IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.39 ⁜ Vol. 11, Issue 5, May 2022

DOI: 10.17148/IJARCCE.2022.115116

PLANT HEALTH IDENTIFICATION USING LEAF IMAGES

VANSH ARORA

Student, IT, Maharaja Agrasen Institute of Technology, Delhi, India

Abstract: Identification of plant health is the new challenging area for the researchers. One of the most important steps in automatic identification of plant diseases is to extract the infected region from the normal portion of the plant. Studying the infected leaves it has been observed that the greenness of the infected portion of the leaves changes significantly with respect to the normal leaves. Images of potato leaves of both categories healthy and diseased captured with digital camera and resolution of 256x256 pixels forms the dataset. CNN model is used for identifying the health status of plants.

Keywords: Convolutional Neural Networks, Plant Health Identification.

I. INTRODUCTION

Increasing population and rapid climate change have compelled the researchers to think about sustainable development. One of the major challenges of sustainable development is to reduce the use of pesticides not only to reduce the cost, but to save the environment and increase quality. Precise, accurate and early diagnosis of plant diseases may reduce the use of pesticides. Plant disease diagnosis through optical observation of the symptoms on plant leaves, incorporates a significantly high degree of complexity. The existence of an automated computational system for the detection and diagnosis of plant diseases, would offer a valuable assistance to the agronomist who is asked to perform such diagnoses through optical observation of leaves of infected plants. With the development of computational systems in recent years, and in particular Graphical Processing Units (GPU) embedded processors, Machine Learning-related Artificial Intelligence applications have achieved exponential growth, leading to the development of novel methodologies and models, which now form a new category, that of Deep Learning. Deep learning refers to the use of artificial neural network architectures that contain a quite large number of processing layers, as opposed to swallower architectures of more traditional neural network methodologies. The now computationally feasible deep learning models have revolutionized sectors such as image recognition, voice recognition, and other similarly complex processes that deal with the analysis of large volumes of data, giving a huge boost to applications that use these processes, like, e.g., self-driving vehicles, machine translation and interpretation, etc. The introduction of these deep learning techniques into agriculture, and in particular in the field of plant health diagnosis, has only begun to take place in the last couple of years, and to a rather limited extent. The basic deep learning tool used in this work is Convolutional Neural Networks (CNNs). CNNs constitute one of the most powerful techniques for modeling complex processes and performing pattern recognition in applications with large amount of data, like the one of pattern recognition in images. CNNs have broken the mold and ascended the throne to become the state-of-the-art computer vision technique. Among the different types of neural networks (others include recurrent neural networks (RNN), long short term memory (LSTM), artificial neural networks (ANN), etc.), CNNs are easily the most popular. These convolutional neural network models are ubiquitous in the image data space. They work phenomenally well on computer vision tasks like image classification, object detection, image recognition, etc.

In this work, specific CNN architectures were trained and assessed, to form an automated plant health identification system, based on simple images of leaves of healthy and diseased plants. The available dataset contained images captured in laboratory.

Studying the literature it has also been found that, with the help of advance technologies like remote sensing, image processing, and Sensor technology, researchers are trying to develop some systems for automatic and early detection of diseases. Studying the infected leaves, it has been observed that the greenness of the infected portion of the leaves changes significantly with respect to the normal leaves.

II. BACKGROUND

Various authors have used the different approaches to detect the plant health and diseases for different types of plants and crops with leaf images. Following is the related literature review of proposed work :

Santanu Phadikar and Jyotirmoy Goswami found that with the help of advanced technologies like remote sensing, , image processing, and Sensor technology, researchers are trying to develop some systems for automatic and early

DOI: 10.17148/IJARCCE.2022.115116

detection of diseases. They used a five-step methodology. The steps included image acquisition and noise removal by applying a 5 median filter, computing vegetative indices (GVI, NDVI, EVI, SAVI) images, segmentation of VI images using OTSUs method, texture value calculation using GLCM, and finally Classify diseases. Out of all the VIs they found EVI gave best result. The dataset was of images of the rice leaves infected by leaf blast (caused by pathogen Magnaporthe grisea) and brown spot (caused by pathogen Bipolaris oryzae) diseases. The images are acquired using the digital cameras.

