Tomato Leaf Disease Detection And Prediction

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Abstract- *Tomato are a main source of food for the global population. Plant diseases tends to production loss, which can be handled with continuous monitoring. Manual plant disease monitoring is both error-prone and laborious. Early identification of plant diseases using artificial intelligence (AI) and computer vision can help to decrease the immense effects of diseases and also helps to overcome the disadvantages of continuous manual monitoring. The combination of recent advances in computer vision and increasing global smartphone penetration made possible by machine learning has paved the way for smartphone-assisted disease diagnosis. Finally, the approach of training the deep learning models on increasingly high and publicly available image datasets presents a clear path towards smartphone-assisted crop disease diagnosis on a huge global scale.*

Keywords- Convolutional neural network (CNN), deep learning, tomato leaf disease, image datasets.

I. INTRODUCTION

Identification of the plant leaf diseases is the key to protect and prevent the losses in the quantity and yield of the agricultural product. The studies of the plant leaf diseases mean the studies of visually observable patterns seen on the plant leaf. Health monitoring and detecting disease on plants is very critical and crucial for sustainable agriculture. It is very tough to monitor the plant disease manually. It requires a huge amount of work in the plant diseases, and also requires excessive processing time. Hence, image processing is used for the identification of plant diseases by capturing the images of the leaves and comparing the images with the data sets. The data setconsists of different plants in the image format.

II. LITERATURE REVIEW

A. Tomato Leaf Disease Diagnosis Based on Improved Convolution Neural Network by Attention Module - Shengyi Zhao, Yun Peng, Jizhan Liu and Shuo Wu

- This paper proposed a deep CNN that integrates an attention mechanism, which can be better adapt to the diagnosis of a variety of tomato leaf diseases. The network structure mainly consists of attention extraction modules and residual blocks. A dataset containing 4585 tomato leaf images is obtained, and the size of each picture is fixed at 224×224. The dataset consists of a total of 10 tomato leaf categories, such as bacterial spot, early blight, healthy, late blight, leaf mold, mosaic virus, Septoria leaf spot, target spot, two-spotted spider mite, and yellow leaf curl virus. Therefore, this paper used a various image enhancement technique, and enhanced image data in combination with OpenCV under the Pytorch framework. Some wide range of CNN models have been proposed, such as GoogleNet, VGGNet, AlexNet. However, these convolutional neural network models decreased the speed of training and detection due to the vast numbers of parameters and computational operation. However, the model can correctly extract complex features of various diseases. Extensive comparative experiment results show that the proposed model achieves the average identification accuracy of 92.81% on the tomato leaf diseases dataset.

B. Tomato leaf disease detection using Artificial intelligence and machine learning - Gaurav Langar, Purvi Jain, Nikhil Panchal, B.E., Computer Science, DY. Patil School Of Engineering Academy, Ambi, Pune-410507, India

- In this paper, 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 of the image. Image smoothing is done with the help of filtering techniques. There are different types of filtering techniques available in processing of images like median filter, Gaussian filter, average filter etc., The segmentation can be done using various methods like Otsu ‘method, converting RGB image into HIS model, k-means clustering etc. Finally, classifiers are used for the testing and training of the datasets. These classifiers may use support vector machines (SVM), neural network, k-nearest neighbours, fuzzy logic based etc. The dataset consists of leaf diseases of tomato plant. Adding healthy tomato leaf images, the total dataset consists of 520 images. The preliminary preparation and augmentation are done to the dataset. The images of the dataset are resized to fit 412×412 dimensions that are chosen to be relatively

small and also close to a fraction of the average size of all images. After excluding 10% of the images as testset, the remaining images are used as training set which are augmented, in order to reduce overfitting, by adding horizontally flipped copy of the images, then a portion of these images is further separated as the validation set pretrained on Image-Net and fine-tuned on the dataset, and the proposed Convolutional neural network architecture with and without residual learning. Different diseases have different symptoms and features, by classifying these visual symptoms of diseases data is trained on convolution neural network (CNN). After training a model is created which can detect all the leaf diseases. After testing a trained model on Pascal voc. Format, MAP (Mean Average Precision) is found to be 0.76.

C. Tomato Leaf Disease Detection using Convolution NeuralNetwork- Prajwala TmTm, m, Sai Ashritha Kandiraju, Nagaratna B Chittaragi

- The image data of tomato leaf health and disease in this paper comes from the PlantVillage open-source dataset. A dataset contained 4585 tomato leaf images is taken, and the size of each image is fixed at 224*224. The dataset consists of a total of 10 tomato leaf categories, such as bacterial spot, septoria leaf spot, target spot, early blight, healthy, late blight, leaf mold, yellow leaf curl virus, twospotted spider mite, and mosaic virus. This paper used various image enhancement techniques, enhanced image data in combination with OpenCV under the Pytorch framework. Residual network with 101 layers is used to effectively solve the problem of gradient degradation, and it won the 2015 ImageNet Large-scale Visual Recognition Challenge. Compared with, VGGNet, AlexNet, and GoogLeNet, ResNet has less computation and higher performance. In this paper, ResNet-50 is used as the feature extraction network which has less calculation and better performance. It can be seen that the SE-ResNet50 model proposed in this paper can well complete the task of tomato leaf disease prediction and has high accuracy and robustness. This model is a very useful tool for detecting diseases in the field of crops.

