

Plant Disease and Diagnosis Treatment through Deep Learning Techniques

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Abstract – Technology has percolated into each and every sphere of our life. What seemed impossible yesterday is implemented today and evolved tomorrow. Agricultural sector is bound to change a lot than it was in these past decades. A lot has changed and use of technology has increased a lot in helping the farmers increase their production. Farmer these days have access to Smartphone devices in which they can search the type of pesticides and fertilizers to use in order to improve production and prevent crop damage. But they cannot use any chemical without any expert's advice. The endpoint of these advancements in agricultural sector is to make the expert's opinion available to the farmers present anywhere event in remote locations. This can be done by developing a suitable application where they can check their crops health and see measures to prevent or cure diseases. This application would make use of machine learning and deep learning algorithms in order to detect the disease infecting the plant and with the help of the data already fed in the database it would be able to tell the farmer about how to cure a particular disease which is affecting his crops.

Keywords- Deep Learning, Machine Learning, Diagnosis, CNN, ANN

I-INTRODUCTION

The purpose of this document is to present a detailed description of the Plant disease detection and diagnoses

using deep learning. It will explain the purpose and features of the system, the interfaces of the system, what the system will do, the constraints under which it must operate and how the system will the system, what the system will do, the constraints under which it must operate and how the system will needed for development, validation and verification will ease. To be specific, this document is going to describe functionality, external interfaces, performance, attributes and the design constraints of the system which is going to be developed.

This software system can prove to be a breakthrough in modern technology and would have a deep impact on our lives. There would not be expert intervention in the mobile application which would make it easy for the farmer to cure the disease as he would not have to go to the local vendor or any expert to listen to their advice to cure or prevent any disease. Moreover, in cases where the disease can take over the entire farm within one night could be detected by the farmer at the farm itself and he would be able to cure the disease in time protecting his unharmed crops which would also reduce economic damage.

Our project predicts the plant's disease using the image uploaded by the user and gives the remedies for that

particular disease by showing the chemical cure, biological cure and the preventive measures so that the disease does not occur in future.

II- PROBLEM STATEMENT

The importance of agriculture cannot be over emphasized in today's world. The quality and the quantity of the food we eat depends on the agricultural sector. The better the health of the crops the better would be the health of the people and most importantly healthy farming would increase the farmers output and hence the profit. But unfortunately, farmers in today do not have access to expert's advice on which chemical or biological measures are to be taken to keep the crop healthy. There should be a technological means through which a farmer, without going to the local vendor or a specialist physically, could somehow have access to the remedies recommended by the experts by sitting in their farm while looking over their crops so that immediate preventive action or cure could be done if his/her crops become diseased or damaged.

Our project predicts the plant's disease using the image uploaded by the user and gives the remedies for that particular disease by showing the chemical cure, biological cure and the preventive measures so that the disease does not occur in future. It takes the input in the form of an image which uses the camera of the mobile and by using the model running at the server at the backend it predicts the disease and gives the cure. So, the farmer, instead of going to the local vendor or any specialist, gets the expert's recommendation in his mobile device itself.

The main motivation behind "Plant Disease Diagnosis and Treatment Through Deep Learning" is to provide remedies recommended by experts and scientists to the farmers at their home or fields where they can cure their crops immediately and using correct medicines. There have been attempts to solve these problems, but none of the solutions have been particularly effective. However, application of deep learning in agricultural sector to detect and cure crop diseases has potential to change all these problems. If diseases can be caught in their early stages the we could prevent the worldwide loss of economy related to agricultural sector. Diseases occurring in plants does not only affect the farmer but even affect the economy of the entire country. Sometimes the diseases are so worse that they can infect the entire farm within one night and all the crops get damaged till the sunrise and the entire yield have to be

discarded. This severity of the matter shows that how important technology has become because at that time the farmer cannot heed the advice of any expert or scientist which a mobile application would be able to give. The use of deep learning and AI techniques can improve the sorry condition of our agricultural sector not only in India but all over the world. This would not only help the farmers to improve their production and get more profits but also increase the nutrients of the food that we intake and would lead to a better health of the people consuming the crops.

These are the few reasons which inspired various organizations and researchers to focus on developing several techniques in order to detect and not only cure but also prevent diseases occurring in plant by using machine learning and deep learning techniques. This inspires us as well to develop a model for predicting the plant diseases and provide the cure and preventive measures.

Develop a mobile application that predicts plant's disease and recommend the remedies to cure that disease and also tell the preventive measures so that the disease doesn't occur in future. The app would interact with a backend server which has a model running to predict the plant disease and the server transmits back the result to the application to show to the user.

