IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 8 Issue 4, April 2021
ISSN (Online) 2348 – 7968 | Impact Factor (2020) – 6.72
www.ijiset.com

Plant Disease Detection Using TensorFlow

S.B. Chaudhari[1], Vaibhav Wagaskar[2], Mohseen Shaikh [3], Vijay Shirsath[4], Onkar Shelke[5]

[1]Professor, Department of Computer Science Engineering, Jaywantrao Sawant College of Engineering, Hadapsar, Maharashtra, India,
Email: sbchaudhari300@gmail.com

[2,3,4,5] Department of Computer Science Engineering,Jaywantrao Sawant College of Engineering, Hadapsar, Maharashtra, India,
Email: onkyshelke07@gmail.com

Abstract — In this paper we proposed to create Convolutional Neural Network (CNN) model that can identify Diseases on leaves of plants. So, we are going to discuss how we can use existing tools like TensorFlow and Keras to solve this real-world problem. Here we have chosen to implement neural network using TensorFlow to detect different diseases on plant leaves. Hence, we are going to use Plant Village data-set from Kaggle and build CNN model using TensorFlow framework. After this we will train this CNN model on Plant Village data-set. After that we will save model in ".h5" file and use this pretrained model to detect diseases on the leaves.

Keywords-- data-set, loss, TensorFlow, convolutional neural network, hypothesis, neural network,plant leaf disease, optimizer.

I. INTRODUCTION

Agriculture is always backbone of developing nations. To make people in such country economically well and strong we need to harvest good quality and quantity from agriculture. Every year huge amount of crop gets damage due to bad weather, viruses and different crops diseases. Usually farmer fails to identify new diseases on crops and plants. So, plant does not get specific treatment for specific disease or viruses. Usually many farmers cannot afford the experts advices due to lack of money and other circumstances like travelling long distance to get the help, and the time-consuming processes. To overcome all this problem, we have great tools in technologies. To ensure quality yield we definitely need to use different techniques and available technologies. Time to time diagnosis is very important now days to maximize yeild.

We can make use of the new technologies like
Artificial intelligence and Machines Learning to overcome the problem that usually occurs.

Rest of the paper is organized as follows. Section III explain working of single neuron and complex neural network. Section IV explain how system work and interpret the result. Then section V point out the main applications. Finally, in section VI we conclude this paper along with possible future directions to improve the model and features.

II. PLANT DISEASES AND ITS SYMPTOMS

Before designing model, we need to make analysis of images. Identify the images into categories, so below are few of them: -

1) *Bacterial diseases:* Plants affected with bacterial spot usually shows symptoms like pale green spot, wilting, and blight.

IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 8 Issue 4, April 2021
ISSN (Online) 2348 – 7968 | Impact Factor (2020) – 6.72
www.ijiset.com

2) *Viral disease:* Viruses are difficult to identify. But we can consider symptoms like: - Crinkled leaves, Yellow leaves, mosaic leaf pattern

WORKING OF ARTIFICIAL NEURON AND DEEP NEURAL NETWORK

Understanding how Artificial neuron works is very essential while building complex neural network. Hence below diagram shows different input and output variables that neuron has: -

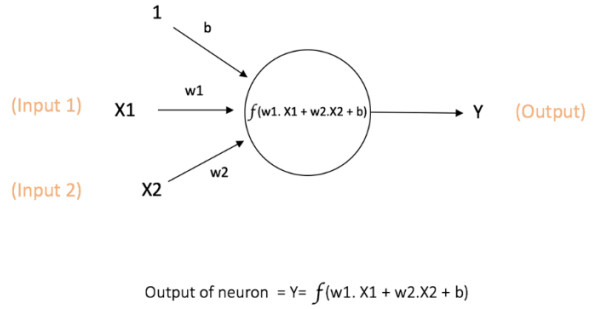


Figure 1. Single Artificial Neuron

Above neuron has two input variable viz.X1,X2. And It has weights w1,w2 associated with these variables. And 3rd parameter shown is bias. For this neuron bias has value 1. When all those parameters are feeded to neuron It perform the mathematical calculations as shown in formula. Usually these calculations are performed using activation function.

