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Phytopathology and Diagnosis using Deep Learning

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Abstract:- Phytopathology is the scientific study of plant diseases caused by environmental conditions. Plant diseases must be detected in the early stages of harvest. For detection of plant diseases as accurately and quickly as possible with the lower costs, analysis of patterns and symptoms of plant disease are required. Hence, we present a system which will detect whether the plant is affected with any disease. If the plant is affected with any disease, the system will provide the causes for disease along with solution for the same. This system is using CNN, that comes under Deep Learning which is primarily used for classification of images based on the characteristics.

***Keywords*:-** *Phytopathology, CNN (Convolution Neural Network), Harvest, Plant Disease Detection*

I. INTRODUCTION

India is the mostly agriculture dependent country. Most of the sectors in India are agriculture based. Indian agriculture sector provides half of the employment. India is the country which provides the spicy products, rice, wheat, spices to the globe. Farmers are completely dependent on agriculture and the crops which they produce. Therefore, in agriculture sector plant diseases must be detected and identified with accurate solutions.

Due to the plant diseases, farmers cannot produce the yield as they are expecting and therefore it affects the economy as well. So to identify and detect plant diseases as early as possible, we should make use of disease detection techniques. Various parts of the plants such as stem and leaves gets affected due to diseases. A person/farmer cannot identify the accurate disease. In most of the countries, farmers are unable to make a contact with agriculture experts or technicians. Therefore, it is necessary to adopt new technologies which will perform the plant disease detection as well as classification.

II. CONVOLUTIONAL NEURAL NETWORK

CNN can be used in various applications such as natural language processing, speech recognition. It can be used to identify the satellite images which contain trees, roads, buildings, etc. CNN algorithm such as neural networks, where it consist of neurons which takes it's input and multiplies with its weight and then it is passed through the activation function layer to another neurons. In CNN, each layer makes use of output of previous layer as an input. In CNN there is no need to perform feature extraction and classification because the model itself extracts the features while training. The applications such as speech recognition, image processing, image restoration, natural language processing makes use of CNN.

CNN easily identifies and classifies the various objects without/less processing; CNN can be used to analyze the visual images and also be used to extract the features with multi-layered structure. Figure 1 represents the architecture of CNN.

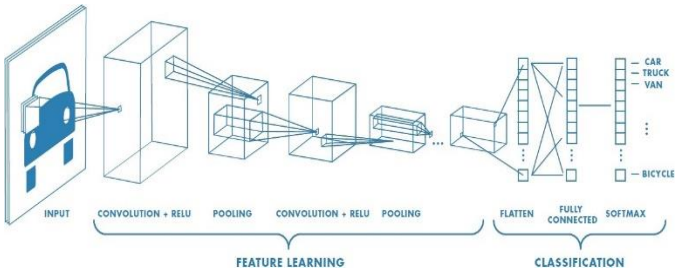

Fig 1:- General Architecture of CNN

CNN consists of four main layers:

A. Convolutional layer

In convolution layer, sequences of mathematical operations are performed so that features can be extracted from input image. The filter is used to reduce the size of an image. The filter is moved step by step from left corner of an image. At every step, the values present in image are multiplied with the filter values and the summation of result is performed. A new matrix of a smaller size is created from the input image. Figure 2 represents the convolution functionalities in convolution layer of 7x7 image input and 3x3 filter

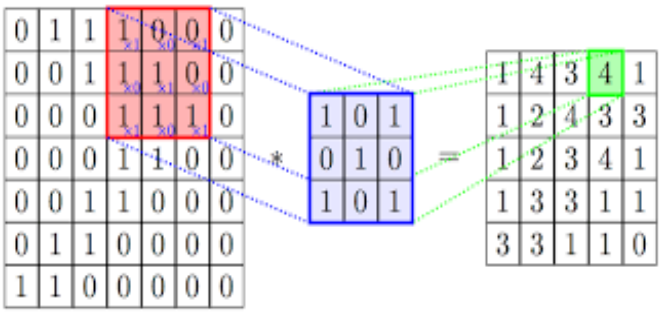

Fig 2:- Convolution functionalities of 7x7 image with 3x3 filter

B. Pooling layer

The pooling layer gets implemented after the convolution layer is performed. In this layer the resulted output matrix size is get reduced. In pooling layer filters with different sizes can be used, By default 2x2 size filter is used. Figure 3 represents an example of pooling functionalities.

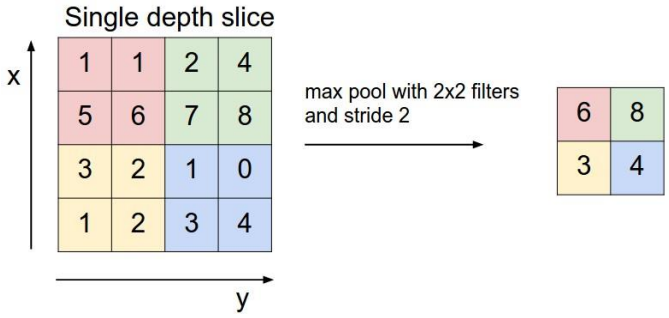

Fig 3:- Pooling functionalities

C. Activation function layer

Activation function layer is simply output of a function. This layer performs functions such as identification, tan h, Rectified linear unit, Arc Tan.

D. Fully connected layer.

After performing convolution, pooling and activation layers, resulted matrix is given as input to the fully connected layer. In this layer Recognition and classification both functions are performed. Figure 4 represents fully connected layer.

