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PLANT DISEASE DETECTION

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Abstract—**This review paper contains the analysis of the plant disease detection papers on using Convolutional Neural Networks (CNN), Support Vector Machines (SVM), Back Propagation, and K-means Clustering for detecting disease in plants and covers the most recent developments in these techniques. A very famous Plant Village Dataset is chosen and discussed on its data preprocessing and feature selection. The SVM, Random Forest classifier, and CNN are found to be efficient and accurate methods of classification. The review also covers the potential for automation and smartphone-assisted diagnosis as well as suggestions for future research.**

Keywords— **Support Vector Machine, Convolution Neural Network, Deep Neural Network.**

I. INTRODUCTION

As plant disease is a cause for the detection in food production around the globe. Of the 36.5% average of total losses, 14.1% are estimated to be caused by disease. Con- sidering that 14.1% of crops are lost to plant disease alone, the total annual worldwide crop loss from plant disease is about $200 billion. Plant Diseases are a threat to food security and so to face this challenge it is important to detect the disease process that will be thwarted so plant can regain their health and vigour to resist such problems [1]. A plant disease is anything that prevents a plant from performing to its maxi- mum potential [2]. Much research has been conducted to detect plant diseases. Now many machines on vision-based plant disease detection equipment have been initially applied in agriculture and have replaced traditional naked eye identification to some extent[3]. Detection of disease requires intensive labour and monitoring is a tiring job as manual labour is required. Image processing algorithms are developed and used to detect plant infection or disease by identifying the leaf area's colour features[4]. For colour segmentation, K means algorithms are used and GLCM is used for disease classification [3]. Vision-based plant infection showed efficient results and promising performance. The early detection of disease will lead to more cures and improves the chance of survival[5]. Common methods for diagnosis and detection of plant disease include visual plant disease estimation by human rates. Plant pathologists use many different tools to figure out diseases in plants, but it is not convenient and available everywhere and requires time and money [6], to overcome and make it feasible these ML-based models are proposed to be utilized for the same at an early stage. CNN- based deep learning model was proposed for the accurate classification of plant disease [4], this uses RGB images, and pre-processing was undertaken followed by segmen-tation. Several classifiers have been used in the past few years by researchers such as k-nearest neighbour (KNN), support vector machines (SVM), artificial neural net- works (ANN), back propagation neural network (BPNN), Na¨ıve Bayes and Decision tree classifiers [7]. The most used is the SVM classifier. These techniques use machine vision equipment to acquire images to judge whether there are diseases and pests in the collected plant images.

II. LITERATURE REVIEW

2.1 Surender et al(2015)

In this paper, Surendra et al. propose a method for detecting plant diseases using an artificial neural network (ANN). The authors demonstrate the effectiveness of the proposed method on five datasets: Tomato Leaf Disease, Soybean Disease, Potato Late Blight, Apple Scab, and Grape Powdery Mildew. The authors first pre-process the data by performing normalization, data augmentation, and feature selection. They then apply a three-layer ANN to classify the images into the respective disease classes [6]. The results show that the proposed method can achieve an average accuracy of 93.3%, demonstrating the effectiveness of the proposed method. The authors also show that the proposed method can achieve comparable accuracy to state-of-the-art methods.

2.2 Sharada P.Mohanty et al(2016):

This paper presents a deep learning-based approach for the automatic detection of plant diseases from images. The authors use convolutional neural networks (CNNs) to classify and detect plant diseases in images. The proposed method is based on a two- stage approach in which the first stage is a feature extraction stage, and the second stage is a classification stage. In the feature extraction stage, the authors use a pre- trained CNN model to extract features from the input images. In the classification stage, the extracted features are used to classify the images into different categories. The authors also use a support vector machine (SVM) to further improve the accuracy of the system. The proposed system is tested on a plant disease dataset consisting of over 6,000 images belonging to 4 classes [1]. The results show that the proposed system achieves an accuracy of 90.3%, outperforming existing methods

2.3 Kulkarni et al(2021):

This paper presents a novel approach to the detection of plant diseases using image processing and machine learning. The authors propose a deep learning-based model that combines features extracted from both the visual and textural components of the infected leaves. The model can accurately distinguish between healthy and diseased leaves and can also detect the type of disease present [3]. The authors evaluate their model using an extensive dataset of images of both healthy and diseased leaves and demonstrate that it can achieve a high degree of accuracy. In addition, the authors discuss the potential applications of the model in the field of agriculture and plant health management. This paper is a valuable contribution to the literature as it presents a promising approach to the automated detection of plant diseases.