Activation Function is mathematical formula which decides whether neuron will be fired or not. Below are some popular activation functions that are often used in building neural network.

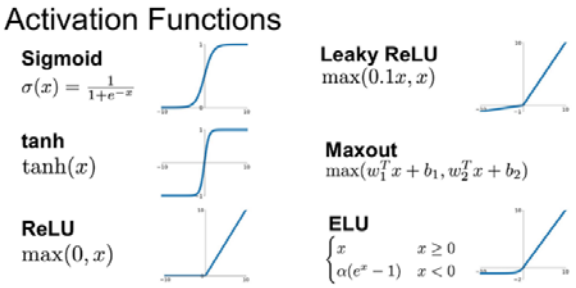
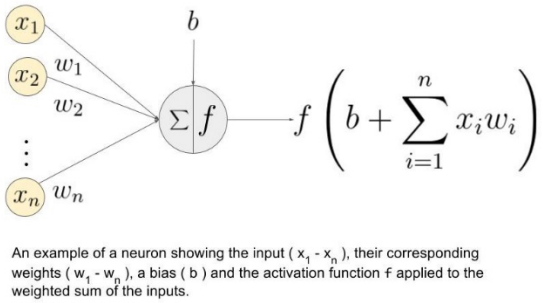


Figure 2. Activation Functions

Now let us see how complex features are feeded to neuron Suppose we have single neuron and n number of features. Then all those n number of features are feeded to neuron. Neuron makes computation with help of activation function and produces output. Below diagram shows how It is achieved:-

IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 8 Issue 4, April 2021
ISSN (Online) 2348 – 7968 | Impact Factor (2020) – 6.72
www.ijiset.com



An example of a neuron showing the input (x_1 - x_n), their corresponding weights (w_1 - w_n), a bias (b) and the activation function f applied to the weighted sum of the inputs.

Figure 3. Single Artificial Neuron with n Number of Feature/Variables

In above diagram x1, x2…. Xn are feature and w1, w2……Wn are weights. We calculate sum of product of XiWi till last variable and then bias is added.

Now let us take look over more complex neural network i.e. Deep Neural Network. Deep Neural Network is nothing but complex network of many Neurons.

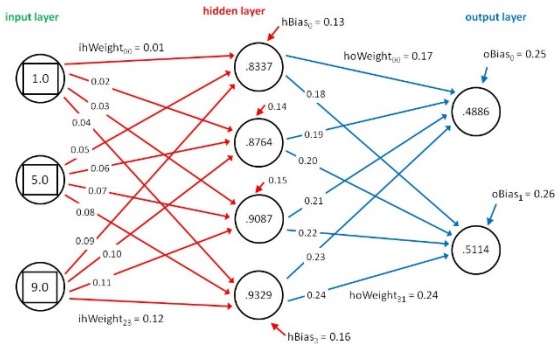


Figure 4. Deep Neural Network

Above diagram shows exact overview of what we are going to implement in Neural Network. Diagram show complex Neural Network with Input Layer, Hidden Layer, and Output Layer. Now Let us study how this could help us.

We know that image consist of pixel and RGB color code. Let us consider gray Scale Image of 25x25 pixel. Each pixel in this image will have certain value between range 0-255.Now we convert image to matrix of size 25x25.Where each element in matrix represents single pixel value. That mean there are altogether 25*25 = 625 values for single Image.

With the help of python libraries, we can flattened matrix to a 1-dimensional array.

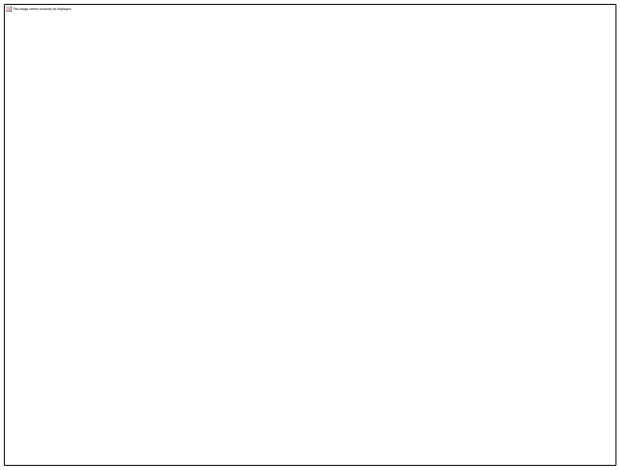


Figure 5. 25x25 Pixel Hand-Written Digit

So this 1-Dimensional Matrix consists of 1 column and 625 rows. Now we can feed this 625 row to neural network having 625 neurons in input layer.