Konstantinos P. Ferentinos used basic CNN architectures (i) AlexNet (Krizhevsky et al., 2012), (ii) AlexNetOWTBn (Krizhevsky, 2014), (iii) GoogLeNet (Szegedy et al., 2015), (iv) Overfeat (Sermanet et al., 2013), and (v) VGG (Simonyan and Zisserman, 2014). These models and their training and testing processes, were implemented using Torch71 machine learning computational framework, which uses the LuaJIT2 programming language. The cropped the images to resolution of 256x256 pixels and fed to CNN. Out of all the CNN architecture used VGG gave best result with success rate of 99.53

Sandeep Kumar and Basudev and Vivek used SPAM model for feature extraction and reduced the redundant features and irrelevant features using Exponential Spider Monkey Optimization and then used Support Vector Machine to classify the plants as healthy and disease.

Jayme Garcia and Arnal Barbedo analyses the challenges in the plant disease identification systems whose scope is limited to the capture conditions of images in order to function properly and provides some possible solutions. The challenges like presence of complex background that can't be separated from region of interest, definitions of boundaries of symptoms, image capture conditions giving characteristics that make analysis difficult, disease symptoms with wide range of characteristics, similar symptoms in a number of diseases that may occur at the same time.

III. PROPOSED METHODOLOGY

- STEP 1 - Image Acquisition : This is the process of acquiring the images through a camera by going to the site or from other available sources such as image databases or online repositories. The captured images are in three colors, that is, Red, Green, and Blue (RGB), for which a color transformation structure is created, and a device-independent color space transformation is applied on it.

- STEP 2 - Image Pre-processing : To remove noise in an image, different pre-processing techniques are used. Clipping of leaf image is applied to extract the region of the image in which we are interested. The extracted plant leaf image is transferred to a digital system to remove the unnecessary areas. Some essential steps of pre-processing are: Resizing the image, Noise removal from the image, enhancement and smoothing of the image.

- STEP 3 - Image Segmentation : This method of image processing is used to partition an image into significant components according to similar characteristics. Various methods are available for image segmentation such as boundary and spot detection algorithm, region and edge-based methods, Otsu's method, thresholding techniques and k-means clustering, etc.

- STEP 4 - Feature Extraction : It is a type of dimension reduction technique that effectively represent the useful part of the image. Various features such as texture, color, edges and morphology can be extracted for the detection of plant disease. Color co-occurrence method is used for feature extraction.

- STEP 5 – Classifiers : Classifiers are used to identify and categorize the different diseases that occur on plant leaves based on obtained features. Several classifiers that have been used in earlier work to detect diseases in plants are K-nearest neighbors (K-NN), Support Vector Machines (SVM), Convolutional Neural Network (CNN) and Artificial Neural Network (ANN), etc.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.39 ⁜ Vol. 11, Issue 5, May 2022

