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DETECTION OF PEPPER, TOMATO AND POTATO LEAVES CONDITION USING CONVOLUTIONAL NEURAL NETWORK

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Abstract: These days, technology has taken its own place in every corner of the world. Food is a basic requirement for everyone and it's very important. To solve problems like hunger and malnutrition we need a good source of food for everyone. Most of the plants are either infected or dead. By observing a leaf, we can't identify the problem of that plant due to lack of necessary infrastructure which harms the crop that results in malnutrition. All the diseases of the plant are an observable pattern on leaves. To avoid these situations, we developed a web application that takes plant leaf images and determines their condition, gives tips to improve the harvest. In this paper, we discuss the identification of plant conditions using a Deep learning algorithm called Convolution Neural Network (CNN).

Index Terms **- Malnutrition, Deep learning, Convolution Neural Network.**

I. INTRODUCTION

Modern technologies have given human society the power to provide enough food to fulfill the demand of over seven billion individuals. However, food security remains vulnerable by variety of things together with temperature change, the decline in pollinators, plant diseases. Plant diseases don't seem to be solely a threat to food security on a world scale, however may have fatal consequences for granger farmers whose livelihoods rely on healthy crops. Numerous sorts of the tomato are widely grown in temperate climates across the planet. Tomato is the most generally cultivated crop in India. Tomato is a vital vegetable crop regarding both income and nutrition. Potato is a crop which has always been the poor man's friend. Potato is being cultivated within the country for the last 300 years. For vegetable purposes it's become one among the foremost popular crops in the country. Bell pepper also referred as capsicum, sweet pepper is a popular vegetable in India. Pepper has become a crucial green vegetable crop globally.

Within the developing world, over eighty percentage of the agricultural production is generated by granger farmers, and reports of yield loss of over 50% due to pests and diseases square measure common. Moreover, the biggest fraction of hungry individuals (50%) lives in granger farming households, creating granger farmers a bunch that is significantly at risk of pathogen-derived disruptions within the food offer. Varied efforts are developed to stop crop loss. Historical approaches of widespread application of chemicals have within the past decade progressively been supplemented by integrated pest management approaches. Traditionally, illness identification has been supported by agricultural extension organizations or alternative establishments, like native plant clinics. Leveraging the increasing net penetration worldwide the application proposed will help many agriculturalists all over the world. Smartphones, supply a really novel approach to assist determining diseases as a result of their computing power, high-resolution displays, and intensive inbuilt sets of accessories, like advanced HD cameras. It's calculated that there'll be between six and seven billion smartphones on the world by 2022. At the top of 2015, already sixty ninth of the world's population had access to mobile broadband coverage, and mobile broadband penetration reached forty seven percentage in 2015, a 12-fold increase since 2007. The combined factors of widespread smartphone penetration, HD cameras, and superior processors in mobile devices cause a scenario where illness identification is technically possible at large scale. Nowadays many smartphones have integrated LIDAR support which helps in developing an AR real-time application which makes the process further more accurate and simple to use. According to WHO in 2013, India is of the top third country suffering from malnutrition. Wastage of food due to plant illness is a major cause of malnutrition. In this paper we discuss working and methodology of an application which helps farmers, gardeners, agriculture enthusiasts and encourages many others to grow plants.

II. DATA SET DESCRIPTION

The dataset is collected from an open-source application from plantvillage. Plantvillage dataset consists of 15 classes which has 3 different plant categories (Tomato, potato, pepper) with their diseased and healthy leaf images. Dataset consists 20,639 images. We are using color images which help in detecting the plant's condition. The table 2.1 represents various categories :

Table 2.1: Example Leaf images from the dataset

 Pepper bell Bacterial spot	 Pepper bell healthy	 Potato Early blight	 Potato Late Blight	 Potato Healthy
 Tomato Target Spot	 Tomato mosaic virus	 Tomato Yellow Leaf Curl Virus	 Tomato Bacterial Spot	 Tomato Early Blight
 Tomato Late Blight	 Tomato Leaf Mold	 Tomato Septoria leaf spot	 Tomato Spider mites Two spotted spider mite	 Tomato healthy

III. PREPROCESSING

The following steps are used for preprocessing the data:

Re-sizing images: Since all the images in the dataset are not of same size, we have to resize all the images into a specified image size so we are re-sizing them into 256X256X3

Conversion of image into array: Use image_to_array() pre-defined method presents in keras library to convert the images into binary values.

