|| Volume 5 || Issue 7 || July 2020 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

TOMATO LEAF DISEASE DETECTION USING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Guide) Prof. Madhavi Patil[1]

Gaurav Langar[2], Purvi Jain[3], Nikhil Panchal[4]

B.E., Computer Science, DY. Patil School Of Engineering Academy, Ambi, Pune-410507 , India

gauravlanger123@gmail.com[1], purvi.jain071998@gmail.com[2]

Abstract: In these years we get to know that, agriculture is the main source of national income for most developing countries. Thus, this is one of the important and main reason to be considered for the detection of plant disease, as disease is the main cause of rottening of fruits or vegetables or crops. Thus we can assume that if proper care is not taken regarding this thing then it leads to loss of money, time, quality, quantity, etc. Thus the main motive is to reduce the use of pesticides and thus yield a good crop and increase the production rate. Plant disease can be detected using image processing. Disease detection follows some steps like pre-processing of the image, feature extraction, classification, and prediction of classified disease. Thus creating a recognition system can help in evaluating high precision image of the plant for proper cure and further prevention

Keywords: *Digital Image Processing, Plant Pathology, Mathematical Statistics, Image Segmentation*

I INTRODUCTION

Agriculture, from many years have been associated with the cultivation of basic crops that are considered important for our diet and most important for our living. Agriculture is mostly compensating the economic growth of the country. It could be considered as the crucial part of society. Since many industries have been setup all across the world, we can say that industrialization and causes of it are destroying the path of agriculture. Globalization can be considered as another cause of low farming activity. The increase of population and need to cultivate crops accordingly and changes in climatic condition have cause a great impact in the production as changes in climatic conditions can also cause growth of various disease in plants. Thus our main aim would be to decrease the use of pesticides to decrease cultivation cost and save our environment. Now a days, data mining a powerful and widely used method can be used in plant disease prediction. Thus using data mining concepts with image processing it will be easy for us to recognize whether crop is infected or not, classify disease according to various issues and with the help of colors developed due to disease and thus suggesting various remedies for it based on severity of disease. Thus the research focuses on collecting of the data of diseases on plants and training a model for disease detection. Recent advanced technology has made the use of deep convolutional networks which helps in recognition, classification and also smart phone based size and color detection of leaves on plant for detection of disease.

II TOMATO LEAF DISEASE & SYMPTOMS

Symptoms may include a detail change in color, shape or function of the plant as it responds to the pathogen. Here we are discussing these diseases symptoms that should be keep in mind if the plant growth seems low .The classification and detection of leaf diseases accurately is the key to prevent the agricultural loss. Different plant leaf bears different diseases and have different symptoms.

--Septoria Leaf Spot:

Septoria leaf spot is one of the most common tomato plant leaf diseases. You can first detect this fungus as it creates a small, circular spot with a grayish-white center and dark edges. Small black spots may show up in the center. Affected tomato plant leaves turn yellow, wither, and fall off. Long periods of warm, wet weather

contribute to this tomato plant disease, and splashing water spreads spores to other leaves.

--Early Blight (Alternaria):

Another tomato plant disease fungus, Alternaria, also causes leaf spot or early blight. Lower leaves show brown or black spots with dark edges, almost like a target. Stem ends of fruits may be attacked, showing large, sunken black areas with concentric rings. This tomato plant disease fungus usually strikes after plants set fruit.

--Late Blight:

The tomato plant disease late blight, caused by the fungus Phytophthora infestans, occurs during periods of cool, rainy weather that may come at the end of a growing season. It looks almost like frost damage on leaves, causing irregular green-black splotches. Fruits may have large, irregular-shaped brown blotches that quickly become rotten. This tomato plant disease fungus also affects potatoes and can be transferred from them. Use the same controls as for septoria leaf spot.

--Mosaic Virus:

Mosaic virus attacks many kinds of plants and is common in tomatoes. While mosaic virus doesn't kill the plant, it diminishes the number and quality of fruits. The virus gets its name from the markings that resemble a mosaic of light green and yellow on the leaves and mottling on the fruits of affected plants. Leaves may also grow in misshapen forms, resembling ferns.

