ISSN 2395-1621

FASAL DISEASE DETECTION AND CLASSIFICATION USING DEEP LEARNING TECHNIQUES

Sujaya T Ekbote, Tejaswini M R, Niveditha M S D, Ms. Mamta Wanjre

Computer Science And Engineering
Electronics And Communications

Karnataka India

ABSTRACT

In India, Agriculture plays an essential role because of the rapid growth of population and increase in demand for food. Hence, it requires an increase in crop yield. Presently, the loss of food is mainly due to the infected crops which reduces the product rate. Identification of plant disease is very tedious and time consuming. If identification is not performed at the initial stage, then there is a huge loss on the production of crop, and economical value of the market is affected. In order to prevent this we have proposed an automated plant disease detection system. Advancement in visual computing with improved computational hardware has exonerated way for automated disease recognition. Results and solutions on publicly available datasets using Deep Learning, Convolutional Neural Network (CNN) architectures have manifested its viability.

Keywords—Crop Disease, Deep Learning, Convolutional Neural Network, Image Processing.

ARTICLE INFO

Article History

Received: 8th March 2020

Received in revised form :

8th March 2020

Accepted: 10th March 2020

Published online :

11th March 2020

I. INTRODUCTION

India is a fast developing country, and agriculture is the back bone for the country's development. The awareness and the importance of the cultivation needs to be instilled in the minds of the younger generation. Technology has outcast itself in all the fields but presently, we are still using some old techniques in the field of agriculture. Many factors affect the food production and its security such as increase in the temperature, humidity, plant diseases, etc. Plant diseases affect the agriculture yield and also the livelihoods of the farmers who are the main contributors of crop and food production. Plant diseases can be treated if we have a timely, accurate and precise diagnosis. This is the main cause of periodic outbreak of diseases which leads to large scale death and famine. Generally, diseases can be encountered in various parts of the plant such as- fruit, stem, leaves, etc. The main part for disease identification is the plant leaf. The key to prevent the agriculture loss is identification, detection and treatment of the plant diseases. Different plant leaves bare different types of diseases. The major division of plant leaf diseases are based on viral, fungal and bacteria. The most common plant diseases are Alternaria Alternata, Anthracnose, Bacterial Blight, Cercospora Leaf Spot, Powdery Mildew, Downy Mildew and Rust.

Presently, the naked eye observations made by the skilled experts is the main prelude used in practice for detection, identification and treatment of plant diseases. This requires continuous monitoring of the plants from experts. When the crop production is at large scale, or there is a large farm, then this approach is expensive. In some regions, farmers may have to travel long distances in search or to contact experts, this makes the procedure time consuming. In many cases farmers are incognizant of non-native diseases.

Automated detection of plant disease is important as it has benefits in supervising large-scale of crops, and detect diseases from symptoms that appear on the plant leaves. Thus automatic detection of plant disease with the help of image processing technique provides more accurate guidance for disease management. Relatively, visual identification is less accurate and time consuming.

This automated system is designed to overcome the problems of manual techniques. The image is captured using a regular digital camera or high resolution mobile phone camera. This image is given as an input to the system for identification of the disease.

An Artificial Intelligence and Deep Learning based system would offer valuable aid in the diagnosis of the plant disease through object detection algorithms and image based observation. Progression in computer vision provide an opportunity to enhance plant disease diagnosis and extend the field of computer vision for precision agriculture. If the system is affordable, it would be easy for even the farmer to make a timely diagnosis of the disease and act accordingly, apart from making the work of experienced pathologists precise and accurate.

Smart phones have computational power, advanced cameras, high resolution displays, and are also affordable. This helps in providing a novel approach in the deployment of these systems. And in turn helps the farmers to diagnose the plant disease from just an image of the plant leaf.

II. EXISTING SYSTEM

Currently the identification of crop diseases is done manually by the experienced people. Due to many environmental changes and factors, the prediction is becoming prolix. Conventional Expert systems, mainly those which are used to diagnose the disease in agriculture domain depends only on textual input. Usually abnormalities for a given crop are demonstrated as symptoms on various plant parts.