DOI: 10.17148/IJARCCE.2022.115116

IV. IMPLEMENTATION

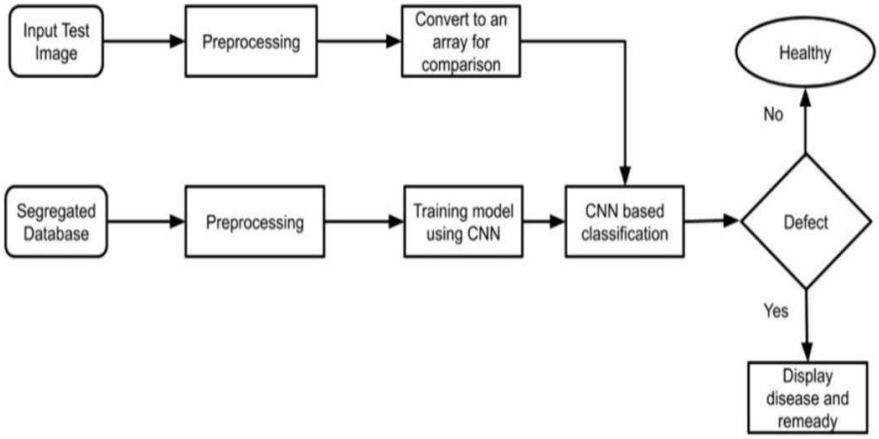

Fig. 1

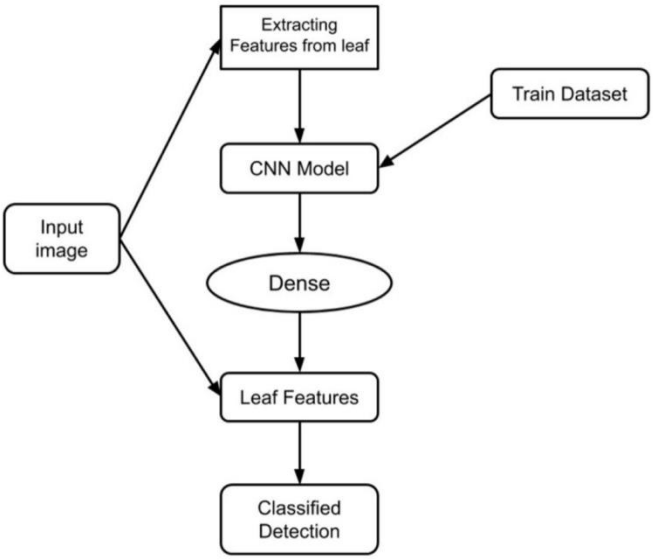

Fig. 2 – Use case diagram

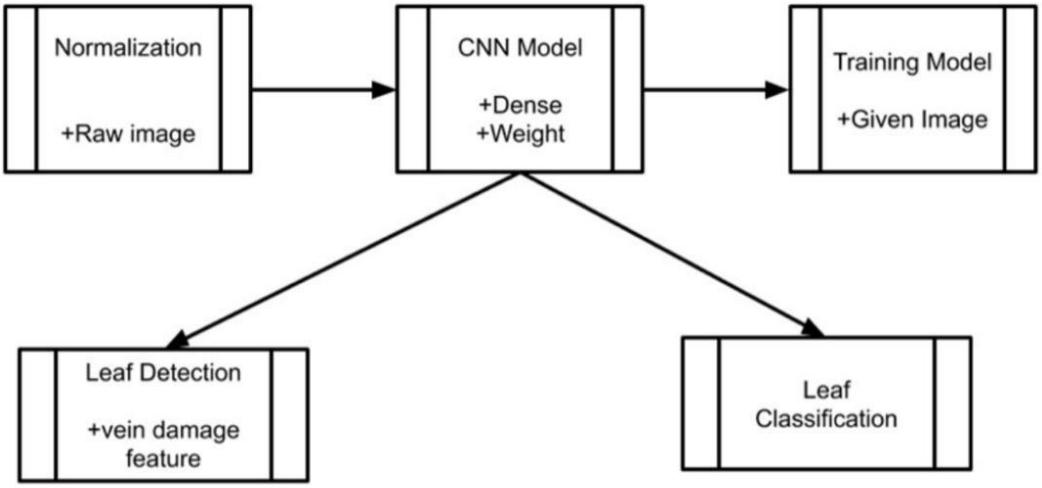

Fig. 3 – Class diagram

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.39 ⁜ Vol. 11, Issue 5, May 2022