-Septoria leaf spot

-Early Blight leaf spot

-Late Blight leaf spot

-Mosaic Virus leaf spot

--Tomato Bacterial Diseases:

Tomatoes can fall prey to a number of tomato plant bacterial diseases, including bacterial spot, bacterial speck, and bacterial canker. They're all slightly different but appear as spots on leaves and fruits.

III. LITERATURE SURVEY

-Khirde et al. has discussed some segmentation and feature extraction algorithm that can be used for the detection of plant diseases by using the image of their leaves. It is very difficult to detect the plant diseases manually due to requirement of excessive time, knowledge of plant diseases and very much amount of work. The author has divided the entire process of plant leaf diseases detection into five steps those are as follows: a) Image acquisition b) Pre-processing c) Segmentation d) Feature extraction e) Final classification of diseases.Image acquisition used the transformation structure for RGB leaf image. Then image is pre-processed to remove the noise and enhance the image contrast. Segmentation is done for the partitioning of image into various feature part using k-means clustering, otsu filters etc. This segmented image is further used for feature extraction and then final

classification is performed using various classification technique In this way, plant diseases can be efficiently identified.

- **Sannakki et al.** Has used feed forward back propagation Neural Network based technique for the diagnosis and classification of diseases in grape leaf. Author has used the images of grape leaf with complex background for the diagnosis as input. Further anisotropic diffusion is used to remove the noise of the image which is further

segmented using k-means clustering.Finally results are observed using neural networks. Results are experimented on downy mildew and powdery mildew images with simulation in MATLAB Confusion matrix is considered with the true positive and false positive parameters for the validation of results The author claims to have accuracy of almost 100% if used hue feature alone.

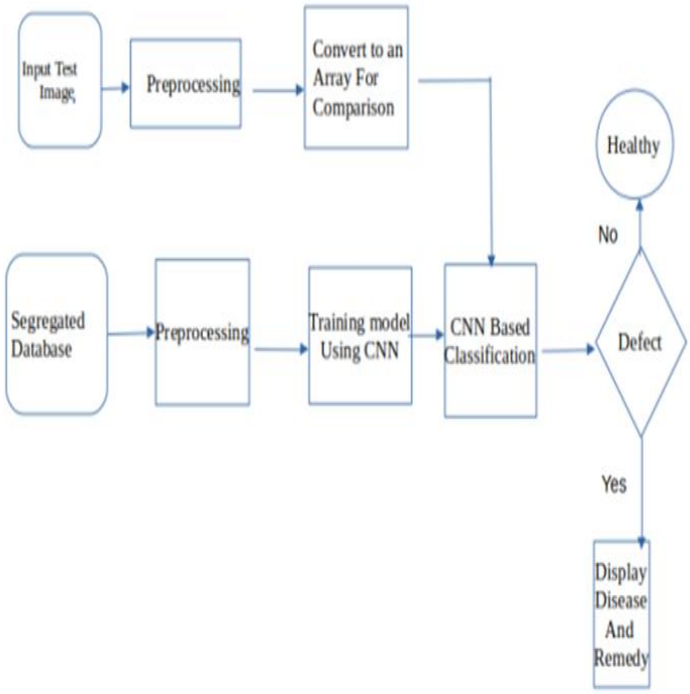
- **Kutty et al**. Has used the neural network based system to classify the watermelon leaf diseases of Downey Mildew and Anthraconse. Author has calculated the true positive rate, true negative rate and overall accuracy for the efficiency of the proposed concept this classification is based on the color feature extraction from RGB color model which is obtained from the identified pixels in the region of interest. The overall performance is depicted with ROC curve having AUC value of 0.5. the true classification result also depicts the value of 75.9% -Rothe et al. Has proposed pattern recognition techniques for the detection and classification of cotton leaf diseases of Alternarnia, Myrothecium and Bacterial Blight. The dataset images are taken from the field of Central Institute of Cotton Research Nagpur. Active contour based segmentation algorithm is used for the isolation of diseased spots. Author has also suggested some feature directions to the similar concept for the crops of wheat, orange, citrus and maize etc.

IV PROPOSED SYSTEM PROBLEM DEFINITION

To demonstrate and classify plant diseases and to give solutions out of it by developing a model that can be used by developer to create smartphone or web application to detect tomato leaf diseases using Convolutional Neural Network.

