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Plant Disease Detection Using Deep Learning Techniques

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Abstract - *Now a days the major disease in agricultural field would be plant disease. It destroys the crop, Farmers experience much difficulties due to the diseases. Most of the people depend on the naked-eye technique to find the disease but it is time consuming. Sooner it increases the complexity. Here many algorithm can be used to detect disease. It depends on the accuracy .So this paper present a method to detect the plant disease using machine learning under which using CNN algorithm can be found. The main focus is to develop a disease detection system for finding the disease. Therefore under CNN algorithm this paper have basically used MobileNet Architecture. Few parameters have been considered inorder to find the result. This paper have considered 38 different leaves to find the disease. By capturing the image and by extracting the features of it we get the disease. In this papers results shows the better accuracy than the other papers.*

Key Words: **CNN, Deep learning, MobileNet.**

1.INTRODUCTION

Agriculture is the base for the country's development. As everyone will depend on agriculture, It plays an important role for the event. It is one of the very old practice. There are ways of infecting the plants, Abiotic and Biotic diseases. Abiotic or the non-infectious diseases are caused by conditions which are external to the plant,and not living agents. They cannot spread from plant to plant, but are very common and should be considerd when assessing the health of ant plant. Whereas, Biotic or infectious diseases are caused by living organism. They are called plant pathogens once they infect plants. For the purpose of discussing plant pathology, only plant disease pathogens will be discussed.

Figure 1.1

Figure 1.2

Figure 1.3

Pathogens can be spread from plant-to-plant and may infect all types of plant tissue including leaves, shoots, stems, crowns, roots, tubers, fruit, seeds and vascular tissues. But there are negative impacts in it, such as climatic changes, plant dieases etc. In India,most of the population does depend on the agriculture. Disease on plant results in the many reduction in both the standard and quantity of agricultural products. Plant pathogens are similar to those which cause disease in humans and animals. Fungi, fungal-like organisms, bacteria, phytoplasmas, viruses, viroids, nematodes and parasitic higher plant are all plant pathogens. Unpredictable climate changes and less information about the soil that is suitable for the particular crop also leads to downscale in the agricultural products. The main disease which we talk here about is plant diseases. The diseases which cannot be seen through naked eye, makes it difficult for farmers to find out the reason for the effect. Due to this farmers find it more difficult to understand the diagnosis of disease and to find the cure for it. In order to make it easy there should be a system which would help the farmers to easily understand what disease does the leaf have. So this paper uses the deep learning technique for the process of

image and realize through its feature what disease does the leaf has. Since deep learning can be used in agricultural field, so this paper use deep learning technique where we make the use of CNN algorithm under which MobileNet Architecture has been used for the detection of the plant disease. This paper consider a leaf which is affected and by using the algorithm, its disease with the accuracy can be found. The early detection of the diseases will be very helpful for the farmers and it will help us to control the spread of the disease.

2. LITERATURE SURVEY

In [1] the authors **S.V.Militante, B.D.Gerardo** and **N.V.Dionisio** has concluded that the latest improvements in computer vision formulated through deep learning have paved the method for how to detect and diagnose diseases in plants by using a camera to capture images as basics for recognizing several types of plant diseases. This study provides an efficient solution for detecting multiple diseases in several plant varieties. The system was designed to detect and recognize several plant varients specifically apple, cron, grapes, potato, sugarcane, and tomato. The system can also detect several diseases of plants. Comprised of 35,000 images of healthy plant leaves and infected with the diseases, the researchers were able to train deep learning models to detect and recognize plant diseases and the absence of these diseases. The trained model has achieved an accuracy rate of 96.5% and the system was able to register up to 100% accuracy in detecting and recognizing the plant variety and the type of diseases the plant was infected.

In [2] the authors **Mercelin Francis and C.Deisy** has concluded that Convolutional Neural Network is the base of all deep learning models. Therefore a Convolutional Neural Network model is created and developed to perform plant disease detection and classification using apple and tomato leaf images of healthy and diseased plants. The model consists of four convolutional layers each followed by pooling layers. Two fully connected dense layers and sigmoid function is used to detect the probability of presence of disease or not. Training of model was done on apple and tomato leaf image dataset containing 3663 images achieving the accuracy of 87%. The overfitting problem is identified and removed setting the dropout value to 0.2. as the model allows parallel processing, it is also run on GPU Tesla to evaluate its speed of performance and accuracy. hence the paper provides an insight of creativeness to the researchers to develop an integrated plant disease identification system that gives successful results in realtime.

In [3] the authors **H.Durmus, E.O.Gunes** and **M.Kirci** has concluded that plant disease have an effect on the expansion of their species, therefore early detection is extremely vital. However, until the occurrence of the Machine Learning set, i.e, Deep Learning, this research space tends to have strong potential in terms of improved precision, several kinds of Deep Learning instrumentation have been used for the identification and classification of plant diseases. Several of the advanced/ changed Deep learning structure square measure used at the side of several virtual techniques to discover and differentiate the symptoms of plant diseases. Additionally, many operational metrics for the testing of those structures/ways square measure used. This review provides an entire summary of the deep learning models accustomed to visualize three plant diseases. Additionally, some analysis gaps are known that square measure additional specific in designation diseases in plants, even before their symptoms becomes obvious.