Like-wise we can do this with images of more resolution and build neural network based on requirement. Here we can build neural Network with any number of hidden layer and there can be any number of output categories.

III. PROPOSED SYSTEM

To implement neural network and train it on dataset first we need to download dataset either on local machine or on cloud storages. Here we will store data set in google drive. To run python code, we will be using google colab as Jupiter notebook.

There are total five steps involved in Disease detection they are as follows:-

1) image acquisition
2) image preprocessing
3) Image Segmentation
4) Segment Selection
5) Configure NN

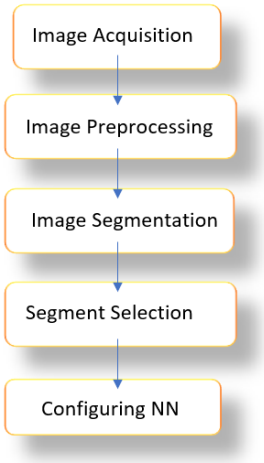


Figure 6. Flow Chart for Disease Detection

A. *Image Acquisition*

We need various images of leaves to train the model. So we acquire high quality images from different sources and categorize them into different categories. For now we will be using Plant Village dataset from Kaggle. It has up to 15 different directories and having up to 20K images. Hence we can directly train our model with this dataset and use for predictions. Later we also can add different images and train model again to improve model.

B. *Image Preprocessing*

The aim of Image pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing, although geometric transformations of images (e.g. rotation, scaling, translation) are classified among pre-processing methods.

The aim of image processing is to enhance the image data (features) by suppressing unwanted distortions and/or enhancement of some important image features in order that our models can benefit from this improved data to make computation on data.
In this phase we usually improve image quality and we make the color correction to highlight feature so that they could be simply catch by the classifier. We also reduces the size of image to certain limit so that we can convert the image to array and feed it to neural network
Image is pre-processed to enhance the image data that suppress undesired distortions, enhances some image features important for further processing and analysis task. It includes color space conversion, image enhancement.

C. *Image Segmentation*

Image segmentation is process of finding boundaries of objects in images and enhance those boundaries in such way that they can become more highlighted and could be capture immediately by classifier.

Image segmentation is best technique to improve image and characteristics of image. It also work well on low resolution and low quality images.

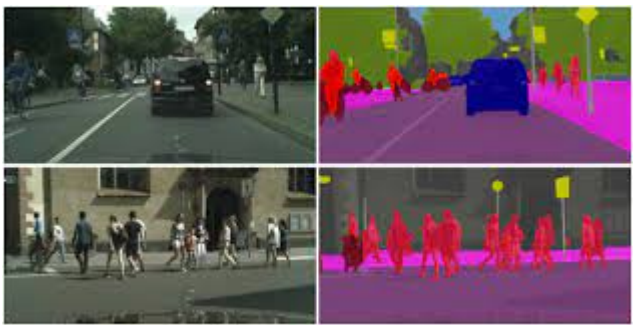


Figure 7. Image Segmentation

In above Figure 7 we can see that people on road are not properly visible with original image. But when we use image segmentation people are marked as red and can be properly seen. Also, intensity of the certain pixel is enhanced.

D. *Segment Selection*

This is process of choosing the correct segment from image and using that selected segment for prediction. In figure 7 we can see that peoples on road are marked In red color, we can select

those people and detect that this are people. And this can be used for further classification.

E. *Configuring Convolutional Neural Network*

Convolutional neural networks (**CNN**) are great for photo tagging and recognizing patterns in image data. Here we will build Convolutional Neural Network in TensorFlow Framework. Below is the figure that gives us idea how CNN work.

