Early Plant Disease Detection Solution for Rural Farmers Using Computer Vision, Cloud Computing and Android

ABSTRACT

Diseases prevalence and the lack of close monitoring often results in crop loss in Bangladesh as high as 30% in some cases. For instance, rice production reduces by about 10% because of diseases, whereas potato and tomato production decreases by 37% and 43% respectively because of leaf infection. Early and accurate detection of these diseases can prevent a large-scale yield loss. However, detection of these diseases is hard for farmers without the direct help of skilled people. To provide the farmers with the initial information, we developed a mobile app that can predict a possible set of diseases from the images of leaf-infection. Our Android App that detects the diseases of crops instantly by taking low-resolution images of the affected leaf. For now, the App considers five major crops of Bangladesh (Potato, Tomato, Apple, Corn, Grape), but the framework developed here is scalable to many others. The computation and prediction are all done in the cloud server to reduce the burden on the handset; precisely, Convolutional Neural Network (CNN) works at the core of the App. The farmers can see solutions and steps to follow immediately for the predicted disease.

Method with System Diagram/Design Complexity

We have developed the App with Bangla Voice assistant for the rural farmers. This app can take low-resolution images and with the help of machine learning and computer vision and classify the disease of the plant. All the computation are done in the cloud and low data is used with fast prediction results. The App also shows the necessary steps to follow to prevent large yield loss at an early stage.

We have used Transfer Learning a technique which takes the advantage of a pre-trained model to learn on new datasets. Here we have used MobileNet as the base model. Our model has a total of 92 layers. We experimented with Custom CNN models as well as AlexNet. The model based on MobileNet fit best for our project. As it's trained in the ImageNet dataset and is a family of mobile-first computer vision models for TensorFlow, designed to effectively maximize accuracy while being mindful of the restricted resources for an on-device or embedded application. MobileNets are small, low-latency, low-power models parameterized to meet the resource constraints of a variety of use cases.

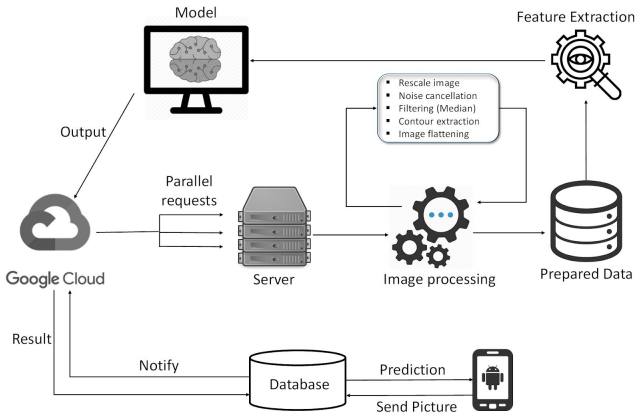

Figure 1: Overall System Architecture

Novelty of Project and Significance

This project can bring on many benefits to the economy of Bangladesh. As there are currently no solutions available for protecting the diseases crops on a large scale. As this requires much manpower and skilled people. With our project, the farmers can overcome the difficulty. There are several app and projects which can detect plants via smartphone. But there aren't many disease detection projects available. Most of the image recognition is used with high-quality images. We are providing a complete solution for the farmers with low specs. Native Bangla voice assistance and step by step tutorials are included to help the farmers in every step. Also, low mobile data is required.

Impact on society/environment

Our project is expected to greatly impact the society. As Bangladesh is mainly dependent on agriculture. We can reduce a lot of yield loss by the proper use of our system. Everyone can use the App for free of cost. As a lot of food production will be saved ultimately the society will benefit

mostly. By increasing food production we won't need extra arable land and thus the environment will benefit also.

Business Model/Financial Scalability plan:

We are focusing on Affiliate Marketing for our project. Our business plan aims to promote disease-specific remedies for the farmers in addition to its disease detection feature. Precisely, it will include pesticides, insecticides, fungicides, herbicides, and the fertilizer required as per the treatment and recovery of the affected corps. Good quality seed and the availability of other amenities needed for farming would be our other targets. Also, the App will advertise the sponsored product. Moreover, once the App becomes popular among farmers and the farming community, revenue earning through the platform would be possible.