Encoding target variable names: Use labelbinarizer() pre-defined method present in sckitlearn library to convert the labels into binary values.

Scaling: Divide the converted array by 255, to normalize the data points in range of 0 to 1. The value 255 is used as the RGB values lie between 0 to 256.

IV. CNN

Convolutional neural network is a Deep learning algorithm mostly used for image classification and image processing. In Convolutional Neural network we need to create the architecture of the model. CNN's are similar to regular neural networks they are made up of neurons and have learnable weights and biases. The main difference is the CNN takes advantage of the image and accepts image as an image with width, height, and depth while the regular neural nets flatten the input. In the process of building the model we need to add different layers and perform different functions. Figure 4.1 shows various layers of the model and their respective input and output shapes. This algorithm takes an image as an input, passes through a sequence of layers, and returns the probability for each class. There are many Hyper parameters that can be tuned to adjust the performance of algorithm. Some of them are Number of epochs, Batch size, Learning Rate, Number of layers and Activation function.

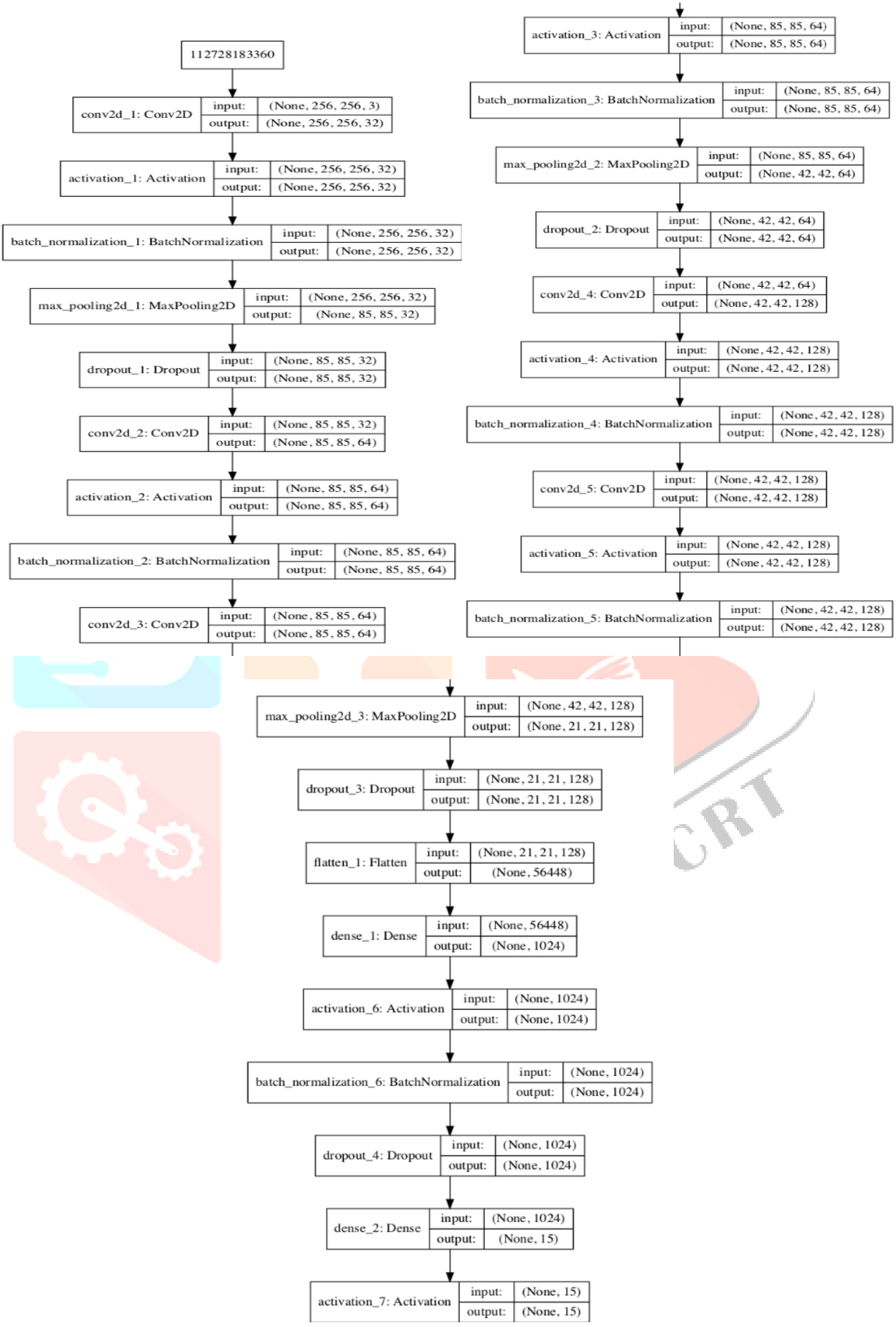

Fig 4.1 : Architecture of CNN model

The following are different layers used as shown in Fig 4.2 :
Convolutional layer : It is used to reduce the images into a form which is easier to process, without losing features.
ReLu activation : ReLu stands for Rectified Linear Unit, used for removing negative dimensionality.
Pooling layer: It reduces the dimensionality of each map but retains important information.
Fully connected layer : Flattens the data into a single dimensional array
Output layer : Softmax function is used. It converts a vector of values to a probability distribution.

