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Leaf Disease Detection Using Deep Convolutional Neural Networks Review and New Approach by VGG19.

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Abstract: Most of the people in India depend on agriculture for their live hood. Need to implement efficient methods to reduce crop diseases and increase crop production. This paper introduces a deep convolutional model using VGG19 architecture to detect crop disease by analyzing the images of crop leaves. In this proposed work collect Around 1000 samples of tomato leaf's including Late Blight, Bacterial leaf Spot, Healthy, Tomato Mosaic, and Septoria Leaf Spot, Tomato healthy are collected from plant village and trained dataset to identify the disease. Detection of disease is done for the leaf samples.

I. INTRODUCTION

For increasing the productivity of the crop, it is necessary to detect the plant disease at an early stage and stop spreading of disease throughout the field. This can be achieved using the deep learning technique by making use of a large, verified dataset that consists of diseased and healthy leaf images. The traditional method of detecting crop diseases needs high experience and knowledge of experts in the field. This method can be time-consuming, ineffective, and of high cost. The traditional method uses image processing technique and k-means clustering for feature extraction which is not very optimal because the K-means algorithm is sensitive to outliers and lacks sensitivity and specificity. The true positive rate (TPR) and false-positive rate (FPR) are not correctly classified with k-means clustering.

Artificial neural networks are mathematical models, its working is like the principles of brain function Their fundamental characteristic is their capacity to be trained through the method of administering learning. During that process, neural networks are "trained" to model some system with the use of existing data that contain specific matching of inputs and outputs of the system to be modeled. CNNs are an evolution of traditional artificial neural networks, focused mainly on applications with repeating patterns in different areas of the modeling space, especially image recognition. Its fundamental characteristic is that, with the technique utilized in their layering, they radically decrease the specified number of auxiliary components (number of manufactured neurons) in comparison to conventional feedforward neural systems. For image recognition applications, several baseline architectures of CNNs have been developed, which have been successfully applied to complicated tasks of visual imagery.

The proposed model uses a VGG19 classifier. Adam optimizer is fast compared to other optimizers and requires less computing power. The categorical cross-entropy is used here because the proposed model uses multi-class classification. It classifies 6 types of tomato leaf images. The activation function softmax is used fully because it selects the most probable output. And ReLu activation is used after every convolution layer.

II. LITERATURE SURVEY

The literature survey mainly focuses on understanding the concept of deep convolutional neural networks in image processing. And present and traditional methods used for crop disease detection.

In [1] authors proposed an image segmentation & thresholding approach for detecting the leaf diseases using Matlab. First, read the image, then convert the image from RGB to Grayscale image, Then the greyscale image is converted to the binary image and remove noise using imfill instruction after that calculate the total green leaf area and total leaf area after getting those areas subtracting the green leaf area from the total area to get the infected areas of the leaf images.

In *[2]* author proposed a DENSENET 201 based convolutional neural network for identifying leaf diseases. The data sets are collected from the plant village and then pre-processing is done to improve the image quality here gaussian filter is used for removing the image noise, feature extraction is done by using Gabor filtering Then, the extracted features are compared with the features obtained from the pretrained DENSENET201 convolutional neural network. From this approach, the author proves that the Convolutional neural network model performs much better than the previous approaches.

There have different types of CNN networks (i) AlexNet (ii) AlexNetOWTBn, (iii) GoogLeNet, (iv) Overfeat, and (v)VGG The previous studies by *[3]* Prove that the VGG model gives better results than the other models. VGG16 and VGG19 are the latest VGG models. VGG-16 is a convolutional neural network that is trained on more than a million images from the ImageNet database. The VGG 16 model consists of 16 layers and can classify images into 1000 object categories. The concept of the VGG19 is the same as the VGG16 except the network is consisting of 19 layers deep. In *[4]* authors used VGG16 based model to classify and

detect leaf diseases. This paper gives the idea of train the convolutional neural network by using the vgg16 approach. The experiment is conducted on the tomato leaf images. This hybrid approach gives an accuracy of 95.90 percentage and overcomes the problem of overfitting.

From *[5]* The practical comparison of VGG 16, VGG 19, and RESNET 50 concludes that the VGG 19 model gives better classification accuracy.

III. VGG19 ARCHITECTURE

CNN is very useful when working with images. Which scans images from top to bottom and left to right to extract essential features from the image and combine the extracted features to identify the images. It can oversee pictures that have been interpreted, turned, scaled, and alter in viewpoint.