III. PROBLEM STATEMENT

Plant diseases have always been a problem in agriculture and it is one of the main reasons restricting the sustainable development of agriculture. As a common vegetable and important cash crop in India, tomato is widely cultivated in various states, covering an area of nearly 800 million square meters in whole India. According to the current statistics, there are as many as 10 types of tomato diseases, which have seriously affected the yield and quality of tomatoes and caused huge economic losses. Therefore, the treatment and prevention of tomato diseases play extremely important roles in tomato production. There are many cases where farmers do not have a knowledge about the crops and the diseases that affecting the crops. This project can be effectively used by farmers thereby increasing the yield and getting to know the disease with the help of a mobile application rather than visiting the expert and getting their advice. The use of image processing techniques in identification of plant diseases in the earlier stages and thereby the quality of the product could be increased.

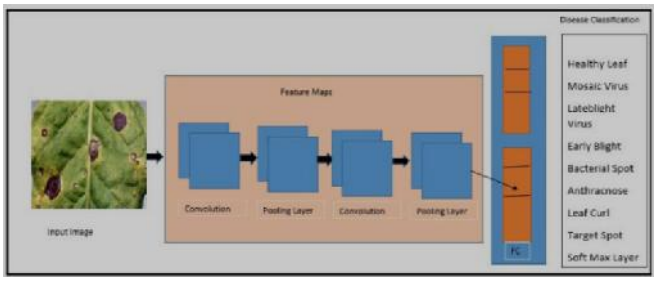


Fig. 1 Architecture

IV. PROPOSED SYSTEM

A. Methodology

Image acquisition:

The first stage of any computer vision system is the image acquisition. Image acquisition involves the steps to obtain the plant leaf and capture the high-quality images through the camera. Images are acquired from the agricultural field or in the internet. The efficiency of the results depends uponthe quality of the training image and input image.

Image pre-processing:

Image pre-processing is a process aimed to improve the image and configures it for next processes by removing the unwanted objects and noises and improving the visual appearance. It also gives a positive effect on both the features extraction and process of segmentation and therefore has a huge impact on the final outputs of the system and its accuracy. Three pre-processing operations:

- The first process crops the image to eliminate the background and noise as much as possible.
- The second operation is image contrast enhancement.

- The third process is to convert all the input images to the fixed sizes.

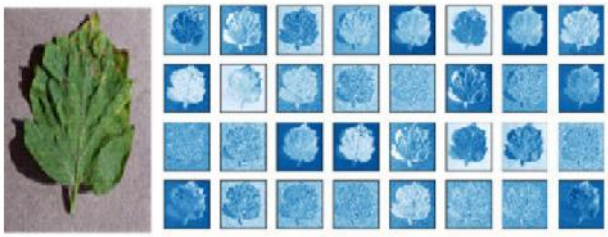


Fig. 2 visualization of convolution filters

Feature Extraction:

The image contains a lot of information, only some of this information are used to distinguish between different situations. The image has many features such as colour, texture and shape. These features can be used as information. Here, a range of colour features and text features are used to separate the diseased leaf from the health leaf.

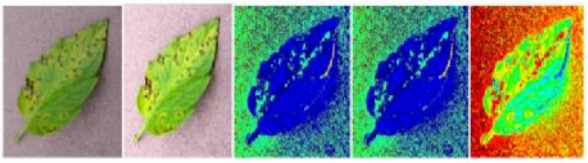


Fig. 3 Action visualization learned weights by all layers

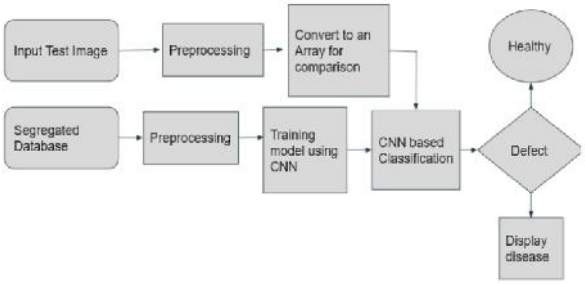
Splitting dataset:

The proportions of train and test data can be:10% – 90%, 30% – 70%, 50% – 50%, 70% – 30%,90% - 10%. We then split the dataset into 70% of the training images and 30% for testing.

CNN based classification:

CNNs are a class of Deep neural networks that can recognize and classify specific features from images and are widely used for analysing visual images. The term "Convolution" in CNN denotes the mathematical function of convolution which is a special kind of linear operation wherein two functions are multiplied to produce a third function which expresses how the shape of one function is modified by the other. It is the widely used for image/object recognition.

B. Flow diagram



V. CONCLUSION

The benefits of tomato leaf disease prediction application are quite remarkable. In this technology era, it has become essential for every farmer in the country to adapt to this trend to find the disease earlier in their crops and have to take fertilizers accordingly. This helps in the increased production rate of tomatoes in our country. As a future work we are planning to add an extra feature in our application which also recommends a fertilizer to an appropriate disease that is predicted. This helps the farmer not to worry about the fertilizer to be used for the disease as the application itself recommends the disease

VI. ACKNOWLEDGEMENT

We express our profound gratitude to the management of Kumaraguru College of Technology for providing us with the required infrastructure that enabled us to successfully complete the project.

We extend our gratitude to our Principal, **Dr. D. Saravanan,** for providing us the necessary facilities to pursue the project.

We would like to acknowledge **Dr. P. Devaki,** Professor and Head, Department of Computer Science and Engineering, for her support and encouragement throughout this project.

We thank our project coordinator **Dr. L. Latha,** Professor, Department of Computer Science and Engineering and guide **Mrs. Francis Jency X,** AssistantProfessor, Department of Computer Science and Engineering, for their constant and continuous effort, guidance and valuable time.

Our sincere and hearty thanks to staff members of Department of Computer Science and Engineering of Kumaraguru College of Technology for their well wishes, timely help and support rendered to us during our project. We

are greatly indebted to our family, relatives and friends, without whom life would have not been shaped to this level.

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