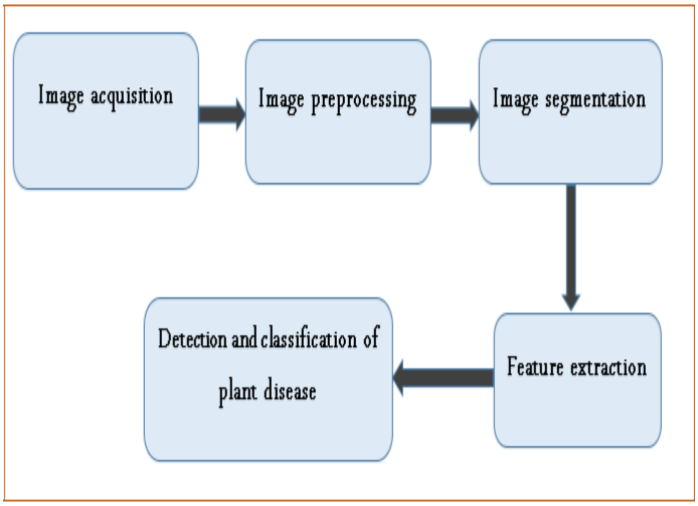
To enable an expert system to produce correct results, end-user must be capable of mapping what they see in a form of abnormal symptoms to answer to the questions asked by that expert system. This mapping may be inconsistent if a full understanding of the abnormalities does not exist.

III. PROBLEM STATEMENT

The main goal is to propose a system to detect plant diseases. An image processing system is developed to help automated detection of disease type. To diagnose a disorder or abnormalities from the leaf image, four image processing phases have to be applied: Image enhancement, Image segmentation, Feature extraction, Detection and classification. In order to employ proposed system we first have to train it with a set of images that signify the plant disorders. Proposed system focuses on specific disease identification, and it can be extended in order to include more diseases. The system starts with the acquisition of image sample. The image sample is pre-processed to remove noise and enhance it. It is then converted into binary image and its texture features are extracted. Later classification is done based on which we detect the type of disease the leaf has been affected.

IV. METHODOLOGY

The plant diseases can be identified by observing leaf of the plant. The digital image processing is used to detect diseased leaf by shape and color of affected area. Image processing technique involves five basic steps and the data flow diagram is as shown below-



Description of Each Steps:

A. Image Acquisition:

The first step in the proposed approach is image acquisition. The general aim of Image Acquisition is to transform an optical image (Real World Data) into an array of numerical data which could be later manipulated on a computer, before any image processing can commence an image must be captured by camera and converted into a manageable entity .In our project we need to select the plant which is affected by the disease. And then collect the leaf, later take a snapshot of leaf and load the image into the system.

B. Image Pre-processing:

Pre-processing helps in improving the image data by removing background, noise. It also mortifies the undesired distortions. It enhances image features for processing and analysis. The median filter is used for image smoothing, removal of noises and highlighting some information. Image enhancement is carried out for increasing the contrast.

C. Image Segmentation:

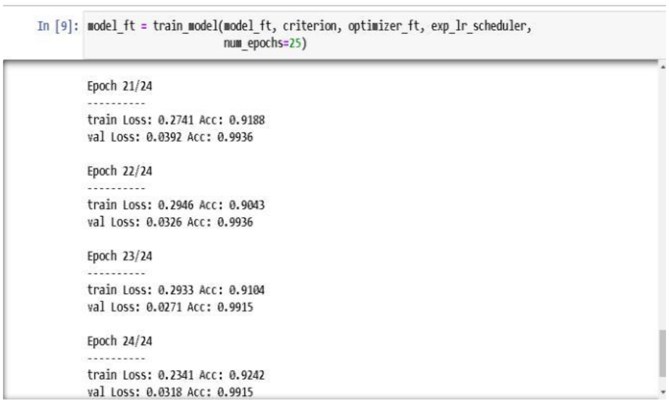
Segmentation refers to the process of clustering the pixels with certain properties into salient regions and these regions correspond to individual surfaces, objects or natural parts of the objects. More precisely, image segmentation is the process of assigning a label to every pixel in an image so that pixels with the same label share certain visual characteristics.

D. Feature Extraction:

Purpose of next feature extraction stage is to reduce image data by measuring certain features or properties of each segmented region such as color, shape or texture. Texture is one of the most important feature which can be used to classify and recognize objects. Using texture features, plant diseases are classified into different types. This will be done in two steps, spot isolation and spot extraction.

E. Classification:

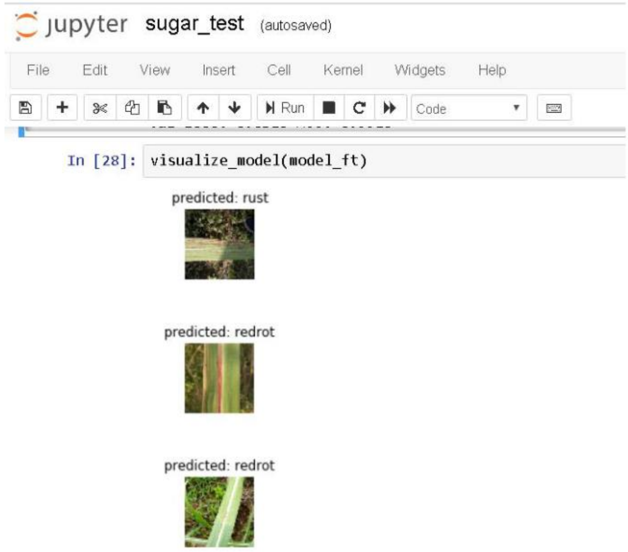
Here classification of input image is done by comparing with various images in database. In this proposed work ANN is used as a classifier.