VGG 19 is a specific type of deep convolutional neural network. Which has 19 weight layers consisting of 16 convolutional layers, 3 fully connected layers, and the same 5 pooling layers. Which process data with input shape of a 2D matrix with size 224*224*3. The input to the preprocessing layer is an RGB image with pixel values ranges from 0-255. The preprocessing layer subtracts the mean value of the RGB content from each pixel of all images in the training set. After pre-processing, the input images are passed through layers of weight. The training images are processed through a stack of convolutional layers.

- The first 2 layers in the VGG19 model are convolutional layers with 3*3 filters.
- Those layers use 64 filters that result in 224*224*64. All the filters are 3*3 with stride 1.
- The next layer is the pooling layer with a max pool of 2*2 size and stride 2.
- Max pooling layer reduces image size from 224*224*64 to 112*112*64.
- After that, this model has two more convolutional layers with 128 filters. Which changes image dimension to 112*112*128
- Again, which has one more pooling layer which changes the image size to 56*56*128.
- Two more convolution layers are added with 256 filters, each followed by a down-sampling layer, which reduces the size to 28*28*256.
- There are two more stacks, each with 3 convolution layers are separated by a max-pool layer with 7*7*512 volume, which is flattened into a Fully Connected (FC) layer and followed by a softmax layer as output.

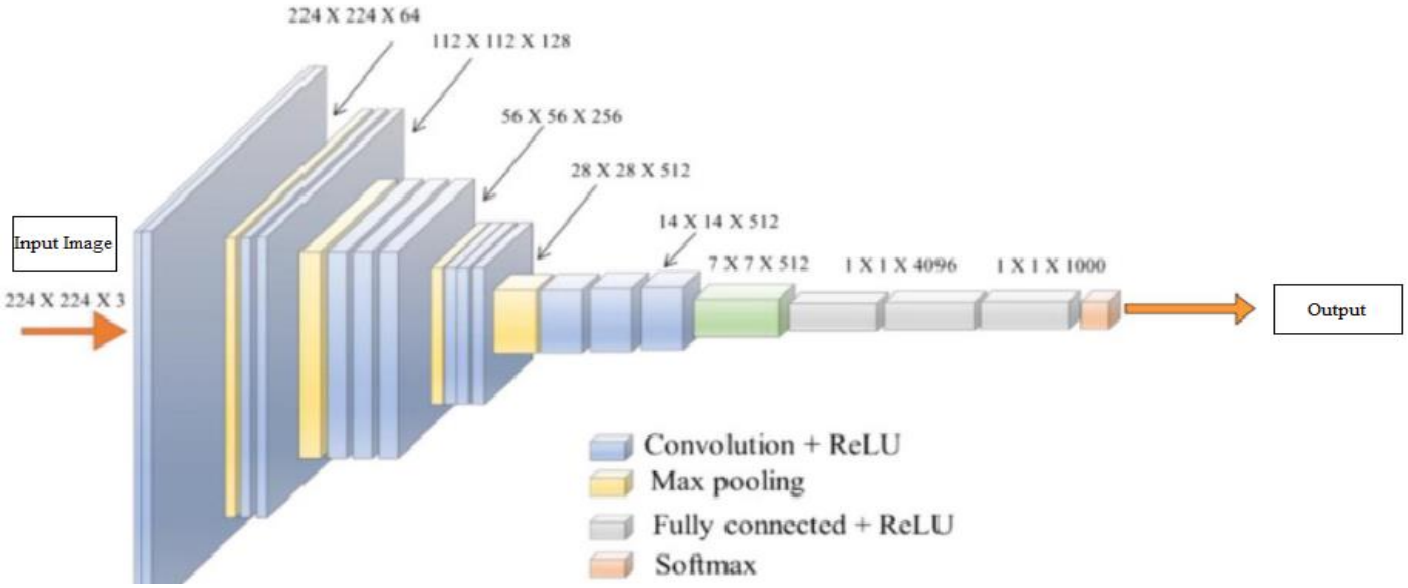

figure 1: VGG 19 architecture

IV. IMPLEMENTATION

A. Create Data Set

The valid and train data set of tomato leaves are collected from the online Plant Village Project. In this approach, we have used Python Keras libraries for image preprocessing and build the VGG19model.