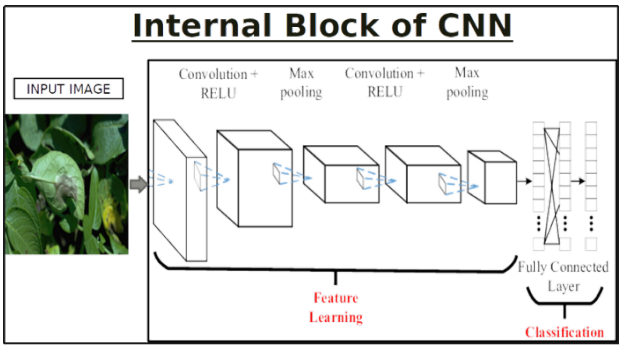


Figure 8. Image Segmentation

When array of image is passed to CNN layer it perform operation called 'Convolution'. It is a linear operation that involves the multiplication of a set of weights with the input. This multiplication is, called a filter or a kernel.

This filter slide over image and extracts important data from image and passes it to consecutive Convolutional layer.

IV. APPLICATIONS

Diseases interrupts its vital functions of plants like photo-synthesis, transpiration, pollination, fertilization, germination etc. Usually these diseases are caused by pathogens viz. bacteria, fungi and viruses, and adverse environmental conditions. Therefore, the first stage diagnosis of disease is important task. Farmers need continuous monitoring of experts which could be expensive and time consuming. Hence we can use technology to find fast, less expensive and accurate method to automatically detect the diseases from the symptoms that appear on the plant leaf is of great realistic significance. This permits Neural Networks to supply image based automatic inspection. and help farmers to treat plant according to diseases.

V. CONCLUSION

This paper summarizes the use of Artificial Intelligence and Convolutional Neural network for detection of plant diseases using powerful tool Tensorflow.

We can make further improvement to model by using more number of images for training. We also can add different categories of plant diseases and rebuild model. Further Natural Language Processing can be implemented to add suggestion,remedies,medicines and spray to diseases.

REFERENCES

[1] Saradhambal.G, Dhivya R, Latha.S, R.Rajesh PLANT DISEASE DETECTION AND ITS SOLUTION USING IMAGE CLASSIFICATION, International Journal of Pure and Applied Mathematics,Volume 119 , No. 14 , 2018 , 879-884.

[2] P. Harini,L. V. Chandran , Disease Detection in Plant Leaves using K-Means Clustering and

Neural Network, International Journal of Trend in Scientific Research and Development (IJTSRD) Volume 4 Issue 1, December 2019 .

[3] Yin Min Oo ,Nay Chi Htun,, Plant Leaf Disease Detection and Classification using Image Processing Spot , IEEE International Conference on Emerging Trends in Sci- enceInternational Journal of Research and Engineering ISSN: 2348-7860 (O), 2348-7852 (P) , Vol. 5 No. 9 , September-October 2018.

[4] Trimi Neha Tete, Sushma Kamlu ,Crop disease detection Plant Disease Detection Using Different Algorithms, Proceedings of the Second International Conference on Research in Intelligent and Computing in Engineering pp. 103–106, DOI: 10.15439/2017 ,R24 ACSIS, Vol. 10 ISSN 2300-5963

[5] Mr.V Suresh, D Gopinath, M Hemavarthini, K Jayanthan, Mohana Krishnan, Plant Disease Detection using Image Processing, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 9 Issue 03, March-2020

[6] Vishnu S, A. Ranjith Ram, Plant Disease Detection Using Leaf Pattern: A Review , International Journal of Innovative Science, Engineering & Technology, ISSN 2348 – 7968 ,Vol. 2 Issue 6, June 2015 .

[7] Anne-Katrin Mahlen , Plant Disease Detection by Imaging Sensors - Parallels and Specific Demands for Precision Agriculture and Plant Phenotypings, Institute for Crop Science and Resource Conservation (INRES) Phytomedicine, Unversity of Bonn Meckenheer Al 100 53115 Bonn, Germany

[8] Alka Dixit, Erande Rani, LokhandeYogita, Nighot Rutuja, Mr.Kote S.V, PLANT DISEASE DETECTION ,INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, ISSN: 2277-9655 (I2OR), Publication Impact Factor: 3.785, February 2016