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A Review on Plant Leaf Disease Detection Using Machine Learning

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ABSTRACT: Plant disease detection has become an increasingly popular technique in recent years, with multiple ways to detect plant diseases. Plant diseases are the most important reasons for reducing and decreasing food production in the plant. Developed Technologies have provided the ability to produce sufficient food to meet society's demand, and identifyingplant diseases is important to prevent losses within the yield. It's troublesome to observe plant diseases manually. Machine learning models can be employed for the detection of plant diseases, machine learning automatically extracts the features in plant leaves. This paper proposed a review of smart and efficient techniques for the detection of plant diseases with the use of machine learning, we have described the technique for the detection of plant diseases with the help of their leaf pictures.Emergence of accurate techniques in the field of leaf-based image classification has shown impressive results. This paper makes use of Random Forest in identifying between healthy and diseased leaf from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of diseased and healthy leaves are collectively trained under Random Forest to classify the diseased and healthy images. For extracting features of an image we use Histogram of an Oriented Gradient (HOG). Overall, using machine learning to train the large data sets available publicly gives us a clear way to detect the disease present in plants in a colossal scale.

KEYWORDS: Diseased and Healthy leaf, Random forest, Feature extraction, Training, Classification.

I. INTRODUCTION

In India, about 70% of the people go to agribusiness, and pests and diseases result in the destruction of crops or part of the plant resulting in decreased food production and leading to food insecurity.

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In recent times, server-based and mobile-based approaches for disease identification have been employed for disease identification. Several factors of these technologies high-resolution camera, high-performance processing, and extensive built-in accessories are added advantages resulting in automatics disease recognition by using machine learning models.

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This problem can be solved using mobile based expert's system in which farmer only need to capture the diseased leaf. Application we are The work commence by capturing image (plant leaf) with required information such as plant information using Android Mobile Phone with camera and through internet connectivity send to the server.

Machine learning is the technology that allows machines to communicate with human beings and understand their needs. It also makes machines act like human beings and make decisions on behalf of humans. It is one area that has grown fast over the past few years. Machine learning helps in classifying plant diseases. The use of this technology is seen as a significant beginning and dealing with plant diseases.

Modern approaches such as machine learning and deep learning algorithms have been employed to increase the recognition rate and the accuracy of the results. Various research has taken place in the field of machine learning for plant disease detection and diagnosis, such as traditional machine learning approach being random forest (RF), artificial neural network (ANN), support vector machine (SVM), K-means method, convolutional neural networks (CNN), etc.The machine learning algorithms here are implemented using random forests classifier. They are flexible and can be used for both classifications and regression techniques, compared to the other machine learning techniques like SVM, Naïve Bayes,logistic regression,and Random forest give more accuracy.

Random forests are as a whole, learning method for classification, regression and other tasks that operate by constructing a forest of the decision trees during the training time. Unlike decision trees, Random forest overcome the disadvantage of over fitting of their training data set and it handles both numeric and categorical data.

II. LITERATURE SURVEY

[1] S. S. Sannakki and V. S. Rajpurohit proposed a "Classification of Pomegranate Diseases Based on Back Propagation Neural Network" which mainly works on the method of segmenting the defective area and color and texture used as the features. Here they used a neural network classifier for the classification. The main advantage is it Converts to L*a*b to extract chromaticity layers of the image and Categorisation is found to be 97.30% accurate. The main disadvantage is that it is used only for limited crops.

[2] AakankshaRastogi, Ritika Arora, and Shanu Sharma," Leaf Disease Detection and Grading using Computer Vision Technology &Fuzzy Logic". K-means clustering is used to segment the defected area; GLCM is used for the extraction of texture features, and Fuzzy logic is used for disease grading. They used an artificial neural network (ANN) as a classifier which mainly helps to check the severity of the diseased leaf.

[3] MalvikaRanjan et al. in the paper ―Detection and Classification of leaf disease using Artificial Neural Network" proposed an approach to detect diseases in plants utilizing the captured image of the diseased leaf. Artificial Neural Network (ANN) is trained by properly choosing feature values to distinguish diseased plants and healthy samples. The ANN model achieves an accuracy of 80%.

[4] Mohanty, S. P., Hughes, D. P., & Salathé, M. (2016). Using deep learning for image-based plant disease detection. Frontiers in Plant Science, 7(September), [1419].https://doi.org/10.3389/fpls.2016.01419

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III. METHODOLOGY

The method for plant sickness detection the usage of system masteringmay be divided into numerous key steps:

Facts series: step one is to collect a big dataset of images of vegetation with each healthy and diseased leaf. It is critical to make sure that the photos are truly exceptional and feature steady lighting situations.

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Facts Pre-processing: The pictures within the dataset might also need to be pre-processed before being used for training the machine mastering version. This includes resizing the photos, normalizing the coloration values, and converting them to grayscale.

Information Augmentation: To grow the dimensions of the dataset and to lessen overfitting, statistics augmentation techniques including rotation, flipping, and zooming can be carried out to the photos.

Characteristic Extraction: the subsequent step is to extract relevant functions from the photos. This will be executed using deep gaining knowledge of strategies inclusive of convolutional neural networks (CNNs) to mechanically analyze features from the pics, or via the usage of homemade feature extraction strategies which includes neighborhood Binary styles (LBPs) and Histogram of orientated Gradients (HOG).

Model training: once the features had been extracted, the subsequent step is to educate a gadget learning version of the dataset. This can be completed through the usage of popular algorithms together with guide Vector Machines (SVMs), Random Forests, and Gradient Boosting Machines. As a substitute, deep gaining knowledge of strategies consisting of CNNs can be used to immediately classify the pictures.

