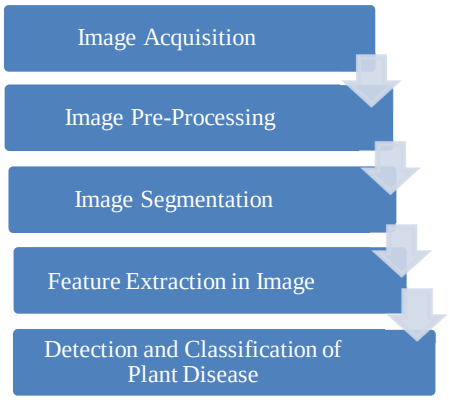

Fig 2: Steps for the Plant Disease Detection

C. Image Segmentation

Image segmentation is the division of a picture into different segments with the same attributes or some degree of similarity. Several techniques, like the otsu method, k-means clustering, and turning RGB images into HIS models, can be used for segmentation.
When a leaf is infected by more than one disease, K-means clustering is employed to divide the image into four clusters, at least one of which has the illness. The k-means clustering algorithm aims to categorise objects (pixels) into K number of classes based on a collection of criteria. By reducing the sum of squares of distances between the objects and the corresponding cluster or class centroid, classification is accomplished.

D. Feature Extraction

The identification of an object depends heavily on feature extraction. The use of feature extraction in image processing is widespread. The characteristics that can be employed in the detection of plant diseases include colour, texture, morphology, edges, and others.

Color co-occurrance Method

This technique uses both colour and texture to give an image its own distinctive traits. To do this, the RGB image is translated into the HSI format [10]. This technique is applied in.
Three main steps made up the CCM technique. The first step is to convert an image's RGB (Red, Green, and Blue) colour representation into an analogous HSI (Hue, Saturation, Intensity) colour representation. After this procedure is finished, Color Co-occurrence Matrices are produced from the HSI pixels. Finally, texture features are produced using the CCM matrices.

E. Classification

In the classification of plant leaves, the many morphological characteristics of the leaf are used. Neural networks, genetic algorithms, support vector machines, principal component analysis, and k-nearest neighbour classifier are a few of the classification approaches employed. Agriculture uses the classification of plant leaf diseases extensively.

K-Nearest Neighbor

A straightforward classifier used in machine learning is called k-Nearest Neighbor. It works by locating the examples of a query that are closest to those neighbours, and then using those neighbours to determine the query's class.

Support Vector Machine

A non-linear classifier is the Support Vector machine (SVM). This is a recent development in machine learning that is applied to a variety of texture classification difficulties as well as pattern recognition issues in general. SVM offers superior classification performance because the input data is non-linearly transferred to linearly separated data in a high-dimensional space. The marginal distance between various classes is maximised via SVM. This approach is applied in.

Artificial Neural Network

In an ANN, the feature vectors are regarded as neurons. The neuron's output is a function of the inputs' weighted total. It is possible to employ the back propagation technique, modified SOM, and multiclass support vector machines.

Fuzzy Logic

In order to employ these rules for classification, fuzzy logic classifiers use fuzzy sets or fuzzy logic to translate the values of real-world data into membership degrees using membership functions.

IV. COMPARISION TABLE

Author	Year	Description	Outcome
Rajleen Kaur and others	2015	SVM is put into use.	Name of the illness and its location.
Sanjay B. Dhaygude, et al.,	2013	To extract statistical texture features, SGDM is employed.	Evaluation of the presence of disease on plant leaves.
Anand.H.Kulkarni et al.	2012	Utilized in 2012 include the Gabor filter and Artificial Neural Network (ANN).	91% Accuracy
Dheeb Al Bashish, among others	2010	K-means 2010 Both the clustering method and the neural network approach are employed.	93% precision.
Aakansha Ratogi et al.	2015	2015 saw the implementation of automatic leaf recognition and leaf disease grading.	Grading and infection percentage using the fuzzy logic toolbox.
Zahra Sarayloo, et al.	2015	The mRMR feature extraction approach and the Otsu thresholding method are employed.	illness classification of wheat with a 98.3% accuracy rate.

V. CONCLUSION

A precise and effective method should be utilised to identify and categorise plant diseases, and image processing and neural network techniques can aid with this. This essay examined a number of previously employed strategies. These methods pertain to feature extraction, segmentation, and classification. These techniques have

allowed for reliable detection and categorization of numerous plant diseases. Yet, there are still some opportunities for the advancement of the currently used methods.

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