After creating the model, Split the data into training and validation sets of 75 and 25 percent. We create extra data by augmenting each train image, which helps in recognizing the image from any angle, any part or any side of given input image. Augmentation performs random rotations, shifts, flips, crops. For example, take a single image it captures image with different angles like it rotates, shifts, crops the image.

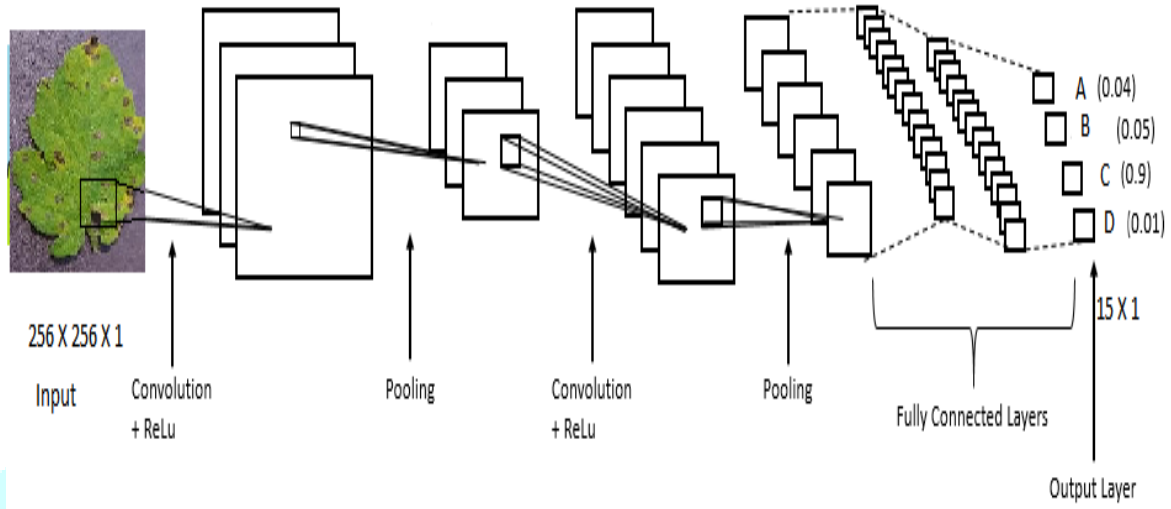

Fig 4.2 : Different CNN layers

Next perform training using the fit() method and train the model for a minimum of 45 epochs. For each epoch we get training accuracy, training loss, validation accuracy and validation loss. Finally, we get trained model. To find the efficiency of model we test model using evaluate() method. We get an accuracy of 94.6%. After achieving the desired model performance, save the model to disk using model.save() method.

V. Web Application

To create a web application, we need a framework like Flask or Django. Here we will discuss routing using Flask. In flask application we create user defined functions for preprocessing, load the saved model to predict the plant category. A web page is created using Hyper Text Markup Language, Cascading Style Sheets and Java Script.

VI. Testing And Results

Unit testing is done and the table 6.1 shows few test cases.

Table 6.1 : Test cases and Expected results

Request id	Ticket id	Request description	Expected Output	Actual Output
R_01	T_01	Enter URL of Web Page	Display Web Page	Same as Expected
R_02	T_02	Press Choose File Button	Display Web Page	Same as Expected
R_03	T_03	Select input File with .jpg or .png or .jpeg	Open File Explorer	Same as Expected
R_04	T_04	Press Predict Button	Display Result class and Description	Same as Expected
R_05	T_05	Select any other file	Error	Something went wrong

The following are few screenshots of web application. First home page is opened then ‘Choose File’ button is used to take the input image. After selecting the input image ‘Predict’ button is used to get results. Finally, results are displayed. If the given image is diseased then few management tips are given.

