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Smart Harvesting Application for Crop Recommendation and Disease Detection

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Abstract — **This project addresses the critical issue of crop selection and crop disease detection for Indian farmers by developing a user-friendly Android app that leverages machine learning algorithms to recommend the most suitable crop for a given region and Detecting crop diseases and suggesting preventative measures and treatments. By analyzing factors such as temperature, rainfall, and area, the system provides data-driven insights to inform farmers' decisions. Key features include crop prediction using Random Forest classification, disease detection, real-time Mandi prices, AI-powered Q&A, community features, agri news updates, and multi-language support. This system has the potential to increase crop yields, reduce losses, and enhance the livelihoods of Indian farmers, ultimately contributing to the growth of India's agricultural sector.**

I. INTRODUCTION

Agriculture is the backbone of India's economy, with a significant portion of the population dependent on it for their livelihoods. However, Indian farmers face a myriad of challenges, including unpredictable weather patterns, varying soil types, and the uncertainty of crop selection. In a country where agriculture occupies the second-largest land area globally, the need for innovative solutions to support farmers and enhance agricultural productivity is paramount.

This research paper introduces a cutting-edge application that leverages machine learning algorithms and image recognition technology to recommend crop yields and detect crop diseases. The application is designed to provide farmers with data-driven insights to inform their decisions, making farming more efficient and sustainable.

The core concept of this application revolves around the development of a machine-learning model that recommends crop yields based on crucial environmental parameters such as temperature, area, rainfall, and soil PH. Additionally, the application includes a robust image recognition system for the early detection of crop diseases. By providing farmers with these critical insights, the application aims to equip them with the tools they need to make well-informed choices about their crops, ultimately resulting in more resilient and productive agricultural practices.

To ensure accessibility to a diverse audience, the application will be available in multiple languages, including Hindi, English, and Marathi. Furthermore, the application includes a user-friendly interface that allows farmers to easily input data and receive insights.

This research paper presents the results of a comprehensive evaluation of the application's performance in predicting crop yields and detecting crop diseases. The results demonstrate the application's potential to significantly boost crop yield and subsequent profits for Indian farmers, making it a valuable tool for enhancing agricultural productivity and sustainability.

II. LITERATURE SURVEY

A. Venugopal, Rima Mathew [1], This paper focuses on the prediction of crops and the calculation of their yield with the help of machine learning techniques. Several machine learning methodologies are used for the calculation of accuracy. Random Forest classifier and Decision tree classifier were used for the crop prediction for the chosen district. The proposed technique helps farmers in decision-making of which crop to cultivate in the field. This work is employed to search out the gain knowledge about the crop that can be deployed to make an efficient and useful harvesting. The accurate prediction of different specified crops across different districts will help farmers of Kerala.

P. Dharmendra Kumar, A. Suhasini, D. Anand [2], The study presents a crop disease detection system that uses 2DCNN to achieve 98% accuracy through sophisticated preprocessing and segmentation techniques. Focusing on automated disease detection highlights the need to grow the database and add 7 DYPCOE, Akurdi Department of Information Technology more training data to improve disease identification in future research.

Nidhi Kundu, Geeta Rani, Kalpit Gupta [3], In This research paper, the authors achieved the object of automating the disease detection, classification, and crop loss estimation for maize crops. The authors pre-processed the collected dataset by applying the K-Means algorithm. they applied both supervised and unsupervised algorithms on pre-processed, and non-pre-processed datasets for classifying images. The authors trained VGG-19, ResNet-50, and finetuned VGG-16 models the proposed DL model MaizeNet, on a dataset

III. METHODOLOGY

This project utilizes two powerful algorithms, Random Forest and Convolutional Neural Network (CNN), to predict crop yields and detect crop diseases.

Random Forest is a popular machine learning algorithm that is based on the concept of ensemble learning. It combines multiple decision trees to predict the class of a dataset, improving the predictive accuracy of the model. The algorithm is based on two assumptions: (1) there should be actual values in the feature variable of the dataset for accurate predictions, and (2) the predictions from each tree must have low correlations.

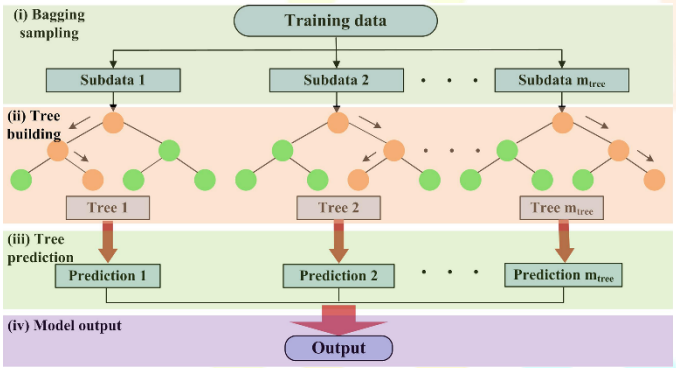


Fig. Random Forest

A class of deep learning techniques known as Convolutional Neural Networks (CNNs) has shown to be incredibly successful in a variety of computer vision applications, including object identification, image segmentation, and image categorization. CNNs work especially effectively on applications like image processing, where the input data has a grid-like pattern.

One kind of deep learning algorithm that works especially well for tasks involving picture recognition and processing is the convolutional neural network (CNN). Convolutional, pooling, and fully connected layers are some of the layers that make it up.