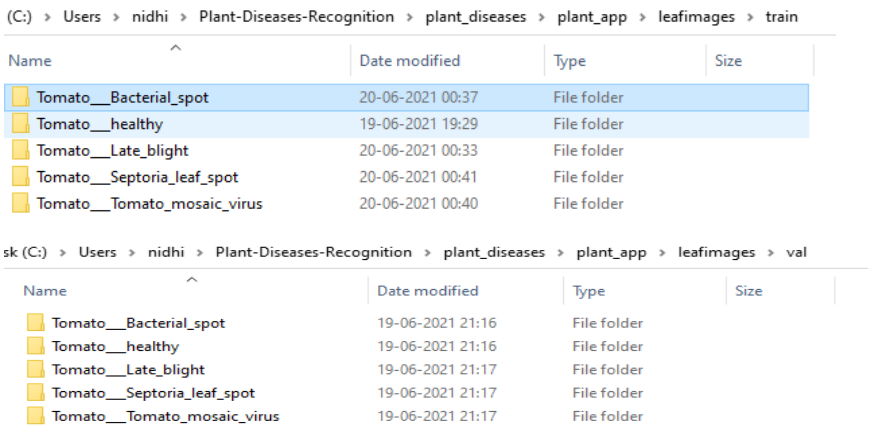

figure 3: train and validation image directory

Both train valid data sets are read from folder by using Image Data generator and Data Pre-processing is performed which involves the framing of each image into a unified dimension of size 224X224.

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B. Build And Train VGG 19 Model

Build VGG 19 model and save the model for detecting leaf diseases.

