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Android Application on Plant Disease Identification using Tensorflow

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Abstract— ***The changes in environment and climate lead to various diseases in plants. These diseases are sometimes difficult to identify without the right knowledge and expertise. The farmers and other plantation growers do not possess the expertise and resources to correctly identify the diseases of plants and their remedies. To handle this problem machine learning technology can be used, which can correctly identity the disease of the plants and display the remedies to the end user. Any new emerging disease can be added by proper botanist and their associations for the awareness of farmers. The machine learning system learns about the plant diseases from large datasets and gets trained to correctly identify new test cases given as an input by the farmers through the camera of their smart phones. Here we propose the methodology uses tensorflow incorporated with android application which can suggest the user about the disease.***

Keywords— ***Android Application, Machine Learning, Prediction, Plant Diseases, TensorFlow, Image Dataset, Farmer***

I. INTRODUCTION

The innovative design and simplicity allow the users and farmers to navigate through the Android application with relative ease. The options are clear and boldly presented. The application accommodates a variety of plant categories in its learned model to identify from. The user can scan the suspicious plant for disease identification from the application camera. The goal of such an application is to facilitate expert decision on the plant health as per specified by the botanical community. It is a dire task to identify plant diseases for the uneducated farmers in real life, which may lead to plants death and a low harvest. Our application eliminates unnecessary stress and cost associated with transport, navigation and unsatisfactory results. A brief description of each disease is mentioned, along with a reasonable solution and all the help needed. The application has the option of adding new learned models on different plants or new disease developed with the help of botanist or any other agriculture or plantation associations

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II. RELATED WORK

The current system of identifying diseases in plants include an examination of plants leaves and resemble the spots from the spots of a diseased plant. This is usually done by an expert such as a botanist. The farmers or other small nursery owners cannot afford to call a botanist as the plant disease can occur frequently and it is not feasible to show every symptoms of plants to a botanist. The plants in such cases die and the farmer's yields get affected [3]. There currently do not exist any automated system that uses machine learning technology that categories plants as diseased or healthy. The current methods are traditional methods used since ages and is not applicable today as the number of diseases increased due to the use of harmful pesticides on plants [4].

In [6] they devised a rule based semi-automatic system using concepts of k-means and support vector machines to detect healthy leaves from diseased leaves. The best performing feature set for soya bean leaf disease detection. Whereas [7] they have used K-means clustering to perform image segmentation. The segmented images are labelled by maintaining a catalogue. Artificial Neural Network for pattern matching and disease classification. Diseases are categorized based on feature vectors, colour, morphology, texture. Authors in [8] propose K-means clustering for image segmentation by using Otsu's method for setting the threshold. Thesholding is used to create gray-scale image from color images. They use Support Vector machines to classify the disease. The disadvantage in this proposal is that user to manually select the region of interest. In [9] they propose image processing using convolution neural network and use Transfer learning technique of machine learning for classification. They retrain the existing Googlenet Inception V3 model on a publicly available dataset. Tensorflow is used to retrain the Inception Model.
In the work [10], the image is processed to identify the plant using the features of the leaf using artificial neural network. The leaves are then subjected to disease classification using K-Means and artificial neural network. In the work [11], they use Generative Adversarial Networks (GANs) to augment the limited number of images for crating training dataset. They use Convolution Neural Network (CNN) for classification. The use of GANs method helps to increase the variations of the available dataset. The authors in [12] have proposed K-means clustering for image segmentation. The color and texture features are extracted from the fruit image. The color and texture features are fused together as input to the Random Forest Classifier.

III. PROPOSED METHODOLOGY

A. Different Modules

There are three actors that interact with the system farmer, the botanist and the machine learning platform. The various modules include the camera capture from where the user can scan the infected area of the plant Figure 1. The trained module is the one where the learned module can be added to the system whenever a new disease is identified by botanist and whenever new changes to the existing learned models are done. The front-end module consists of the 'detect a disease' option and the method to detect various plant types. The user can enter all the details of the infected plant and can get remedies accordingly [2]. The android application developed will be helpful to scan and send the input data to the backend. The next module includes the tensorflow model specifically developed on the datasets of infected plants. The mentioned system modules are developed using XHTML, Java, Python and the proper datasets of the plants diseases [1].