DOI: 10.17148/IJARCCE.2022.115116

V. RESULTS

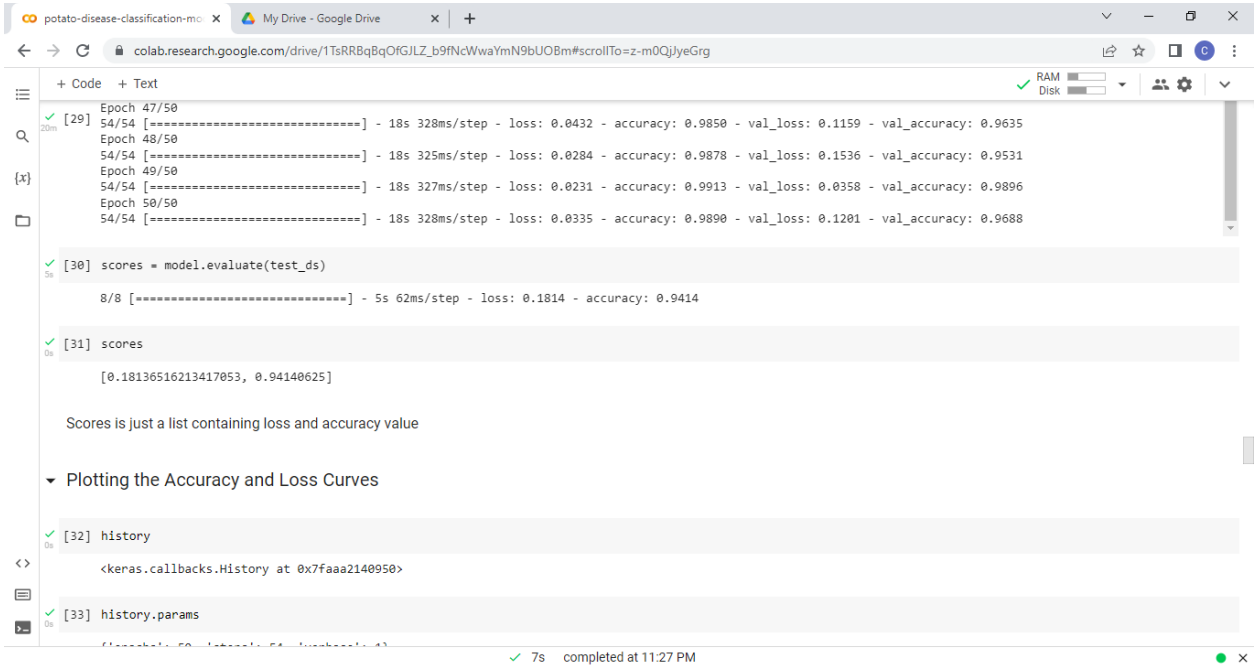

Fig. 4 – Accuracy

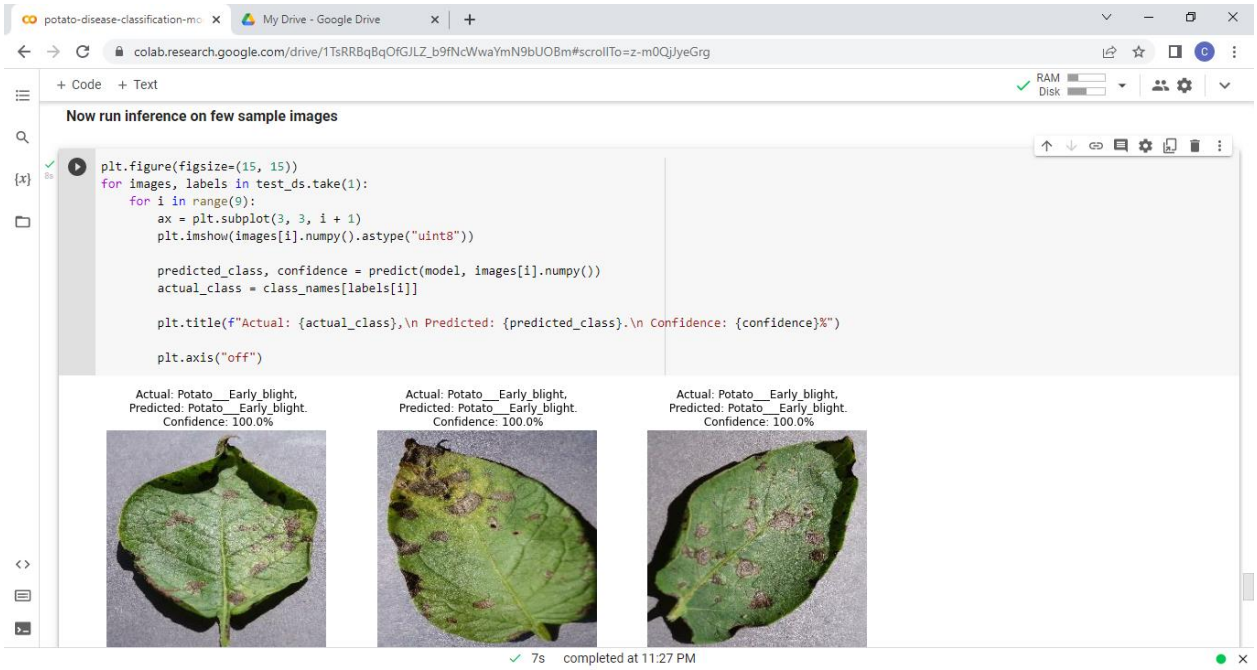

Fig. 5

© IJARCCE This work is licensed under a Creative Commons Attribution 4.0 International License

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.39 ⁜ Vol. 11, Issue 5, May 2022

