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CROP DISEASE NOTIFICATION SYSTEM

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Abstract - *Crop sicknesses are a primary danger to food security; however, their fast identification remains tough in lots of elements of the sector because of the shortage of the essential infrastructure. The aggregate of growing worldwide smartphone penetration and current advances in computer imaginative and prescient made viable with the aid of deep getting to know has paved the way for cellphone-assisted sickness prognosis. The use of a public dataset of 20,306 photos of diseased and healthy plant leaves accumulated underneath controlled situations, we educate a deep convolutional neural network to pick out 15 crop species and 29 diseases (or absence thereof). The educated model achieves an accuracy of 85.35% on a held-out check set, demonstrating the feasibility of this approach. Universal, the method of schooling deep learning models on an increasing number of huge and publicly to be had image datasets gives a clean route in the direction of phone-assisted crop ailment diagnosis on a massive worldwide scale. Notifications offer a completely unique mechanism for increasing the effectiveness of actual-time facts transport systems. However, notifications that demand farmers' attention at inopportune moments are more likely to have destructive effects and may become a motive of capability disruption in place of proving beneficial to farmers. In order to address these demanding situations a spread of notification mechanism based on tracking and gaining knowledge of crop disease behavior were proposed. The goal of such mechanism is maximizing farmers receptiveness to the added records by means of routinely inferring the proper crop and the proper fertilizers, for assuring accurate yield of crops.*

***Key Words*:** Smartphone, Notifications, Crop Disease, Deep Convolutional Neural Network.

1.INTRODUCTION

Plant illnesses, pest infestation, wind pressure, and nutrient deficiencies are a number of the grand demanding situations for any agricultural manufacturer, at any vicinity and for anything Commodities or size of the operation is dealing every day. It's far critical that farmers would know the existence of such challenges of their operations on a well-timed basis. Nevertheless, it could be pretty helpful to agricultural manufacturers to have access to with no trouble to be had Generation to coach them on how to cope with each of those threats for Agricultural Production to beautify crop manufacturing and operation profitability.

Machine Learning (ML) coupled with laptop vision have already enabled sport-changing precision agriculture abilities by means of providing the capability to optimize farm returns, hold herbal resources, lessen unnecessary use of fertilizers, and discover sickness in vegetation and animals from remotely sensed imagery.

This paper offers a cell-based machine for detecting plant leaf diseases [1] the use of Deep Learning (DL) in real-time. In particular, we developed a distributed gadget that is prepared with components executing on centralized servers at the cloud and locally at the user's cellular gadgets. We created a dataset that includes more than 20 k pictures for the most common place 38 plant ailment categories in 15 crop species, together with tomato scab, tomato, grape leaf blight, rice [2]and lots of others [3].

The contributions of this paper are threefold. First, we advocate a dispensed ML powered Platform that is organized with parts executing on the cell consumer gadgets at the agricultural discipline and excessive-overall performance servers hosted inside the cloud. Second, the proposed Machine is capable of taking pictures, processing, and visualizing massive imagery agrarian datasets[4]. Third, we evolved a person-pleasant interface on pinnacle of the CNN model to allow Farmers to interact with the disorder detector quite simply on the cellular aspect. Fourth, Mobile notifications are presented in a unified fashion by almost all mobile operating systems.

In order to ensure real-time awareness of users about the delivered information, mobile operating systems [5] rely on notifications that steer users' attention towards the delivered information through audio, visual and haptic signals. This is indeed in contrast with the traditional paradigm of pull-based information retrieval and delivery in which the user has to initiate a request for the transmission of information.

2.SYSTEM DESIGN

The distributed run-time system for the plant disease detector with Notification is organized with parts executing on mobile devices at the user side, as well as on centralized servers at the cloud side [6]. Module 1 describes the farmer registration at client side, which includes Login and Sign in Dashboard. Module 2 depicts the crop prediction depending on soil, temperature and rainfall attributes on the preferred location [7]. Module 3 recognizes the disease of the crop which formulates the device to send Notification for the users.

