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Plant leaf Disease Identification using Deep learning techniques

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***Abstract:** Agriculture is an important source of our country's growth. The major loss in an agricultural economy is because of the plant disease. Though technology plays a vital role in all the fields still today the agriculture field is using the old methodologies. Successful cultivation depends on identifying plant disease. Previously the identification was done manually by the experienced people but now it became difficult due to environmental changes. By using the deep learning techniques the plant disease can be identified effectively. Vgg16 and ResNet are the proposed techniques to increase accuracy than the existing system. The disease can be identified with images of the leaves by applying those deep learning techniques. Detection can be involved in steps like image acquisition, image pre-processing, image segmentation, feature extraction, and classification. By controlling the disease, productivity can be increased. The features of the leaf image are taken and trained using the neural network algorithm and then the prediction is done by testing the images. The features of the leaf image are taken and trained using the neural network algorithm and then the prediction is done by testing the images.*

***Keywords:** Data augmentation, Resnet, VGG-16, CNN.*

I. INTRODUCTION

Diagnosis of the plant disease through the naked eyes with the symptoms on the plant leaves, which incorporate the higher complexity. This complexity makes even the experts may often fail in the diagnosis of the plant disease. The designed automated system helps to identify the disease with the plant's appearance and visual symptoms. For farmers, this will be a useful technique to alert at the right time and avoid the spread of the disease in a large area.

Related works:

In plants, infection signs, for the most part, happen on leaves, natural products, buds, and youthful branches. This circumstance causes an organic product to be squandered (to drop) or be harmed. What's more, these sicknesses lead to the arrangement of new diseases furthermore; the spread of the disease is regular conditions that occur while cropping [1]. Consequently, it is imperative to decide the ailment ahead of time and to play it safe before it spreads to different trees. As a result, the battle against ailments and vermin in plants is the absolute most significant issue [2]. Collecting several datasets based on vein recognition. Data sets organizations based on collected images. Implementing the system by use of certain algorithm techniques and feature extraction system[3]. Initially, the analysis is done whether the plant has a disease or not, then the classification is done to analyze the type of disease [4].

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The analysis will be done using a feature extraction technique. Initially, to overcome this disease issue the technical person like botanists and agriculture engineers are used to analyze the leaf, and then the testing is done. Which is time-consuming and also not more accurate. In this system, the farmer doesn't need to know the diseased and non-diseased plant but applying the deep learning algorithm will predict the disease accurately [5]. To predict whether the plant has a disease or not the classification should be done [6]. For that, the two-step process should be followed. One is training which is the first step where we will have a large number of datasets for diseased and not diseased images to train the machine. Testing is the second step where the current image is analyzed and predicted based on the training data [7].

II. PROPOSED SYSTEM:

The plant disease detection system is considered as an image classification problem and can be performed using a deep learning algorithm. Hence the CNN architecture can be used to perform this disease detection system. To perform CNN the required data should be collected using Data collection, data augmentation, pre-processing, and feature extraction **as shown in fig 2.** Normally the feature extraction is performed using features of the trained data and based upon that data, the threshold values can be kept and then in testing part the value of the features will compare with the trained one to predict the image is diseased or not.

Flow chart diagram of the proposed System:

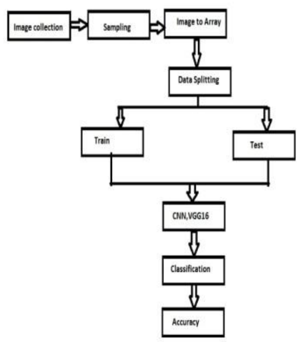

Fig 1: Flow Chart of the process

First, the dataset is collected, then splits into two parts. 80% of training and 20% of testing. Initially, 20639 images have been taken. But, after balancing, totally we got 5000 images that comprised of different plant diseases like bacterial blight, leaf spot, and healthy Leaf. After that, By using the transfer learning technique the deep learning models are trained, and to indicate the significance of the model, their training plots are obtained. Then, for the classification of the images, performance metrics have been used, and finally, to detect and classify images, visualization techniques have been used. The above flow chart describes this process (**fig1**). Basic CNN architecture like ResNet and vgg 16 were implemented. The result of applying the filters to an input image will be capture by the feature maps of a CNN. Visualizing a feature map is to try to gain some understanding of the feature of CNN.