DOI: 10.17148/IJARCCE.2022.115116

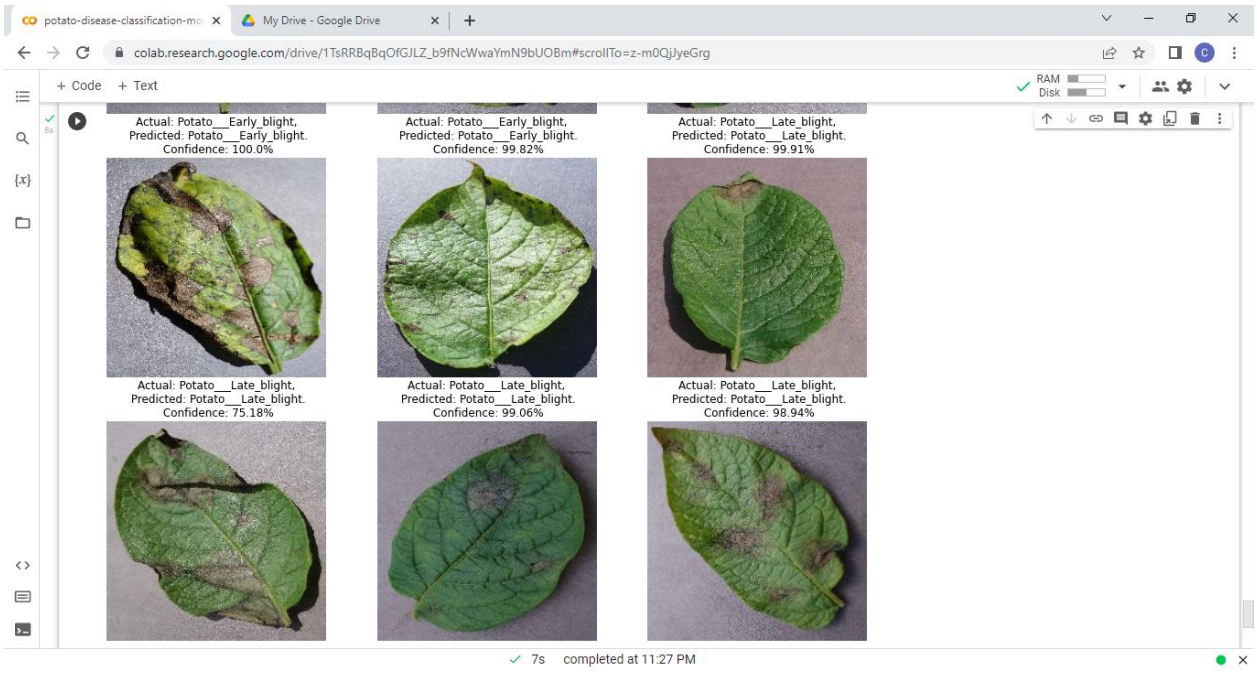

Fig. 6

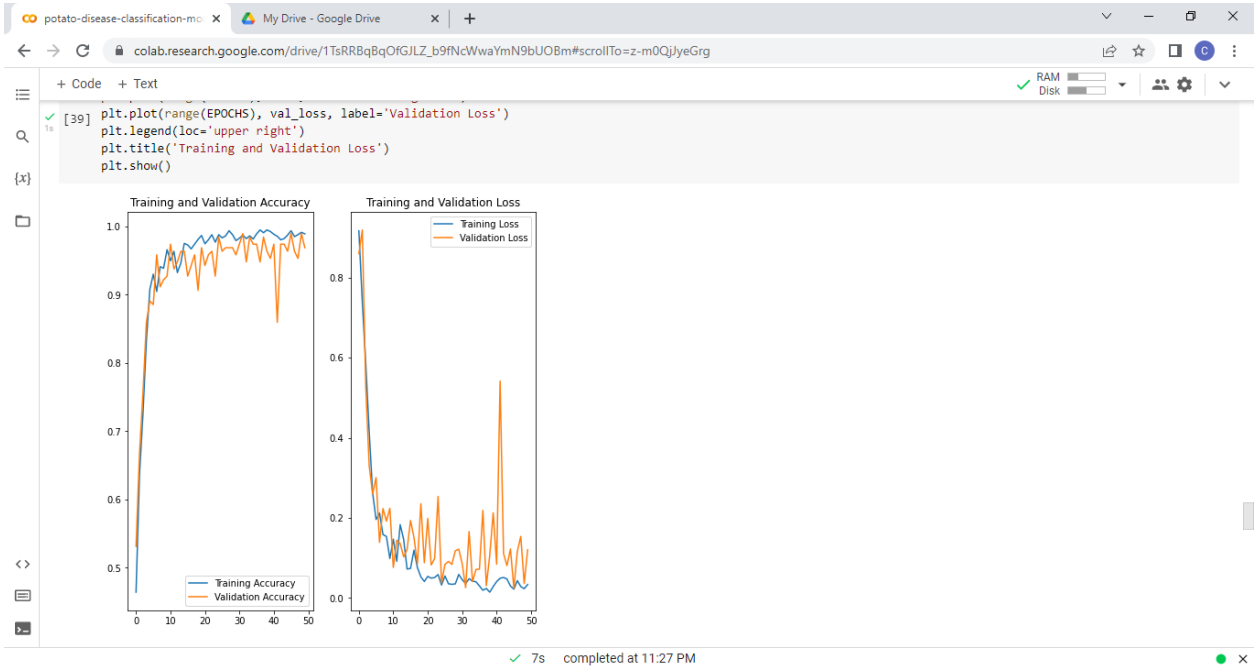

Fig. 7 – Result analysis

VI. CONCLUSION AND FUTURE SCOPE

- To prevent losses, small holder farmers are dependent on a timely and accurate crop disease diagnosis.
- In this study, a pre-trained Convolutional Neural Network was fine-tuned, and the model was deployed online
- Agricultural department wants to automate the detecting the yield crops from eligibility process (real time).
- Automating this process can be carried out by showing the prediction end in web application or desktop application. To optimize the work, implement the software in an AI environment.
- The proposed system is based on python and provides an accuracy of around 98%.
- The accuracy and therefore the speed are often increased by the use of Google's GPU for processing.
- The system can be installed on Drones for aerial surveillances of crop fields.

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.39 ⁜ Vol. 11, Issue 5, May 2022

DOI: 10.17148/IJARCCE.2022.115116

REFERENCES

[1] K. P. Ferentinos, "Deep learning models for plant disease detection and diagnosis," Computers and Electronics in Agriculture, vol. 145, no. September 2017, pp. 311–318, 2018.

[2] J. Garcia and A. Barbedo, "ScienceDirect A review on the main challenges in automatic plant disease identification based on visible range images," Biosystems Engineering, vol. 144, pp. 52–60, 2016.