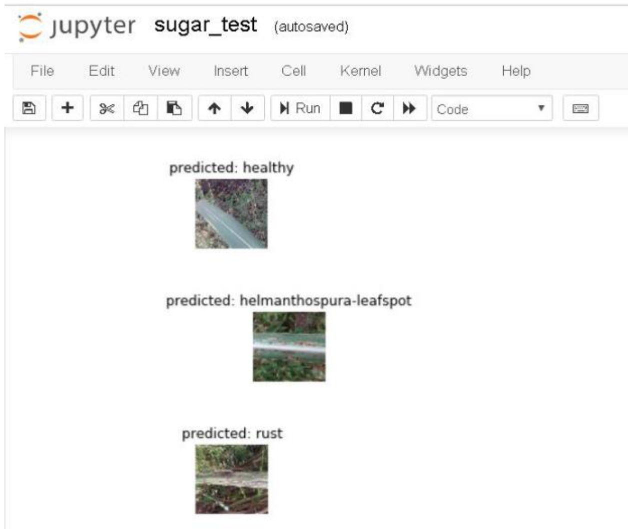


Detection Approach:

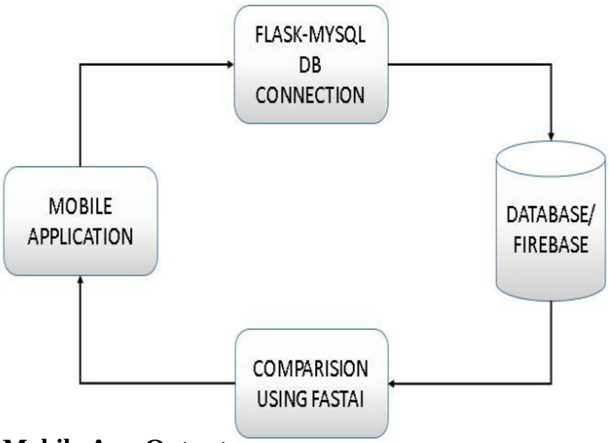
To accurately recognize infected regions from the diseased leaf images, YOLOv3 and Faster-RCNN are used for evaluation. These are the two state-of-the art detections networks. These mentioned models are significantly swift. The regional interests and proposals are predicted on a convolutional feature map using region proposal network (RPN) in Faster-RCNN, after passing image through a CNN. The ROI layer helps in finding the class suitable to a proposed region. YOLOv3 does the predicting of regions and localizing the object, and all this in a single CNN. It performs real time detection. This model has a 106-layer CNN block, which is a variant of Darknet. Our work is composed of Faster-RCNN with VGG-16 as its backbone and YOLOv3. The evaluation and implementation of these architectures on the datasets is done by training the entire model starting from To accurately recognize infected regions from the diseased leaf images, YOLOv3 and Faster-RCNN are used for evaluation. These are the two state-of-the art detections networks. These mentioned models are significantly swift. The regional interests and proposals are predicted on a convolutional feature map using region proposal network (RPN) in Faster-RCNN, after passing image through a CNN. The ROI layer helps in finding the class suitable to a proposed region. YOLOv3 does the predicting of regions and localizing the object, and all this in a single CNN. It performs real time detection. This model has a 106-layer CNN block, which is a variant of Darknet. Our work is composed of Faster-RCNN with VGG-16 as its backbone and YOLOv3. The evaluation and implementation of these architectures on the datasets is done by training the entire model starting from pretrained weights for the convolutional block on ImageNet dataset in both the models.

V. System Output

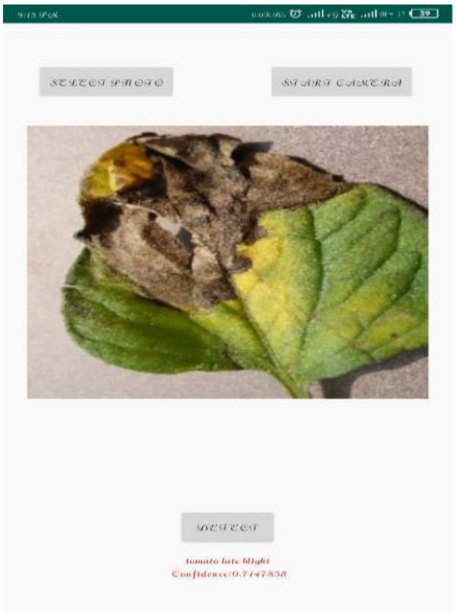




Android App for Plant Disease Detection:



Mobile App Output:



VI. LITERATURE SURVEY

Many systems have been proposed to solve or to reduce the problems in this field, by making use of image processing and some automatic classification tools.