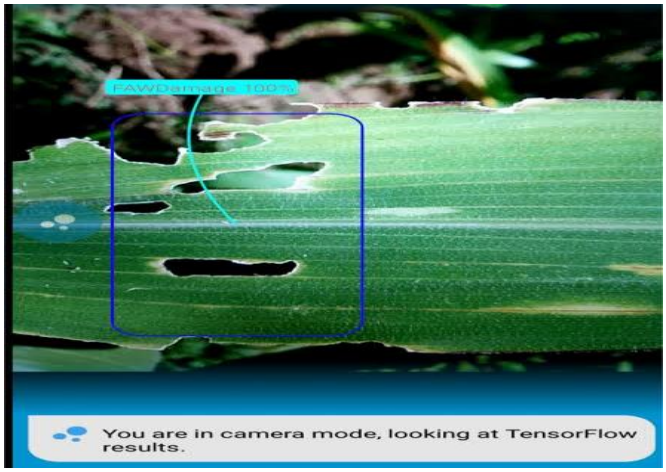

Figure1: Working of different modules in identification

B. Compete Flow of The Proposed System

As mentioned before, the top-level use cases are here more appropriate to describe the user communication with the system. This is because they provide information not only about the system behavior, but also about the sequence of interactions that the farmers usually performs in order to achieve a goal. The checkout top-level use case is shown in Figure 2. Once the farmer has some items scanned in his android phone, the next step is to navigate to the remedy page. Here the user can remove or modify his diseased part that has been scanned until the scan is clear to start the prediction process. Users can scan the same plant species multiple number of time. There, after entering all plant and required information, the system will confirm the disease and the system will display the remedies. The customer can choose an option between other scan and detailed analysis on the same problem.

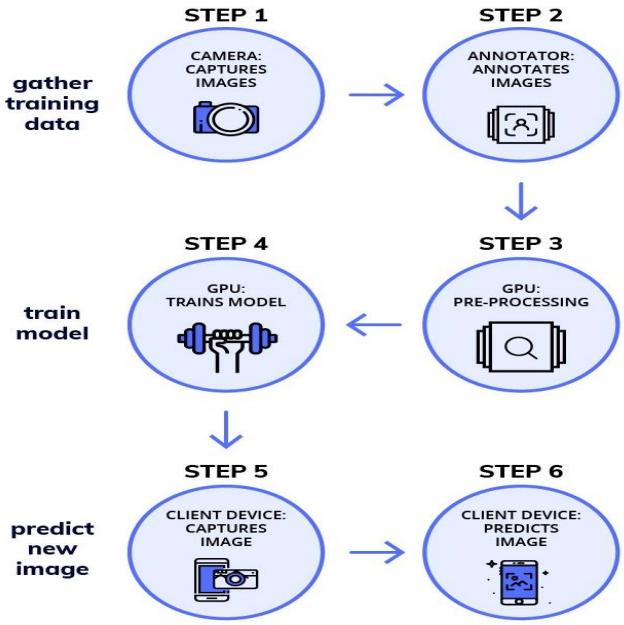

Figure2: Complete Flow of proposed system.

C. Algorithm Used

The Plant disease identification makes use of an algorithm to carry out all processes for the scan of plants to the proper prediction of diseases with medical expertise behind it.

ALGORITHM:

STEP 1: Android Application Setup:
The application includes the user to give proper credentials for the registration or login of the user to the application and settings proper permission of the application. The use of Tensor Flow is embedded inside the android application make use of learned model

STEP 2: Creating learned model over the dataset:
The model is pre learned on the dataset of the plants using appropriate algorithms of the Tensor Flow framework ex: clustering.

STEP 3: Training and testing datasets:
The tensorflow includes the details of the plant disease and the model trained over this data. Training and testing sets are divided into a ratio of 10:1 respectively. The clustering algorithm of machine learning is used which are prewritten in the tensorflow framework [5].

STEP 4: Testing data:
Application includes the 'Identify the disease' option. This further lets the system to predict the disease on the new plant sample biased on the details of the plants provided by farmers if necessary.