III- METHODOLOGY

The first step is for the user to login into the smartphone application or register himself first if he has not already registered. After logging into the app, the user enters into the home screen whose screen shot is shown below. The user can open the home page where he can see his last photo taken, upload a new image of the leaf of the plant he suspects to be diseased and he can open the library which consists of all the diseases which can be identified by the application. The upload screen is shown in the below figure. It consists of two options one to click the image from the camera itself and the other option is to upload an image which is already present in the gallery. But first the user needs to select the type of plant for which he is uploading the image i.e., citrus, corn or tomato. After selecting or clicking the image of the plant that, the user suspects, is diseased, the app uploads that particular image onto the server. The communication between the server and the mobile application is done using the REST api's. The directory structure of the server on which the image is being uploaded is shown below. The backend app is deployed online on Linode

server. Along with that a screen shot of the server responding to the requests made by the mobile application in which the user who is making the request can be seen and what the request is being made can be seen. The model which is used to predict the disease i.e., the VGG16 model is deployed on the backend server. The backend server is also responsible for communicating with the backend database which is stored using PostgreSQL so that it can retrieve the cure for the disease that is predicted by the model. The cure consists of the chemical control, biological control along with extra information about the disease i.e., the symptoms and the preventive measures to be taken so

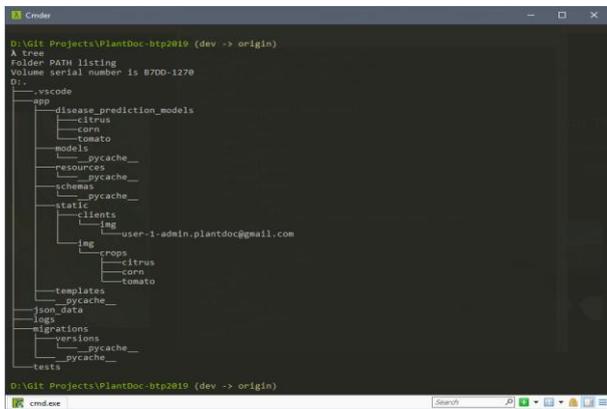


Fig 2.1: Directory Structure of Flask app

that the disease does not occur in the future. All these details are sent back to the mobile application and the results are displayed to the user. Screen shots of the result of the predicted disease are shown below:

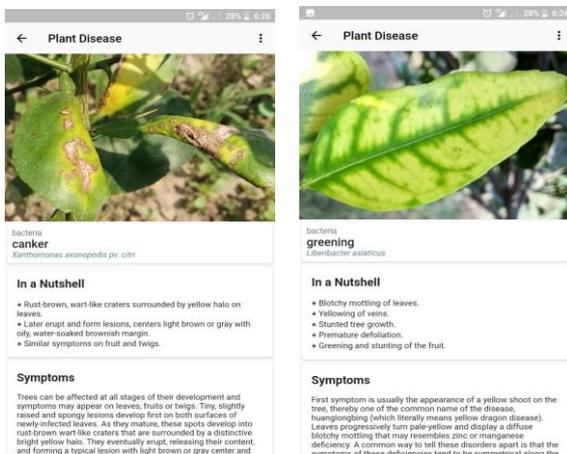


Fig 2.2: Snapshot of Result of Detected Diseases

IV-RESULTS

The result obtained is shown in table for various categories for the classes. The output of test image is shown below fig

[INFO] loading and preprocessing image...
 Image ID: 3, Label: healthy



Fig 3.1: Healthy image prediction

Classes	Grey Leaf Spot	Comm on Rust	Healthy	Norther Leaf Blight
Test Images	78	90	85	60
Correct	70	80	77	53
Accuracy	0.8974	0.9222	0.9058	0.8833

Fig 3.2: Results of Corn crop

Classes	Ca nker	Gr een ing	Healt hy	Gummo sis	Leaf Miner
Test Images	54	35	40	26	53
Correct	49	31	37	24	48
Accur acy	0.9074	0.8857	0.925	0.92307	0.90566

Fig 3.3: Result of Citrus Crop

V-CONCLUSION

Finally, it is concluded that the model is successfully tested on the field images which gives the good accuracy so that the model can be used as a product to help the farmers. Now, we have to just

know the remedies and the system is good to go. Further, in the same application, we can expand the idea. Instead, just of only one crop, we can make another portal in the app in which scientist can upload the photo of certain diseased plants and train the model. This thing can expand the application and can be more useful. Since, Agriculture is a vast field. So, we have only implemented a product which can detect disease and tell the farmer that the following method should be used but as technology is improving, we can implement a method in which robot does the human labor task for spraying. In this method, first of all we have to detect the affected area using the same process of convolutional neural network, afterwards we can finally apply the process. It is itself a research area.

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