III. MODEL DESCRIPTION:

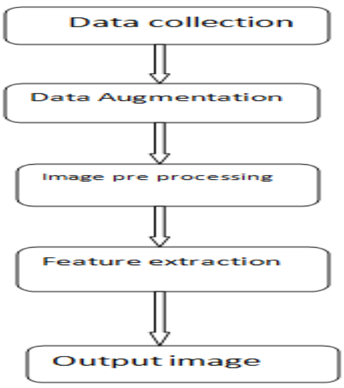

Fig 2: Architecture diagram of the proposed system.

Data Collection:

The data collection deals with collecting the plant leaves of various plants. The images will be collected and filter according to the dimension, size, and format. The total data that are collected will be stored in a database in one format.

Data Augmentation:

Data augmentation is normally performed to change the dimension or direction of an image. Normally the 3-pixel images are in the vertical direction and 5-pixels are in the horizontal direction. Normally the data augmentation method is used to perform the padding, cropping of an image, and then the horizontal flipping to achieve the neural network architecture.

Image Preprocessing:

The elimination of the noise in the picture to adjust the pixel values is called preprocessing. The quality of the image has been enhanced. Eg- The images may contain dust, spores, and water spots as noise.

Feature Extraction:

It's an important part to gracefully predict the infected region. Shape and textual extraction are done here. To determine the health of each plant, the leaf image is captured and processed.

VGG model:

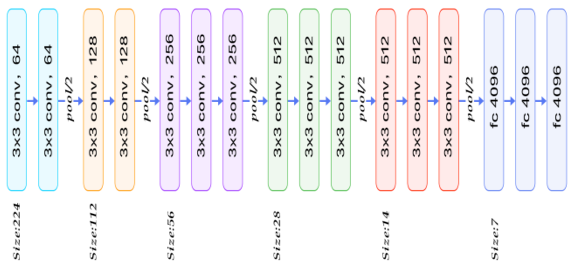

Fig 3: 16 Layers of the vgg 16 Architecture.

The VGG-16 is a very deep convolutional neural network that has 138 million of parameters. Training on this deep architecture needs large-scale datasets. However, our training data is much smaller than the ImageNet. So a pre-trained VGG-16 model (Fig 3) was fine-tuned on our datasets. To mitigate this problem, ResNet incorporates identify shortcut connections which essentially skip the training of one or more layers creating a residual block**.** This Vgg16 model gives 95% of accuracy on our dataset.

ResNet model (Transfer Learning):

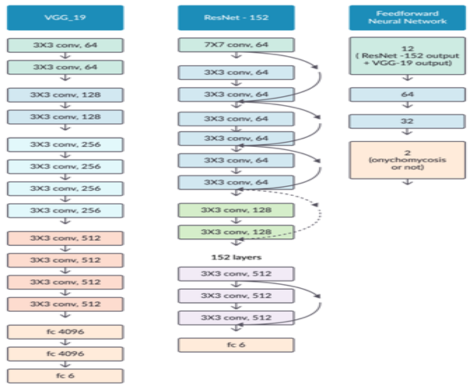

Fig 4: ResNet Model

In CNN architecture while training at certain condition adding the neural network will slow down the training process and also saturate the accuracy. ResNet model gives 85% of accuracy.

CNN Model:

The pre-trained CNN model can be treated as a feature extractor. A linear classifier can be built by using extracted features as input. On the other hand, the fine-tuning method is often carried out to fine-tune some high-level layers. Features in the early layers are more generic. While features in the later layers contain more specific information of original datasets. Freezing early layers can bring us general and useful features for many tasks. And fine-tuning following layers can generate more particular features existing in our datasets. In this, we tried out the VGG-16 model which will do fine-tuning some layer for the pre-trained model. It increases accuracy when compared to the previous convolution network.