STEP 5: Optimization techniques:
The model is optimized by using the optimization techniques in the tensorflow such as model. Optimization, pruning, stemming. The display options are selected according the user from regional language or as set by user during login. The predicted information is displayed in this step and the remedies necessary is shown

STEP 6: Prediction:

This step displays the user the prediction of the current instance of the event. It also displays the history and the current progress of the active diseases so that the user can track the health process.

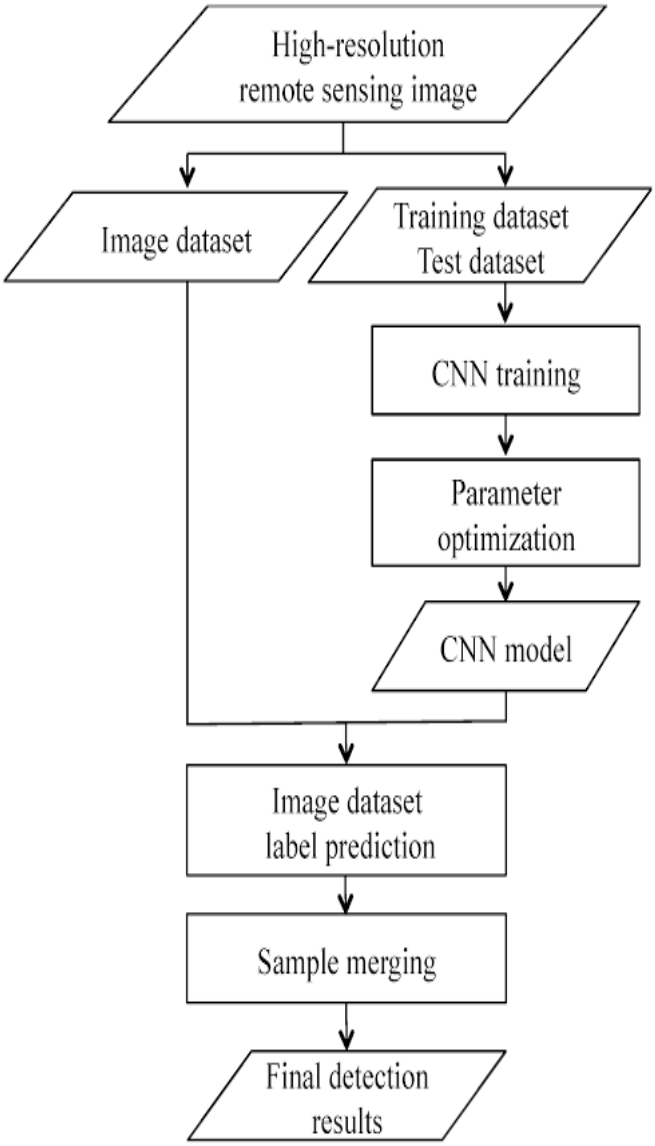

Figure 3: Flow Chart

IV. RESULTS

The proposed model is been implemented in the computer device with 4GB RAM and 1TB hard disk. An android application is developed using android studio and run in the cell phones with 2GB RAM. The proposed system can identify the confidence level of the healthiness of leaf. It can also produce the kind of disease if attacked.

