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Plants Diseases Detection using Python

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Abstract: *Plant disease is an ongoing challenge for smallholder farmers, which threatens income and food security. The recent revolution in smartphone penetration and computer vision methods has created an opportunity for image classification in agriculture. Convolutional Neural Networks(CNN) are considered state of the art in image recognition and offer the ability to provide a prompt and definite diagnosis. In this paper, the perfomance of a pre-trained ResNet34 model in detecting crop disease is investigated. The developed model is deployed as a web application and is capable of recognizing 7 plant diseases out of healthy leaf tissue.*

A dataset containing 8,685 leaf images, captured in a controlled environment, is established for training and validating the model. Validation result show that the proposed method can archieve an accuracy of 97.2% and an F1 score of greater than 96.5%. This demonstrates the technical feasibility of CNNs in classifying plant diseases and presents a path towards AI solutions for small holder farmers.

The project focuses on the approach based on image processing for detection of diseases of plants. In this paper, we propose an Android application that helps farmers for identifying plant disease by uploading a leaf image to the system. The system has a set of algorithms which can identify the type of disease. Input image given by the user undergoes several processing steps to detect the disease and results are returned back to the user via android application

Keywords: farmers

I. INTRODUCTION

The most widely used method for plant disease detection is simply naked eye observation by experts through which identification and detection of plants diseases are done. For doing so, a large team of experts is required, which costs very high when farms are large. At the same time, in some countries, farmers don't have proper facilities or even idea that they can contact to experts. Due to which consulting experts even cost high as well as time consuming too. In such a condition, the suggested technique proves to be beneficial in monitoring large fields of crops. And automatic detection of the diseases by just seeing the symptoms on the plant leaves makes it by easier as well as cheaper. Plant disease identification by the visual way is a more laborious task and at the same time less accurate and can be done only in limited areas. Whereas if automatic detection technique is used it will take fewer efforts, less time and more accurately. In plants, some general diseases are bacterial, black spotted, and others are Rust, viral and Red cotton Leaf. Image processing is the technique which is used for measuring the affected area of disease, and to determine the difference in the color of the affected area [1]. Image segmentation is the process of separating or grouping an image into different parts. There are currently many different ways of performing image segmentation, ranging from the simple thresholding method to advanced color image segmentation methods. The segmentation process is based on various features found in the image. This might be color information, boundaries or segment of an image.

Each year, smartphones continue to become more accessible and affordable. In 2020 there are approximately 5 billon smartphone users in the world . Of this, one billion users are located in India and a further one billion are located in Africa. According to Statista, these figures have consistently risen every year for the last decade With these facts in mind, it is believed that AI apps will play an important role in

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II. LITERATURE REVIEW

Discussed a methodology for recognition of plant diseases present on leaves and stem. The proposed work is composed of K-Means segmentation technique and the segmented images are classified using a neural network. They developed a method for detecting the visual signs of plant diseases by using the image processing algorithm. The accuracy of the algorithm was tested by comparing the images, which were segmented manually with those automatically segmented.
Discussed various techniques to segment the diseased part of the plant. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The use of ANN methods for classification of disease in plants such as self-organizing feature map, back propagation algorithm, SVMs, etc. can be efficiently used. From these methods, we can accurately identify and classify various plant diseases using image processing techniques. An approach based on image processing is used for automated plant diseases classification based on leaf image processing the research work is concerned with the discrimination between diseased and healthy soybean leaves using SVM classifier. They have tested our algorithm over the database of 120 images taken directly from different farms using different mobile cameras.

III. METHODOLOGY

A. Data Acquisition

Additional All Potato and Tomato imagery derive from 'The PlantVilllage Dataset' an open-access repository which contains in total 54,323 images. All Rice imagery originates from the "Rice Diseases Image Dataset" Kaggle dataset . For each species, a select number of classes are chosen. All images are captured in a controlled environment. Due to this, model bias is expected. To access this, a test dataset containing 50 images, sourced from Google is also established. These images contain plant anatomy, infield background data and varying stages of disease.

B. Data PreProcessing

The dataset is divided into 80% for training and 20% for validation. First, augmentation settings are applied to the training data. These are generated 'on the fly', with each operation carrying a weighted probability of appearing in each epoch. Each directory of the plant disease dataset folder varies in the number of images. Instead of taking them all, we select the first N_IMAGES from each directory to train our model. Finally, we set the path of the dataset in the root_dir to access plant images.

C. Classification by CNN

1) Phase One – Trialling of Image size Phase one aims to investigate the effect that image size has on model performance. In total, five images sized are tested ranging from 150 x 150 to 255 x 255. To begin, the Resnet34 pre-trained weights are downloaded. As a default of transfer learning, all layers with the except of the final two layers are frozen. These contain new weights and are specific to the plant disease classification task. Freezing allows these layers to be disease separately trained, without backpropagating the gradients. In exactly this way, the 1cycle policy is used to train the final layers.
2) Phase Two – Model Optimisation Using the most suitable image size, the ResNet34 model is optimised. To further improve the model's performance, additional augmentation settings are added.
3) Phase Three – Visualisations For the purpose of interpretation, a series of visualisations are generated based on the validation and test datasets. Additionally, the model is deployed to create a web application. To achieve this, the completed essential files are stored in a GitHub repository and the model is exported as a pickle file. To deploy the model, the repository is connected to the unified platform; Render. In carrying out this task, the 'Render Examples' GitHub repository was used as a guide.

IV. RESULTS

All the experiments are performed in MATLAB. For input data disease, samples of plant leaves like rose with bacterial disease, beans leaf with bacterial disease, lemon leaf with Sun burn disease, banana leaf with early scorch disease and fungal disease in beans leaf are considered. Original images which are followed by output segmented images.

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Segmented image can be classified into different plant diseases. The input and output image where input image is a banana leaf with early scorch disease and output image shows the classification of disease using feature extraction method.

The co-occurrence features are calculated after mapping the R, G, B components of the input image to the thresholded images. The co-occurrence features for the leaves are extracted and compared with the corresponding feature values that are stored in the feature library. The classification is first done using the Minimum Distance Criterion with K-Mean Clustering and shows its efficiency with accuracy of 86.54%. The detection accuracy is improved by proposed algorithm.

V. CONCLUSION

With very less computational efforts the optimum results were obtained, which also shows the efficiency of proposed algorithm in recognition and classification of the leaf diseases. Another advantage of using this method is that the plant diseases can be identified at early stage or the initial stage. Banana, beans, jackfruit, lemon, mango, potato, tomato, and sapota are some of those ten species on which proposed algorithm is tested. Therefore, related diseases for these plants were taken for identification. The model not only adapts to complex environments, but also increases the accuracy of identification. Compared with the traditional model, the model proposed in this paper not only guarantees the robustness of the convolutional neural network, but also reduces the number and quality requirements of the convolutional neural network on the data set and obtains better result.