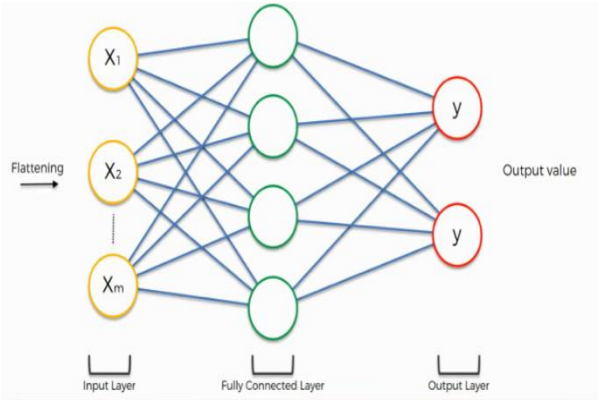

Fig 4:- Fully connected layer

III. PROPOSED METHOD

In this study, images from PlantVillage dataset are used. Dataset is divided into 80-20 ration. 80% of dataset is used for training Neural Network and 20% of dataset is used for testing neural network. Once the neural network is trained for disease classification necessary files are generated for deploying the neural network. This file is used for identifying disease.

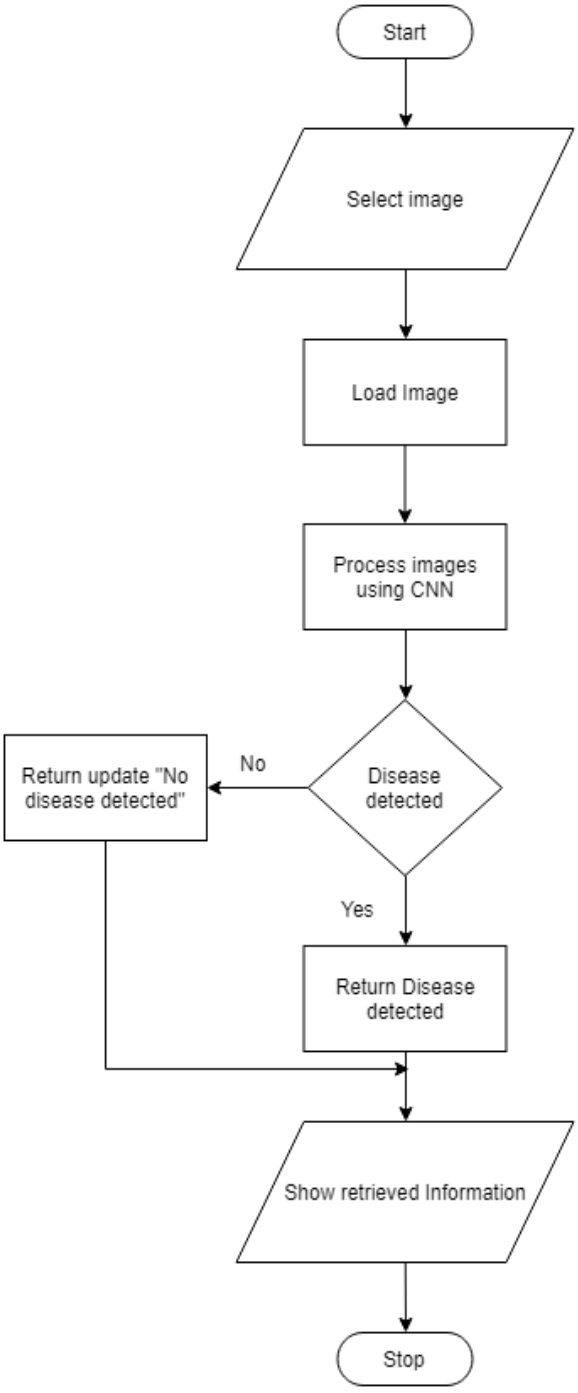

Fig 5

For disease detection, image is captured or selected. The selected or captured image is then processed by Neural Network. If the disease is detected by neural network then it will give a diagnosis report consisting reasons for disease along with how it can be cured.

IV. EXPERIMENTAL RESULTS

To carry out functionality of this system, we have performed a demonstration on few leaf image databases and have performed classification. The challenge occurred while performing demonstration is that, the more than 2 leaves having different diseases are somehow similar to each other. Therefore, this challenge can be resulted in getting the leaves classified in different classes.

V. CONCLUSION

Currently the Convolutional Neural Network (CNN) system can detect healthy tomato leaves and tomato leaves affected by bacterial spots with the accuracy of 97%. By providing more training data to the CNN the system can predict different diseases accurately. CNN doesn't require pre-processing for the input. Which means that the system does not require to do pre-processing and classification in two separate parts, CNN does both the pre-processing and classification. CNN can work with both supervised, unsupervised and semi-supervised data, Because of this the prediction model is easy to train.

REFERENCES

[1]. Leninisha Shanmugam, Agasta Adline A. L, Aishwarya N Krithika G, "Disease Detection in Crops using Remote Sensing Images". 2017 IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development.

[2]. Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin Md Shakaff, Rohani Binti S Mohamed Farook, "Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques". 2012 Third International Conference on Intelligent Systems Modelling and Simulation.

[3]. K. Indumathi, R. Hemalatha, S. Aasha Nandhini and S. Radha, "Intelligent Plant Disease Detection System Using Wireless Multimedia Sensor Networks". IEEE WiSPNET 2017 conference.

[4]. Melike Sardogan, Adem Tuncer, Yunus Ozen, "Plant Leaf Disease Detection and Classification based on CNN with LVQ Algorithm". IEEE 2018 3rd International Conference on Computer Science and Engineering.