[3] S. Kumar, B. Sharma, V. K. Sharma, H. Sharma, and J. C. Bansal, "Sustainable Computing : Informatics and Systems," Sustainable Computing: Informatics and Systems, 2018.

[4] P. M. Mainkar, S. Ghorpade, and M. Adawadkar, "Plant Leaf Disease Detection and Classification Using Image Processing Techniques," vol. 2, no. 4, pp. 139–144, 2015.

[5] P. S. One, I. Economy, B. W. Despite, S. V. Machine, M. Figure, D. Collection, D. Preparation, and R. L. Units, "Plant Disease Identification using Leaf Images," pp. 3–4.

[6] T. Pal, V. Jaiswal, and R. S. Chauhan, "DRPPP : A machine learning based tool for prediction of disease resistance proteins in plants," Computers in Biology and Medicine, vol. 78, pp. 42–48, 2016.

[7] S. Varshney, "Plant Disease Prediction using Image Processing Techniques- A Review," vol. 5, no. 5, pp. 394–398, 2016.

[8] Verma, "Precision Agriculture using Internet of Things: An Overview," in International Journal of Management, IT and Engineering, vol. 9, no. 7, pp. 298-303, July 2019.

[9] https://arxiv.org/ftp/arxiv/papers/1604/1604.03169.pdf

[10] https://www.turcomat.org/index.php/turkbilmat/article/download/7743/6139/13981

[11] Parismita Bharali, Chandrika Bhuyan, Abhijit Boruah, "Plant Disease Detection by Leaf Image Classification

[12] Using Convolutional Neural Network" ICICCT 2019, pp.194-205.

[13] Rahman Tashakkori, Timothy Jassmann, R. Mitchell Parry, "Leaf Classification Convolutional Neural Network