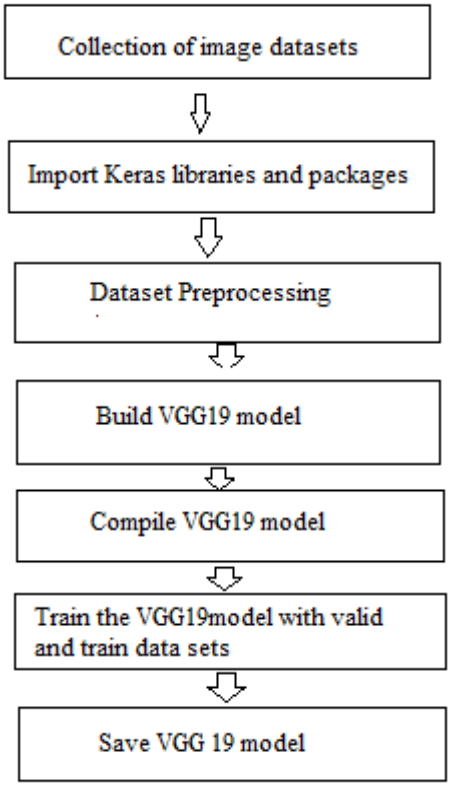

figure 2: block diagram for train VGG19

C. Validate Input image with VGG 19 model

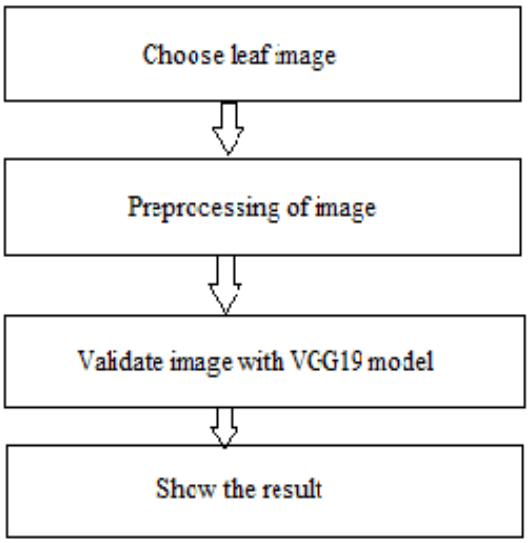

figure 5: validation of input image with VGG19 model

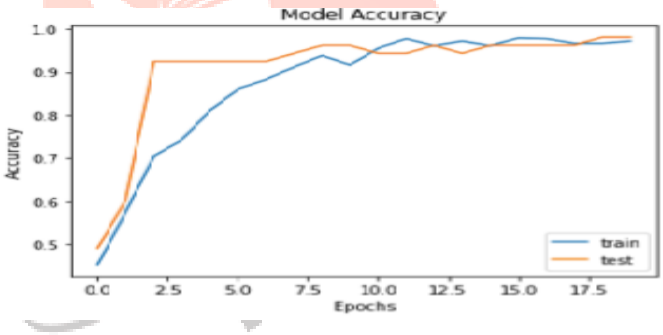

figure 4: model accuracy

The validation process is as shown the Figure:5. Choose a leaf image. Then pre-process images suitable for input to the VGG 19 model such as change the size of the image to 224*224 and convert the image to a two-dimensional array. Then give an image as input to the VGG 19 model. VGG19 model gives the prediction output. Flattens the prediction output find index position of the maximum value.

```
[[1. 0. 0. 0. 0.]]
0
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figure 6: flattened prediction output and index position of the highest value

Consider the Figure:6, Each index position represents the different classes of leaf diseases. The input image that belongs to the class represents the index 0.

V. FINAL OUTPUT

1. Choose an image using choose file button.

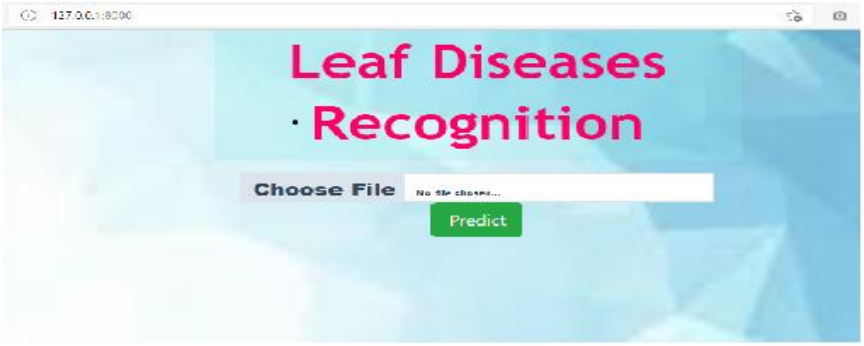

figure 7: web page for leaf disease detection

2. Click on the Predict Button to show the result.
3. After choosing the leaf image click on the Predict button to detect the disease of the leaf image.

figure 8: detection of tomato late blight image

figure 9: detection of tomato bacterial spot image

figure 10: detection of tomato healthy image

figure 11: detection of tomato septoria leaf spot image

figure 12: detection of tomato mosaic virus image

VI. CONCLUSION

The comparative study of different approaches for doing leaf image detection We understand the deep convolutional neural networks give better results than the traditional approaches. Among the deep convolutional neural network VGG models have the greatest accuracy. VGG 19 is the latest VGG deep convolutional neural network Which has 19 layers, which gives more accurate results than the VGG 16. Proposed a new approach to leaf disease detection by using VGG19model.

REFERENCES

[1] Leaf Disease Detection Using Image Processing Techniques, Hrushikesh Dattatray Marathe1Prerna Namdeorao Kothe2, Dept. of Electronics & Telecommunication, Sinhgad Academy of Engineering, Konda (Bk), University of Pune, Pune, India

[2] Detection of Leaf Disease using Convolutional Neural Network, A T Madhavi, MMYughesh, Srinidhi, CSS Vijaya Sundar, Easwari Engineering College, Ramapuram, Tamilnadu, India.

[3] Deep learning models for plant disease detection and diagnosis Konstantinos P. Ferentinos, Hellenic Agricultural Organization "Demeter", Institute of Soil & Water Resources, Dept. of Agricultural Engineering, 61 Dimokratias Av., 13561 Athens, Greece.

[4] Design and Development of Efficient Techniques for Leaf Disease Detection using Deep Convolutional Neural Networks Meeradevi Ranjana V Monica R Mundada Dept of CSE M S Ramaiah Institute of Technology M S Ramaiah Institute of Technology Bangalore, India Bangalore, India Bangalore, India

[5] analyticsindiamag.com/practical-comparison-of-transfer-learning-models-in-multi-class-image-classification

[6] Plant Disease Detection and Classification by Deep Learning—A Review LILI LI1, SHUJUAN ZHANG 2, AND BIN WANG College of Information Science and Engineering, Shanxi Agricultural University, Jinzhong 030800, China 2College of Agricultural Engineering, Shanxi Agricultural University, Jianzhong 030800, China Corresponding author: Shujuan Zhang.