V. WORKING OF PROPOSED SYSTEM

Plant leaf disease detection includes some basic step of image processing to detect & classify plant leaf disease. These steps are image acquisition, image pre-processing, image segmentation, feature extraction, classification and leaf disease detection. These steps are described as below



-Flowchart of Proposed system

1 **Image Acquisition :-**The first stage of any vision system is the image acquisition. Image acquisition involves the steps to obtain the plant leaf and captured the high quality images through the camera. Images are acquired from the internet or agriculture field. The efficiency of the concept depends upon the quality of database images. This image is in RGB (Red, Green, and Blue) form.

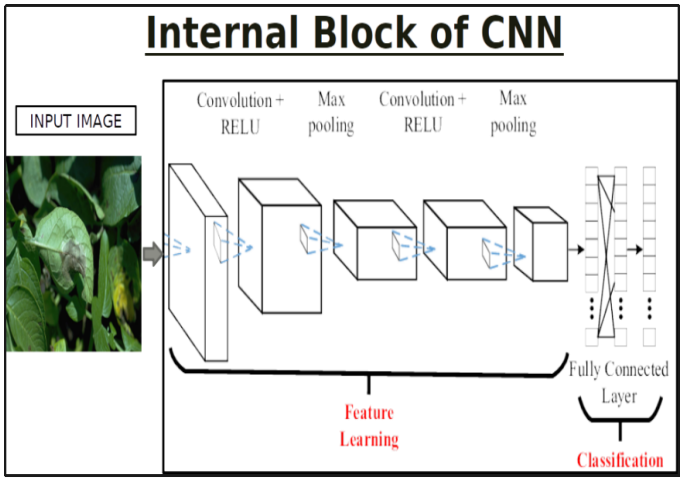
2 **Image Pre-Processing :-**Image pre-processing involves the steps of image enhancement, RGB to Lab conversion, filtering etc. Here, image enhancement is carried out for increasing the contrast. Image smoothing is done using the filtering techniques. There are different types of filtering techniques available in image processing like median filter, average filter, Gaussian filter etc.

3 **Image Segmentation:-** Image segmentation means partitioning of image into various parts of same features or having some similarity. The segmentation can be done using various methods like otsu' method, k-means clustering, converting RGB image into HIS model etc. The K-means clustering is used for classification of object based on a set of features into K number of classes. The classification of object is done by minimizing the sum of the squares of the distance between the object and the corresponding cluster.

4 **Classification & Detection of Diseases:-** Finally, classifiers are used for the training and testing of the datasets. These classifiers may be support vector machine (SVM), k-nearest neighbour, neural network, fuzzy logic based etc. These methods are used to classify and detect the leaf diseases.

VI. ALGORITHM OF PROPOSED SYSTEM

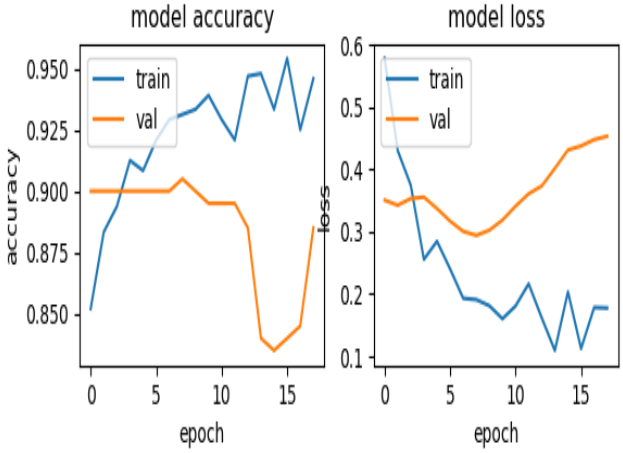
As, our model takes raw images as an input, so we used Convolutional Neural Networks(CNNs) to extract features . *CNNs have wide applications in image and video recognition, recommender systems and natural language processing.* CNNs, like neural networks, are made up of neurons with learnable weights and biases. Each neuron receives several inputs, takes a weighted sum over them, pass it through an activation function and responds with an output.



Here, we are using CNN 2D ..Basically, 2D convolutional layers take a three-dimensional input, typically an image with three color channels. They pass a filter, also called a convolution kernel, over the image, inspecting a small window of pixels at a time, for example 3×3 or 5×5 pixels in size, and moving the window until they have scanned the entire image.