2.4 Kothari et al (written 2018 published 2021):

This paper presents a novel approach for plant disease identification using Artificial Intelligence (AI) machine learning techniques. The authors discuss how AI machine learning can be used to identify plant diseases based on their symptoms. First, the authors propose a pre-processing method to extract features from the images of the plants [7]. Then, the extracted features are used as input for AI machine learning algorithms to classify the plants into different disease categories. The authors evaluate the performance of the proposed approach using a publicly available dataset of plant disease images. They also compare the performance of the proposed approach with existing methods for plant disease identification. The results show that the pro- posed approach outperforms existing methods in terms of accuracy and F1 score. The authors conclude that the proposed method is a promising approach for plant disease identification and can be used to efficiently diagnose plant diseases in the future.

2.5 Kolli et al(2021):

This research paper presents a convolutional neural network (CNN) based approach for the detection of plant diseases. The proposed system consists of two parts, a preprocessing step, and a CNN-based classification step. In the pre-processing step, the leaf images are converted into grayscale images, followed by a segmentation process to obtain the leaf regions [4]. The segmented leaf regions are then resized to a fixed size, and a feature extraction process is applied to generate the feature vectors for the training and testing phase. In the classification step, a CNN model is trained using the extracted feature vectors. The CNN model is tested on a dataset of plant images and the results show that the proposed system can detect plant diseases with an accuracy of 95%. The system is compared with other existing methods, and it is demonstrated that the proposed system outperforms the existing methods in terms of accuracy.

2.6 Jubil et al(2022):

This paper presents a deep learning-based method for plant leaves disease detection, called Efficient Net. The authors proposed an efficient and accurate disease detection model for plant leaf images, which can detect diseased leaves from healthy ones. The proposed model utilized Efficient Net architecture as its base model and was trained on a dataset of leaf images from various plants and diseases [5]. Finally, the authors conducted an ablation study to investigate the effect of various hyperparameters on the performance of the model. The results of the ablation study show that the proposed model is robust and can be trained with different hyper parameters without sacrificing accuracy. The authors also discuss the potential applications of the proposed model and suggest some future research directions. The results show that the model is highly efficient in detecting various plant diseases. It is also capable of generalizing well to unseen data, indicating its potential for real-world applications. The authors also found that the model was able to detect the diseases with a much lower false positive rate than traditional methods. Additionally, the model could detect diseases even before they became visible to the human eye. The results of the research paper indicate that the proposed model is a promising approach for plant leaves disease detection.

III. PROPOSED SYSTEM

3.1 DATASET:

CNN classifiers are capable enough to perform many kinds of image classification tasks. Generally, though, CNN requires a large amount of data to train properly. For each class, it may be hundreds of images to be able to classify correctly.PlantVillage Dataset curated by Sharada P. Mohanty et Al. is a dataset which has 87000 RGB images of healthy and unhealthy plant leaves having 38 classes [3]. There are three different versions of the whole PlantVillage dataset Color, Grayscale, and Leaf Segmented.

3.2 Data Preprocessing and Feature Selection:

The type of Data being used is an image there are many techniques used for image processing for Plant Diseases. Generally, implemented techniques are SVM, BPNN, SGDM and K means Clustering. Data pre-processing is important to remove the back- ground noise so that we could get precise results. Before the extraction of features to detect disease in plants, the RGB image from datasets is converted to greyscale and then the Gaussian filter is used to smoothen the image[3]. The data collected is