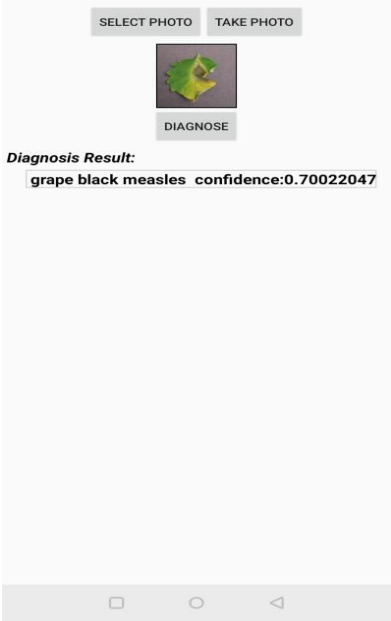

Figure 4: Diseased Leaf with confidence

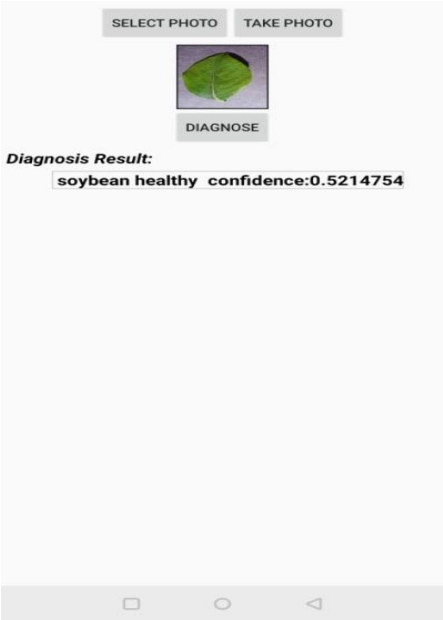

Figure 5: Healthy leaf with confidence

The results of the development of the plant disease identification using tensorflow over the traditional approaches are convenience to use, interactivity, large volume in prediction. As shown in the Figure 6, the number of days is given on x-axis and the yield of the crops or the health of plants mentioned on the y-axis. The Figure 3 displays the data of the machine learning system for the same values as used in traditional disease identification. The difference can be clearly observed. As sown in Figure3, the first blue line represents the data of traditional methods and the second red line represents use of tensorflow and machine learning data.

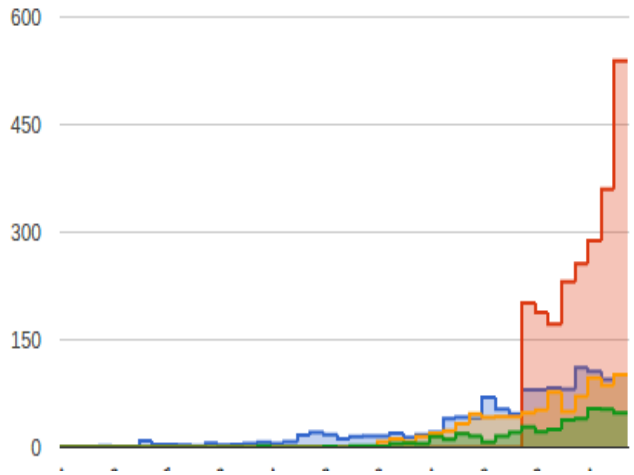

Figure 6: Machine Learning Data Graph

We have considered around 250 images to train our system and try to recognize for the disease. We could able to achieve around 25 samples belongs to Alternaria Alternata group, around 50 images samples belongs to Anthracnose, around 52 images fall under Bacterial Blight, 73 samples belongs to Cercospora Spot and finally 52images samples fall under Mosaic. The detailed information is provided in the following table.

Table 1: Disease analysis for given samples

Name of the Disease	Samples considered	Recognized Samples	Misclassified Samples	Rate of Recognition (%)
Alternaria Alternata	23	21	2	91.3
Anthracnose	50	45	5	90
Bacterial Blight	52	48	4	92.31
Cercospora Leaf Spot	73	68	5	93.15
Mosaic	52	49	3	94.23

The kind of leaf diseases which are classified into 5 classes, are shown in Table 2. It also demonstrates that, the results are of only few samples from Frog eye leaf spot and bacterial leaf spot leaves were misclassified. The average accuracy of classification of proposed algorithm is 97.6.

Table 2: comparison of detection vs trained data.

Leaf disease	Bacterial leaf spot	Frog eye leaf spot	Sun burn disease	Fungal disease	Early scorch	Accuracy
Bacterial leaf spot	23	2	0	0	0	92
Frog eye leaf spot	1	24	0	0	0	96
Sun burn disease	0	0	25	0	0	100
Fungal disease	0	0	0	25	0	100
Early scorch	0	0	0	0	25	100
Average						97.6

V. CONCLUSION

By this Methodology, we can assure with managing all sorts of identification of problems such as assembly line product identification, fruits or vegetables disease identification. It reduces the number of plants dying due to improper identification of disease. The main aim was to learn and design a machine learning application development inside an Android application. Providing flexibility of implementation of tensorflow framework inside any environment. This helped in creating our own android application which uses machine learning.

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