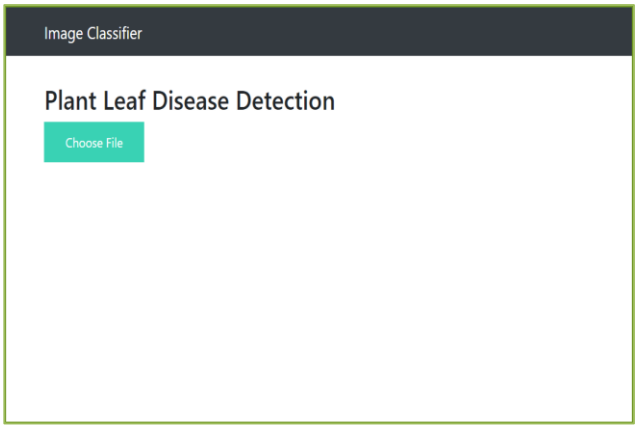

Fig 6.1 : Result screen 1

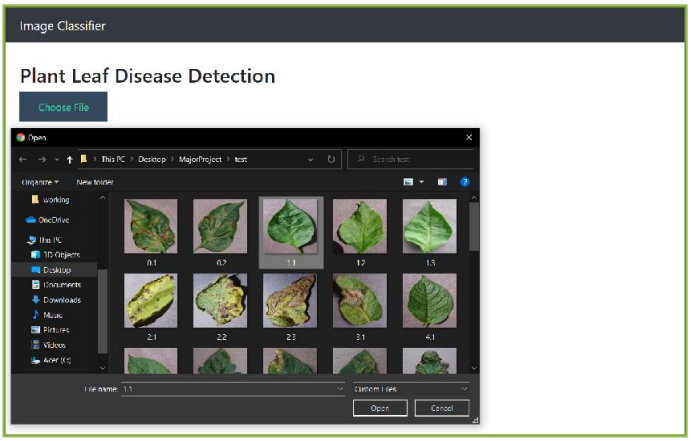

Fig 6.2 : Result screen 2

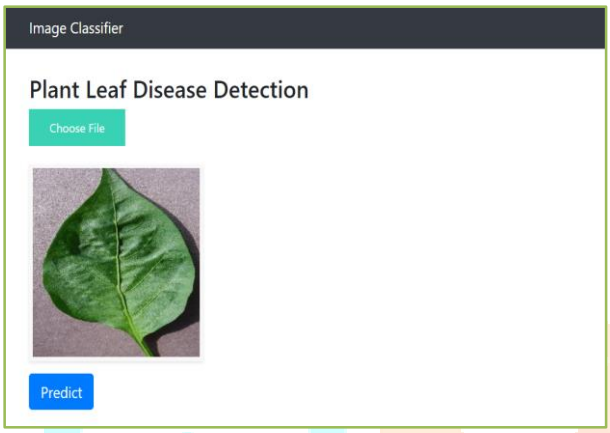

Fig 6.3 : Result screen 3

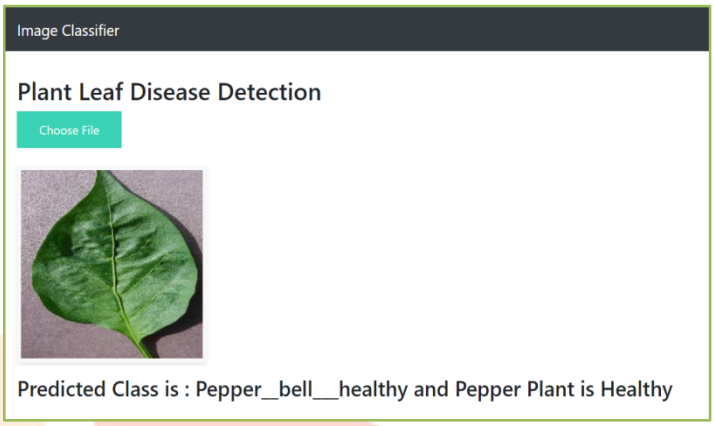

Fig 6.4 : Result screen 4

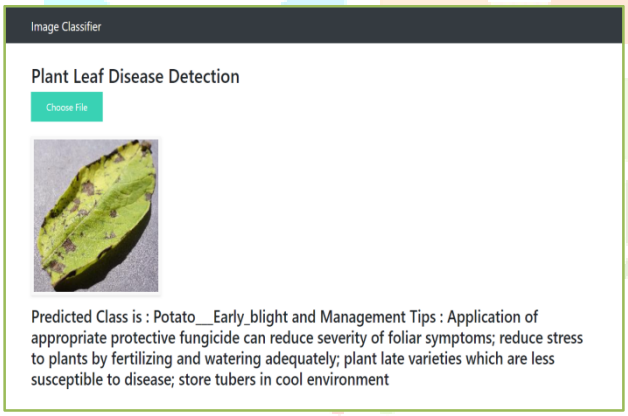

Fig 6.5 : Result screen 5

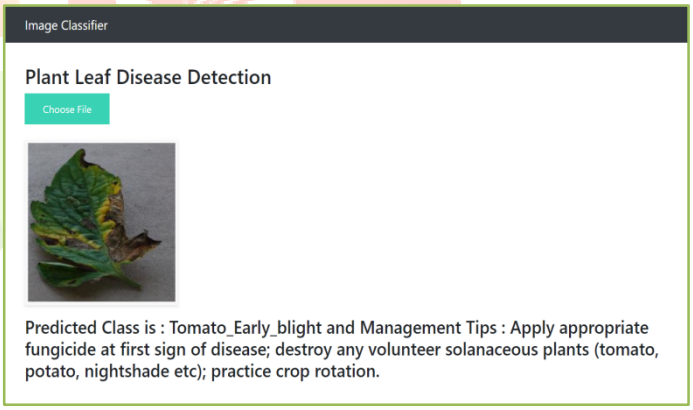

Fig 6.6 : Result screen 6

VII. FUTURE SCOPE

Developed a CNN model to detect the class of a plant using its leaf image. Created a web application for plant condition which takes leaf image as an input and predicts the respective class as output. Application also gives tips to manage disease if the given input plant is affected like nutrients and also gives tips about how to avoid them in future.

In this application we have discussed 3 different types of plant conditions as we can add more plant conditions based on our requirement and finally develop application which supports more plants and their diseases. The proposed method takes only single leaf image as input, develop a model which takes multiple images as input. This is a web application, we can upgrade application by developing a mobile app with an updated version on more plant conditions with their tips and necessary products to improve the plant conditions, include extra features like demo videos for disease management and regular care. Further researches and studies on different plant conditions will improve our knowledge on known diseases and tackle new problems efficiently.

VIII. REFERENCES

[1] "PlantVillage", Plantvillage.psu.edu, 2021.

[2] D. Klauser, "Challenges in monitoring and managing plant diseases in developing countries", Journal of Plant Diseases and Protection, vol. 125, no. 3, 235-237, 2018.