IV. RESULT AND DISCUSSION:

With the sample of 5000 images, The proposed system has got an accuracy of 95% and 85% by using algorithms VGG -16 and ResNet respectively, Which is comparatively higher than the existing system.

Barchart of the output:

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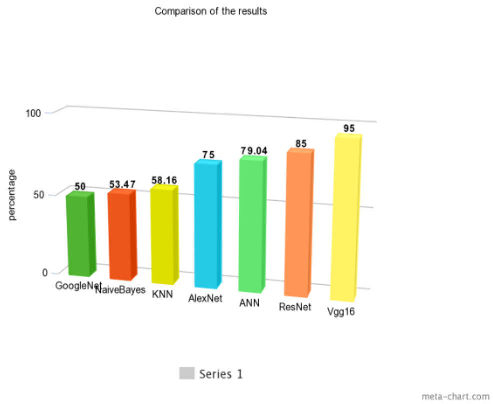

Fig 5: Bargraph representation of the Comparison all the Algorithms.

Comparison Table:

Sl.No	Existing		Proposed	
	Algorithm	%	Algorithm	%
1.	KNN	58.16	Vgg16	95
2.	ANN	79.04	ResNet	85
3.	NaiveBayes	53.47		
4.	AlexNet	75		
5.	GoogleNet	50		

Table 1: Table Representation of the comparison

The above table compares the accuracy of the existing and the proposed system. The proposed system architectures like Vgg16 and ResNet gives higher accuracy than the existing architectures.

Loss value:

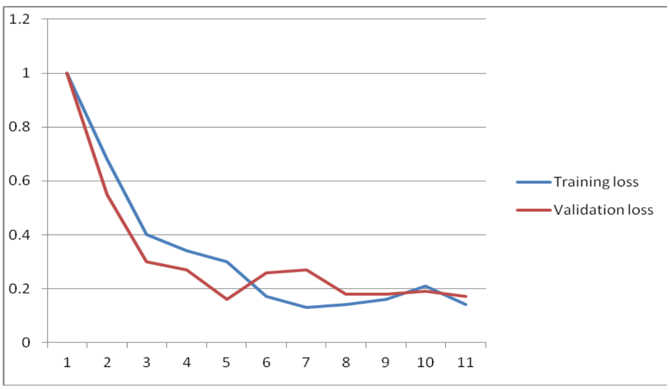

Fig 4: Graphical Representation of the proposed system loss value.

Accuracy Value:

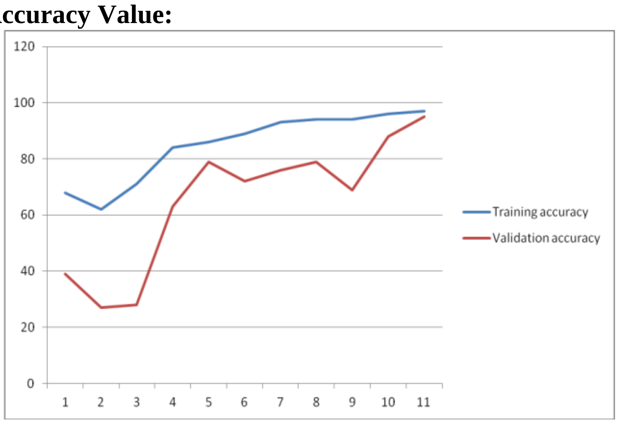

Fig 6: Graphical Representation of the proposed system Accuracy value.

V. CONCLUSION:

Deep learning technologies has become one of the important technologies in the agricultural industry. This paper came with an idea of identifying the disease in the crops. So that farmers can take remedial measures to protect the crops. The infected segment of the leaf is analyzed by the CNN architectures. It will be very useful for the farmers especially in remote areas. To classify the plant disease and to extract the infected leaf the feature extracting technique was very helpful.

FUTURE WORK:

The future enhancement is to develop the open multimedia(Audio/ video) about the diseases, Once the disease is detected.

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