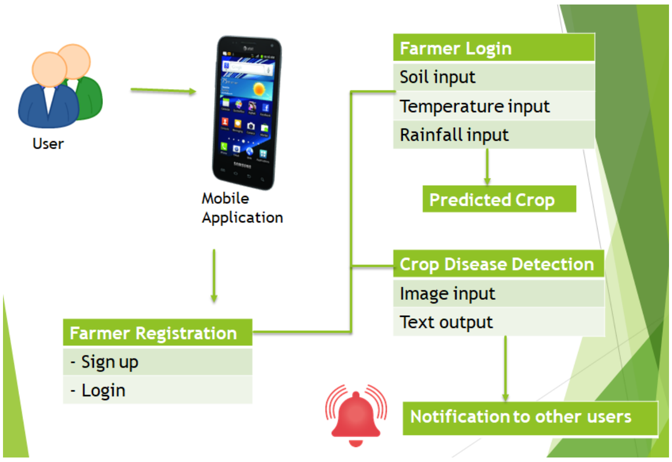


Fig -1: System Architecture

2.1 CNN Structure

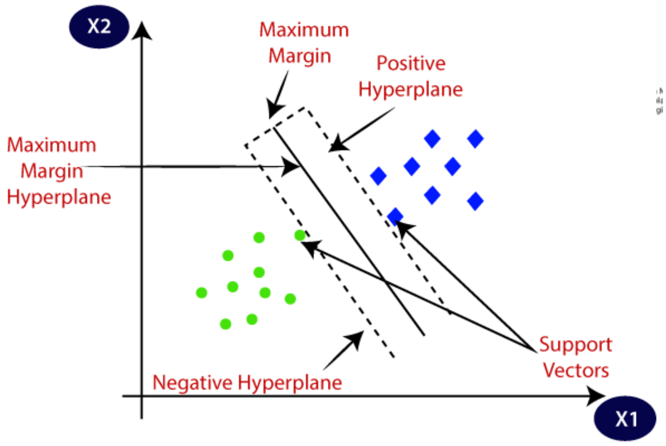
The CNN network has two types of layers: convolution and pooling. Each layer has a group of specialized neurons that perform one of these operations. The convolution operation means detecting the visual features of objects in the input image such as edges, lines, colour drops, etc [8]. The pooling process helps the CNN network to avoid learning irrelevant features of objects by focusing only on learning the essential ones [9]. The pooling operation is applied to the output of the convolutional layers to down sampling the generated feature maps by summarizing the features into patches. Two common pooling methods are used: average-pooling and max-pooling. In this paper, we used the max-pooling method, which calculates the maximum value for each patch of the feature map as the dominant feature.

Before moving the trained CNN model to the mobile device, we converted it into an optimized IR model based on the trained network topology, weights, and biases values. We used the Intel OpenVINO [10] toolkit to generate the IR model, which is the only format that the inference engine on the Android platform accepts and understands. The conversion process involved removing the convolution and pooling layers that are not relevant to the mobile device's inference engine. In particular, OpenVINO splits the trained model into two types of files: XML and Bin extension. The XML files contain the network topology, while the BIN files contain the weights and biases binary data.

2.2 SVM

In the era of big data, machine learning has been broadly adopted for data analysis. In particular, the Support Vector Machine (SVM) has an excellent performance in classifications and predictions with the high-dimensional data. In this research, a novel model selection strategy is carried out, named as the Stepwise Support Vector Machine (StepSVM)[11]. The new strategy is based on the SVM to conduct a modified stepwise selection, where the tuning parameter could be determined by 10-fold cross-validation that minimizes the mean squared error. Two popular methods, the conventional stepwise logistic regression model and the SVM Recursive Feature Elimination (SVM-RFE), were compared to the StepSVM. The Stability and accuracy of the three strategies were evaluated by simulation studies with a complex hierarchical structure. Up to five variables were selected to predict the dichotomous cancer remission of a lung cancer patient. Regarding the stepwise logistic regression, the mean of the C-statistic was 69.19%. The overall accuracy of the SVM-RFE was estimated at 70.62%. In contrast, the StepSVM provided the highest prediction accuracy of 80.57%. Although the StepSVM is more time consuming, it is more consistent and outperforms the other two methods.

Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification [12] as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning. The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane. SVM chooses the extreme points/vectors that help in creating the hyperplane. These extreme cases are called as support vectors, and hence algorithm is termed as Support Vector Machine. Consider the below diagram in which there are two different categories that are classified using a decision boundary or hyperplane:



2.3 Dataset

We conducted a set of controlled experiments to estimate the hyperparameters to improve the prediction accuracy and performance. In particular, we progressively tested random combinations of hyperparameter values until we achieved satisfactory results. Cross-validation optimizers were also used to find the best set of hyperparameters.

Although standard object detection datasets (e.g., Microsoft COCO) exhibit volume and variety of examples, they are not suitable for plant disease detection as they annotate a set of object categories not include plant diseases. Therefore, we collected more than labelled 20k images of healthy and infected plant leaves for training the CNN model from different sources such as Kaggle [13], Plant Village and Google Web Scraper [14]. Many images in our dataset are in their natural environments because object detection is highly dependent on contextual information.

To increase the training accuracy and minimize training loss of the CNN model, we applied a series of image pre-processing transformations to the training dataset. Particularly, we altered the contrast of image colors, added Gaussian noise, and used image desaturation, which makes pixel colors more muted by adding more black and white colors. The primary purpose of these transformations is to weaken the influence of the background factor during the training process. This had a better effect on learning the 38 disease classes more effectively and increased our CNN model's stability.