Model evaluation: The educated model has evaluated the use of a separate validation set of pics that had been not used for education. Metrics inclusive of accuracy, precision, keep in mind, and F1-score can be used to assess the model's overall performance.

Deployment: once the model has been trained and evaluated, it can be deployed in the area to come across plant illnesses in actual time. This can be achieved using smartphone software that takes a photograph of a plant leaf and sends it to the model for evaluation. The version can then provide a diagnosis of the plant's fitness.
On average, the methodology for plant sickness detection the use of machine-gaining knowledge involves gathering and pre-processing a dataset, extracting relevant capabilities from the snapshots, training a system mastering version, evaluating its performance, and deploying it in the subject. By following these steps, correct and reliable plant ailment detection systems can be developed to assist farmers to defend their vegetation and boom yields.

IV. ALGORITHM DESCRIPTION

The algorithm here is implemented using random forests classifier. They are flexible in nature and can be used for both classification and regression techniques. Compared to other machine learning techniques like SVM, Gaussian Naïve Bayes, logistic regression, linear discriminant analysis, Random forests gave more accuracy with less number of image data set. The following figure shows the architecture of our proposed algorithm.

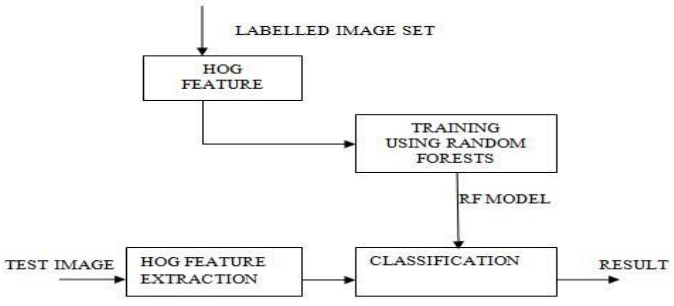

Fig.1. Architecture of the proposed model

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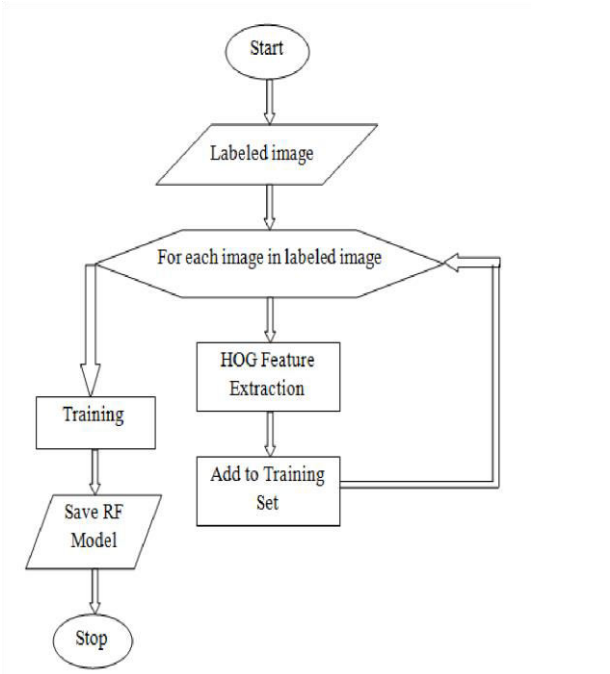

Fig.2. Flow chart for training.

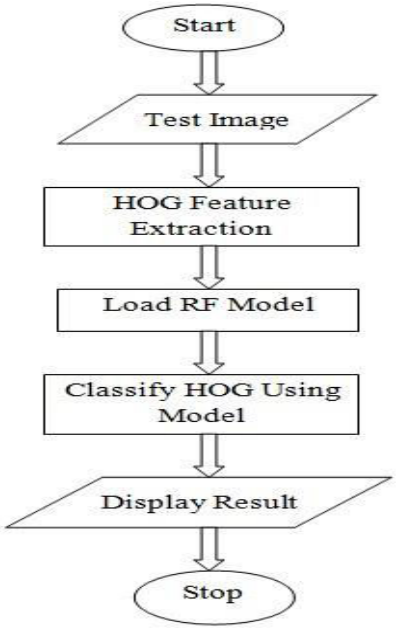

Fig.3. Flow chart for classification

The labelled datasets are segregated into training and testing data. The feature vector is generated for the training dataset using HoG feature extraction. The generated feature vector is trained under a Random forest classifier. Further the feature vector for the testing data generated through HoG feature extraction is given to the trained classifier for prediction as referred to in "Fig.1".

As shown in the 'Fig.2." labelled training datasets are converted into their respective feature vectors by HoG feature extraction. These extracted feature vectors are saved under the training datasets. Further the trained feature vectors are trained under Random forest classifier.

As depicted in "Fig.3." the feature vectors are extracted for the test image using HoG feature extraction. These generated feature vectors are given to the saved and trained classifier for predicting the results.

V. CONCLUSIONS

We conclude that machine learning is helped to identify diseases in plants. The proposed work summarizes multiple studies regarding plant disease automation and identification through different machine-learning methods. The machine learning models detected plant diseases and classified them.

VI. FUTURE SCOPE

The majority of leaf diseases in plants are brought on by fungus, bacteria, and viruses. Several visual symptoms that can be seen in a plant's leaves or stem are utilised to identify the diseases brought on by these organisms. These signs are typically found by hand.to develop a system that is accurate in spotting agricultural diseases and pests. Make a database of pesticides for the appropriate disease and pest. to offer a cure for the illness that has been discovered. The Future work can also be dedicated to the automatic estimation of the severity of these diseases. The instant solutions can be made available to the farmers by designing mobile based application.

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