In [4] the authors **S.Ashok, G.Kishore, V.Rajesh, S.Suchitra,S.G.G.Sophia** and **B.Pavithra** has concluded early detection of plant leaf detection is a major necessity in a growing agricultural economy but also with a large amount of population to feed, itis necessary that leaf diseases in plant are detected at a very early stage and predictive mechanisms to be adopted to make them safe and avoid losses to the agri-based economy. This paper proposes to identify the Tomato Plant Leaf disease using image processing techniques based on image segmentation, clustering, and open-sorce algorithms, thus all contributing to a reliable, safe, and accurate system of leaf disease with the specialization to Tomato Plants.

3. METHODOLOGY

3.1 CNN(Convolutional Neural Network)

A Convolutional Neural Network is the Deep Learning Algorithm which is used for taking an input image, assign importance(learnable weights and biases) to numerous aspects or objects within the image and be able to differentiate one from the other.

3.2 MobileNet Architecture:

The MobileNet model is designed to be used in mobile applications, and it is TensorFlow's first mobile computer vision model.

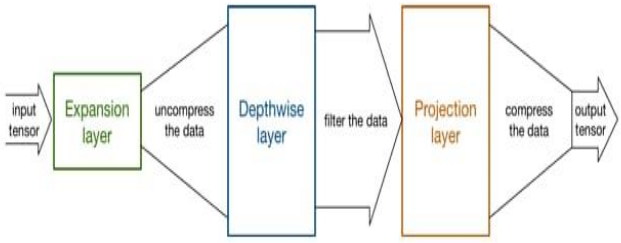

Figure 3.1 MobileNet Architecture

In this figure 3.2, it shows the process of MobileNet Architecture.

MobileNet uses depthwise seperable convolutions. It notably bring down the number of parameters when compared to the network with regular convolutions with the same depth

in the nets. This results in lightweight deep neural networks. A depthwise separable convolution is made from two operations Depthwise convolution and Pointwise convolution. MobileNet is a class of CNN that was open-sourced by Google, and therefore, this gives us an excellent starting point for training our classifiers that are insanely small and insanely fast.

The following are the equations that are used;

$$Accuracy = \frac{TP+TN}{TP+FN+FP+TN} \times 100\% \quad (1)$$

$$Precision = \frac{TP}{TP+FP} \times 100\% \quad (2)$$

$$Recall = \frac{TP}{TP+FN} \times 100\% \quad (3)$$

$$F1 - Score = \frac{2\times(precision\times recall)}{(precision+recall)} \times 100\% \quad (4)$$

The utmost accuracy is 85%.

(True Positive(TP), False Positive(FP), True Negative(TN), False Negative(FS)).

3.2.1 Depthwise Convolution:

Depthwise Convolution is the category of convolution where we apply one single convolutional filter for every input channel. In the regular 2D convolution performed over multiple input channels, the filter is as intense as the input and lets us freely mix channels to create each element in the output.

3.2.2 Pointwise Convolution:

Pointwise Convolution is a type of convolution that uses a 1*1 kernal: a kernel that iterates through every single point. It can be used in conjuction with depthwise convolutions to produce an efficient class of convolutions to produce an efficient class of convolutions known as depthwise-seperable convolutions. thoroughly through a entirely automated system that not only reduce the need time but obtain fast and accurate results.

RESULTS

Figure 4.1 User-login Page

In this figure 4.1, it shows the front page, where we upload the picture from the dataset by clicking on the choose image.

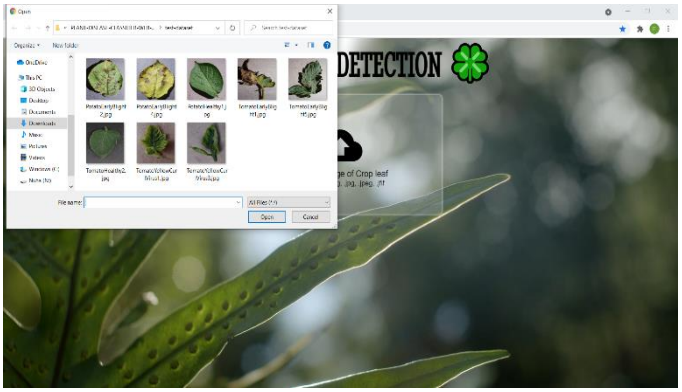

Figure 4.2 Selection Page

In this figure 4.2, it shows the image of web page where we get to select which leaf disease we are going to find.

Figure 8.3 Result Page

In this figure 8.3, it shows the disease name by selecting the image and it also shows the accuracy of the model, here it shows 84% accuracy.

```
[ ] # Evaluate the model on the Validation dataset
    results = mobilenet_model.evaluate(validation_set_from_dir)

    550/550 [==============================] - 59s 107ms/step

[ ] print("Validation Loss :-", results[0])
    print("="*30)
    print("Validation Accuracy :-", results[1])

    Validation Loss :- 0.014583874493837357
    ==============================
    Validation Accuracy :- 0.8529478907585144
```

Figure 4.4 Validation set

Figure 4.4 shows the overall loss and accuracy of the validation dataset.

CONCLUSIONS

The overall system results show that the MobileNet model works better as compared to the other models and provided better accuracy in detecting the plant disease. In this paper the deep learning algorithm i.e Convolutional Neural Network is used to detect the disease in the plant leaves. The model is basically tested on some types of plant species with some types of plant diseases. The model was made using Tensor flow, Keras and tensorflow js frameworks and using these frameworks we created a webpage. Also the model are going to be further improved by increasing the parameters for training and test.

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