We had to normalize the range of pixel intensity values of leaf images in the dataset before training the CNN model. This step was necessary because all dimensions of feature vectors extracted from input images should be in the same intensity range. This made the convergence of our CNN model faster during the training phase. Image normalization was implemented by subtracting the input image's mean value μ from each pixel's value $I(i, j)$, and then dividing the result by the standard deviation σ of the input image. The distribution of the output pixel intensity values would resemble a Gaussian curve centered at zero. We used the following formula to normalize each image in our training set:

$$O(i, j) = \frac{I(i, j) - \mu}{\sigma}$$

where I and O are the input and output images, respectively; and i and j are the current pixel indices to be normalized.

3.SYSTEM TESTING

Test Case ID	Test Case	Test Case I/P	Actual Result	Expected Result	Test case criteria(P/F)
001	Store Xml File	Xml file	Xml file store	Error Should come	P
002	Parse the xml file for conversion	parsing	File get parse	Accept	P
003	Attribute identification	Check individual Attribute	Identify Attributes	Accepted	P
004	Weight Analysis	Check Weight	Analyze Weight of individual Attribute	Accepted	P
005	Tree formation	Form them-Tree	Formation	Accepted	P
006	Cluster Evaluation	Check Evaluation	Should check Cluster	Accepted	P
007	Algorithm Performance	Check Evaluation	Should work Algorithm Properly	Accepted	P
008	Query Formation	Check Query Correction	Should check Query	Accepted	P

4.RESULT ANALYSIS

A prototype of the proposed architecture has been implemented. Nodes mentioned in the Data Collection module are deployed and tested. SVM gives a highest accuracy compared to other machine learning algorithm and also its simplicity.

This section explains the comparison of various parameters with the other algorithms and concludes that accuracy of CNN algorithm is better than other algorithms.

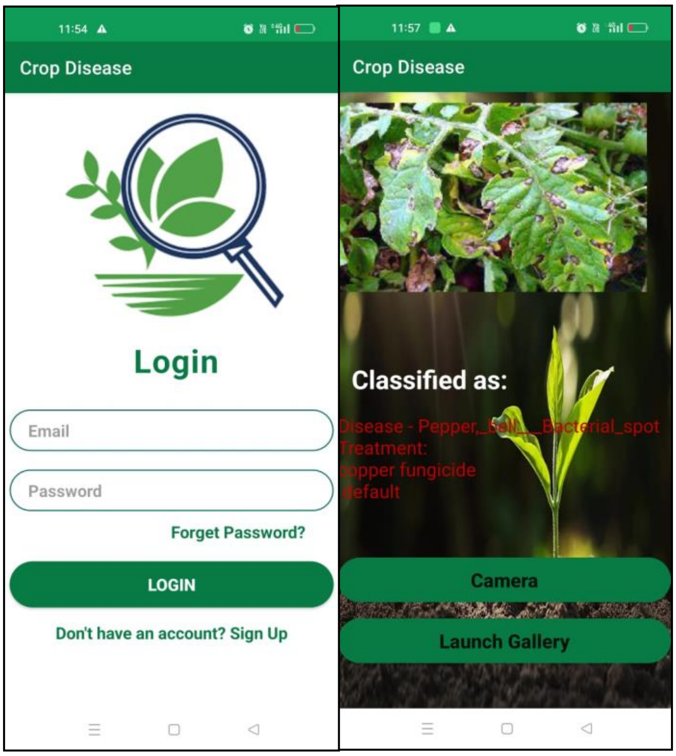


Fig -2: Screenshots

5.FUTURE SCOPE

- This system will help farmer to cultivate crops which are suitable to their land based on the soil nature, temperature, moisture and humidity.
- This system helps anyone without knowledge about their land can involve in farming in successful and profitable manner.
- In future, based on farmers native language they may experience user-friendly UI and reach the app easily.
- This helps the farmer to cultivate the crop based on demand that helps them to get profitable price for their product in the market. In future, this system is integrated with the system that suggest the farmer about manure, natural pest control method to be used for their selected crop at time of requirement.

6.ACKNOWLEDGMENT

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7.CONCLUSION

A model is proposed for predicting soil series and providing suitable crop yield suggestion for that specific soil and detect plant leaf disease. The model has been tested by applying different kinds of machine learning algorithm. Bagged tree and CNN show good accuracy but among all the classifiers [15], SVM has given the highest accuracy in soil classification with less time. It gives us more accuracy as compared to existing system and gives more benefit to farmers.

This paper presented the design of an ML-powered plant disease detector that enables farmers to diagnosis the most common 38 diseases in 14 species. We trained a CNN model using an imagery dataset consisting of 20,00 photos of healthy and diseased plant leaves, where crowded backgrounds, low contrast, and diverse illumination condition images are taken into consideration. To increase the system usability, we developed a mobile app [16] that would create a better opportunity for limited-resources farmers to detect plant diseases in their early stages and eliminate the use of incorrect fertilizers that can hurt the health of both the plants and soil.

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