[3] "Practical Deep Learning for Coders, v3 fast.ai course v3", Course.fast.ai, 2020.

[4] Brahimi, M., Boukhalfa, K. Moussaoui, A. Deep learning for tomato diseases: classification and symptoms visualization. Applied Artificial Intelligence 31, 299–315, 2017.

[5] Fujita, E., Kawasaki, Y., Uga, H., Kagiwada, S., Iyatomi, H., Basic investigation on a robust and practical plant diagnostic system, IEEE, 989–992, 2016.

[6] Rangarajan, A.K., Purushothaman, R., Ramesh, A.,. Tomato crop disease classification using pre-trained deep learning algorithm. Procedia computer science 133, 1040–1047, 2018.

[7] P. Patil, N. Yaligar, and M. S. M, "Comparision of Performance of Classifiers - SVM, RF and ANN in Potato Blight Disease Detection Using Leaf Images," IEEE International Conference on Computational Intelligence and Computing Research, 2017.

[8] P. Sharma, Y. Berwal and W. Ghai, "Performance analysis of deep learning CNN models for disease detection in plants using image segmentation", Information Processing in Agriculture, 2019

[9] PriyadarshiniPatil et al. "Performance comparison of Classifiers - SVM, RF and ANN in Potato Blight Disease Detection using Leaf Images" IEEE International Conference on Computational Intelligence and Computing Research, 2017.

[10] TasfiaAnikaBushra et al "Potato Disease prediction from Leaves using Deep Convolution Neural Network towards a Digital Agricultural System" 1st International Conference on Advances in Science, Engineering and Robotics Technology, 2019.

[11] Mokhtar, U., El Bendary, N., Hassenian, A. E., Emary, E., Mahmoud, M. A., Hefny, H., & Tolba, M. F. SVM-based detection of pepper leaves diseases. In Intelligent Systems', 641-652, 2014.