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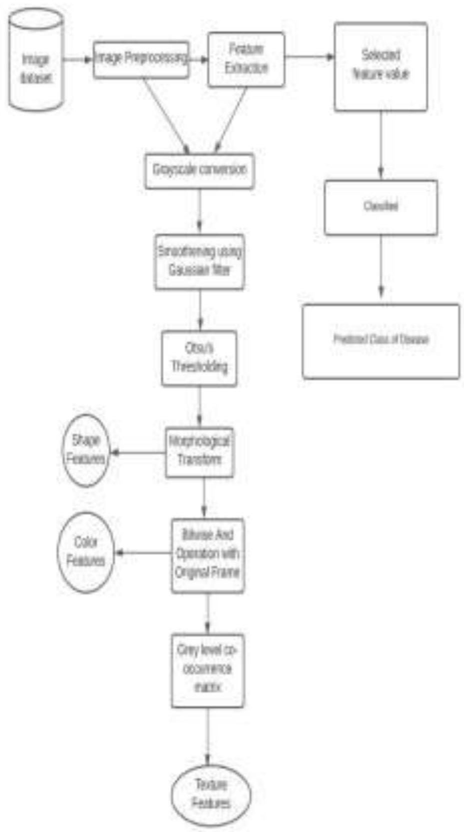
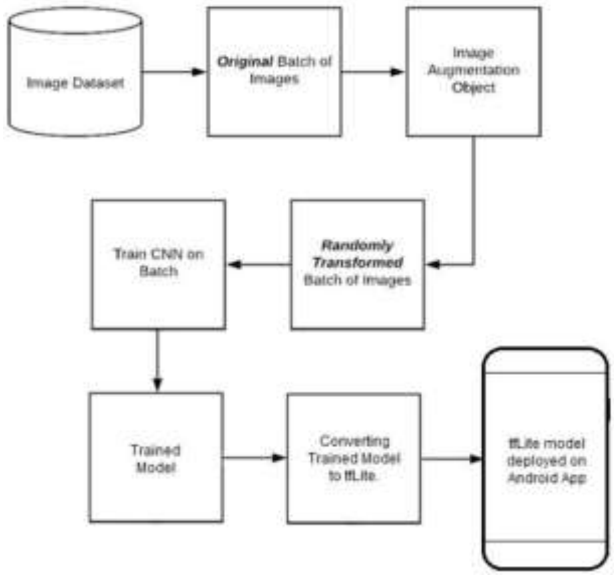


in a raw format, which could not be used for analysis. Data Pre-processing is per- formed for resizing and colour conversion of the image [6]. Bitwise And Operation on binarised image and an original colour image is performed to get the RGB image of a segmented leaf[3]. After the image data is augmented then feature selection is an important step. Some methods for feature extraction are the Color co-occurrence Method, Grey Level Co-occurrence Matrices (GLCM), Spatial Grey Level dependence Matrices (SGDM) method, Gabor Filters, Wavelets Transform, and Principal com- ponent analysis [6]. When the feature selection is done then the data is parsed by machine learning classifiers to find patterns in the data.

3.3 Model:

Classifiers are written on the platform to define features for the classification of the images. For classifying high dimensional datasets SVM (Support Vector Machine) is found to be the best available machine learning algorithm but it is difficult to find



optimal parameters for training purposes because they are non-linearly separable. Random forest classifier has been used for the classification or detection of disease in plants [7]. Generally, to achieve higher accuracies decision trees are used but they usu- ally create over fitting problems. So to overcome this problem random forest classifier can be used. This method can find accuracy in the whole data set without any bias. The average accuracy was 93% and this is computationally efficient as compared to SVM which is also computationally efficient but gives an accuracy of 83.34%. Classification can be done using CNN (Convolution Neural Networks). A model trained based on CNN was able able to attain an accuracy of 94.87% in identifying diseased plants with help of image processing by OpenCV. There is the model which is used to get higher accuracy and better efficiency over existing CNNs is Efficient Net B3. Model, initialized over pre-trained ImageNet weights and max pooling as a pooling type [5]. This model uniformly scales network width, depth, and resolution with a set of fixed scaling coefficients. This model produces 99% of accuracy. There are many models for plant disease Detection but a smartphone-assisted plant disease diagnosis system is efficient for real-world problems as the smartphone comes in handy and now many people have access to it. So if the model when deployed in a mobile application and give higher accuracy then that could be a better way to diagnose plant disease. Model-based on the applicability of a deep convolutional neural network could be for as a classifier [6]. The trained model achieves an accuracy of 99.35%.

Around 606 apps are present on various app stores and according to Ayesha Siddiqua et Al., Only Plantix- your doctor can successfully identify plants from images, detect diseases, and maintain a rich plant database although it needs some improvements to attain perfect accuracy [2].

IV.CONCLUSION

This paper reviews the whole process involved in Plant Disease Detection and summarised it from Dataset, Data preprocessing, feature extraction, model and deployment. Plant Village Dataset has a huge collection of image data. Various models have been discussed the model that uses a deep neural network gives an accuracy of 99.35%. This model could be used for a smartphone-assisted plant disease diagnosis system. Plantix - your doctor app has the highest assessment scores for plant disease detection apps at 4.56 (1.16). More work could be done to make the app more accurate, and a model based on Deep Neural Network could also be used to develop an application which makes plant disease detection more accurate so the problem could be solved.

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