Our model consists of 7 convolutional layers with Relu activation function .i.e. The Rectified Linear Unit (ReLU) is an activation function adopted in the design of most neural networks, particularly CNN's. It is the identity function, f(x) = x, for all positive values and zeros out for negative values of input 'x'. So we have used relu for hidden layers each followed by Max-pooling layer where it maximally activates only a bunch of neurons from the feature and this effectively reduces the width and height of the feature maps while preserving the number of channels and we have also defined the soft-max activation function for classification purpose .

VII.RESULTS



The CNN-based classifiers are tested on a subset of the disease's dataset, including tomato plant leaf diseases. The dataset consists of leaf diseases of the tomato plant. Adding healthy tomato leaf images, the used dataset contains 520 images. The preliminary preparation and augmentation are applied to the dataset. The images of the dataset are resized to fit into 412×412 dimensions which are chosen to be relatively small and close to a fraction of the average size of all images. After excluding 10% of the images as test set, the remaining images as training set are augmented, in order to reduce over fitting, by adding horizontally flipped copy of the images, then a portion of these images is further separated as the validation set pre-trained on Image-Net and fine-tuned on the dataset, and the proposed CNN architecture with and without residual learning. Firstly, the pre-trained YOLO models, are fine-tuned on the dataset to be considered as a baseline for comparison. Then a simplified CNN architecture is proposed and trained with and without the residual learning framework (residual and plain

CNN) to compare the results. All the diseases which may affect the growth of tomato plant has been analysed. Different diseases has different features and symptoms, by classifying these visual symptoms of diseases data is trained on convolution neural network (CNN). after training model is created which can detect all the diseases. After testing trained model on Pascal voc. Format, Mean Average Precision (MAP) is found to be 0.76. System can predict diseases on different scales and resolution of images. Size, orientation, light intensity does not affect the output result. However, on high resolution image detection accuracy will be high. System resize the input image into 412*412 (width * Height) and scales pixel value at this ratio.

VIII. FUTURE SCOPE

Future Scope For mobile apps which is useful for farmers as proper guide to do agriculture. In future we can do the disease detection techniques using various parts of the crops or plants like stem, flower, root.

IX. CONCLUSION

Agriculture is mostly compensating the economic development of the nation. It is considered as the vital part of society. Thus the main aim of proposed work is to decrease the use of pesticides to decrease cultivation cost and save our environment. By using data mining concepts with image processing it will be simple to recognize whether crop is infected or not, which type of diseases, what can be the solution for the same. This paper has various methods for the Identification and classification of plant leaf diseases like pattern recognition method, back propagation, neural network, support vector machine etc. The proposed work also discusses the basic concept of plant leaf disease detection and various leaf diseases symptoms.

As per our survey paper we started our research on every crop and evry part of it but soon we realized that it is not possible for us right now in this period of span as we were in our learning and practicing stage .So specifically we shifted our goal with our very own country's staple crop 'tomato' and started to figure out all the diseases and causes of it that can be predicted from the changes developed in the leaves of the tomato plant.

REFERENCES

[1] Sachin D. Khirade and A. B. Patil. “Plant Disease Detection Using Image Processing.” International Conference on Computing Communication Control and Automation (ICCUBEA), 2015 International Conference on,pp. 768-771. IEEE, 2015.

[2] Sannakki, Sanjeev S., Vijay S. Rajpurohit, V. B. Nargund, and Parag Kulkarni. “Diagnosis and classification of grape leaf diseases using neural networks.” In computing, communications and Networking Technologies (ICCCNT), 2013 Fourth International conference on, pp. 1-5 IEEE, 2013.

[3] Kutty, Suhaili Beeran, Noor Ezan Abdullah, Habibah Hashim, and Aida Sulinda. “Classification of Watermelon Leaf Diseases Using Neural Network Analysis.” In Business Engineering and Industrial Applications Colloquium (BELAC), 2013 IEEE, pp. 459-464. IEEE, 2013.

[4] Nilesh Wani et al. “A Survey on: Image Process using Two-Stage Crawler”, International Journal of Computer Applications,2016, Volume 975, Pages 88-87

[5] Vinod Bharat et al. “Study of Detection of Various types of Cancers by using Deep Learning: A Survey”, International Journal of Advanced Trends in Computer Science and Engineering, 2019, Volume 8 Issue 4,pp 1228-1233