Suhaili Kutty et al. was one of them, who proposed a system to classify Anthracnose and Downey Mildew, watermelon leaf diseases. For classification, neural network pattern recognition toolbox is used. Proposed method achieved 75.9% of accuracy based on its RGB mean color component.

The goal of Sanjeev Sannaki et al. is to diagnose the disease using image processing and artificial intelligence techniques on images of grape plant leaf. And they classify mainly two diseases, downy mildew and powdery mildew of grape leaf. They have used only Hue feature which gives more accurate result. The support vector machine approach for the classification and detection of rose leaf diseases as black spot and anthracnose was used by Akhtar et al. They have used the threshold method for segmentation and Ostu's algorithm which was used to define the threshold values.
Bhog and Pawar were the 2 persons who incorporated the concept of neural network for the classification of cotton leaf disease analysis. For segmentation process, they used K-means clustering. Variant cotton leaf diseases like Red spot, white spot, Yellow spot, Alternaria and Cercospora on the Leaf were detected. For experimentation process, they used the MATLAB toolbox. And achieved an accuracy for K-Mean Clustering method using Euclidean distance as 89.56%.

VIII. CONCLUSION

Manual detection of different anomalies in plants by the supervision of diagnosticians is a tedious and time consuming task. The availability of skillful and knowledgeable persons, and the long processing time can delay in immediate identification and treatment of the diseases. On the other hand, automated detection and classification of the plant diseases using CNN are found to be robust and racy, as it helps in finding visually observable patterns in the images. Also, the use and growth of the computational hardware has made it executable and feasible to utilize them.

CNN architecture has resulted in the faster identification and quicker treatment to surmount the effects of diseases on the plants. Our proposed system mainly focuses on the publicly available datasets consisting of different types of plants and its diseases by evaluating the state-of-art architectures. And it successfully detects the plant diseases in a much reduced processing time.

REFRENCES

[1] Rafael C. Gonzalez. And Richard E. Woods. Digital Image Processing, Pearson Education, Third Edition.

[2] Arivazhagan S., Newlin Shebia R. “Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features”. Agricultural Engineering Institute: CIGR journal, 2013.

[3] Al-Hiary H., S. Bani-Ahmad., M. Reyalat., M. Braik. and Z. AlRahamneh. 2011. Fast and accurate detection and classification of plant diseases. International Journal of Computer Applications.

[4] Sandesh Raut and Amit Fulsunge, “Plant Disease Detection in Image Processing Using MATLAB” International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), Volume 6, Issue6, June 2017.

[5] Sanjeev S. Sannaki, Vijay S. Rajpurohit, V B argund,Pallavi Kulkarni, “Diagnosis and Classification of Grape Leaf Diseases using Neural Network,” IEEE , Tiruchengode, 2013.

[6] Suhaili Beeran Kutty, Noor Ezan Abdullah, Dr. Hadzli Hashim, A’zraa Afhzan Ab Rahim, Aida Sulinda Kusim,Tuan Norjihan Tuan Yaakub, Puteri Nor Ashikin Megat Yunus, Mohd Fauzi Abd Rahman, “Classification of Watermelon Leaf Diseases Using Neural Network Analysis,” IEEE, Business Engineering and Industrial Applications Colloquium (BEIAC), Langkawi, 2013.

[7] Weizheng, S., Yachun, W., Zhanliang, C., and Hongda, W. (2008). “Grading Method of Leaf Spot Disease Based on Image Processing”. In Proceedings of the 2008 international Conference on Computer Science and Software Engineering (CSSE). Washington, DC.

[8] Akhtar, Asma, AasiaKhanum, Shoab Ahmed Khan, and ArslanShaukat. "Automated Plant Disease Analysis (APDA): Performance Comparison of Machine Learning Techniques." IEEE International Conference on Frontiers of Information Technology (FIT).

[9] Bhong, Vijay S., and B. V. Pawar. "Study and Analysis of Cotton Leaf Disease Detection Using Image Processing." International Journal of Advanced Research in Science, Engineering and Technology, 2016.

[10] Fastai https://course.fast.ai/videos/?lessonn=1

[11] Disease Recognition in Sugarcane Crop Using Deep Learning- Malik Hashmat Shadab Mahavir Dwivedi, SN Omkar, Tahir Javed Abdul Bakey, Mohammad Raqib Pala, Dr Akshay Chakravarthy.