The essential part of a CNN is its convolutional layers, which are where elements like edges, textures, and forms are extracted from the input image by applying filters. Next, pooling is applied to the convolutional layers' output**.** which are employed to down sample the feature maps in order to decrease the spatial dimensions while keeping the majority of the data. One or more fully connected layers are then applied to the output of the pooling layers in order to classify or forecast the image.

This application also helps farmers to detect the various diseases the occur on leaves of the crop.

Various types of diseases of leaves:

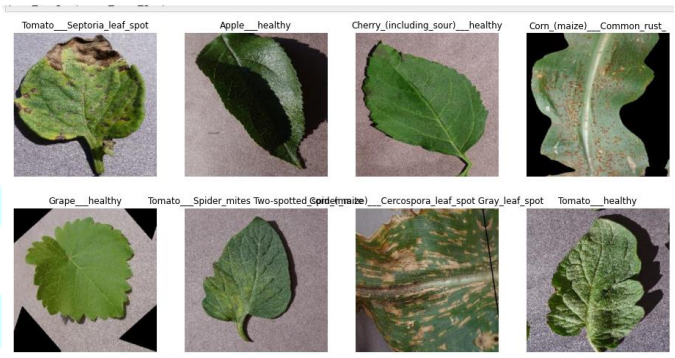


Fig. sample image dataset

We must first determine the sort of ailment in order to treat this form of illness. We have employed CNN, or Convolutional Neural Network, to identify the illness.

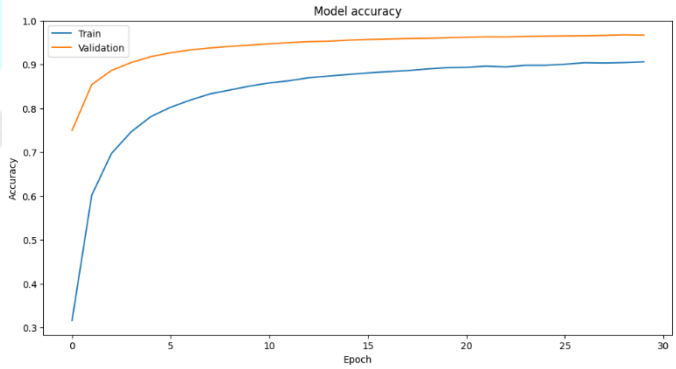
We employed CNN and Random Forest for disease detection and crop prediction, respectively, using Kaggle datasets for effective feature extraction processing.

Datasets employed in the undertaking:

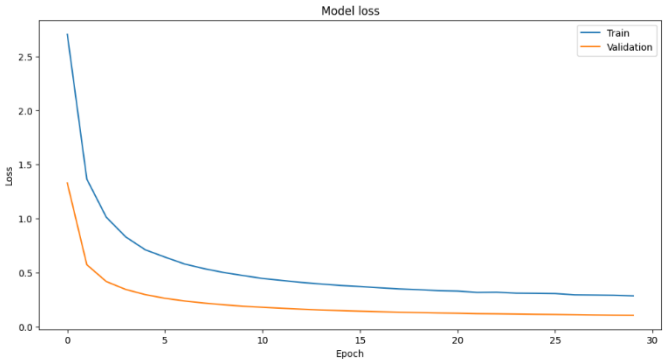
1) Crop Suggestion Information
2) A New Database on Plant Diseases

TESTING AND EVALUATION PHASE

The model's accuracy for both the training and validation sets is shown over 30 epochs. The training accuracy increases steadily from 0.3 to approximately 0.93, while the validation accuracy also increases but plateaus around 0.85. This indicates that the model's performance on the validation set is not improving as much as the training set, suggesting that the model may be overfitting to the training data.



To address overfitting, techniques such as regularization, dropout, or early stopping could be employed. These methods can help prevent the model from learning the training data too well, which can negatively impact its ability to generalize to new, unseen data.



The image shows the training and validation loss of a deep learning model. The loss is decreasing over the epochs, which indicates the model is learning and improving. The validation loss is slightly higher than the training loss, which suggests there is some overfitting occurring. However, the gap between the two is relatively small, so the overfitting is not severe. Overall, the model appears to be performing well, and the training process is successful.

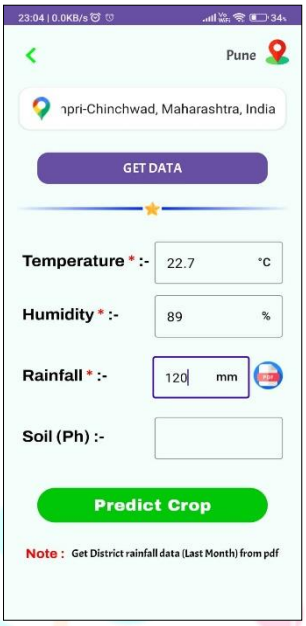
IV. RESULTS

As a result, we have created this app, which can make farming much efficient and easier as well. This crop prediction and disease detection app can provide valuable insights and benefits to farmers and the agriculture industry. Farmers can use these predictions to make informed decisions about planting, harvesting, and resource allocation. This helps farmers reduce input costs and minimize environmental impact.

Early detection allows for timely intervention, preventing the spread of diseases and minimizing crop losses. Farmers can make data-driven decisions on irrigation, pest control, and harvesting timelines.To use such application, initially farmer needs to log in to this application:

After successfully logging into app, user can see various options like Predict crop, Detect disease, Mandi price, Agri news etc.

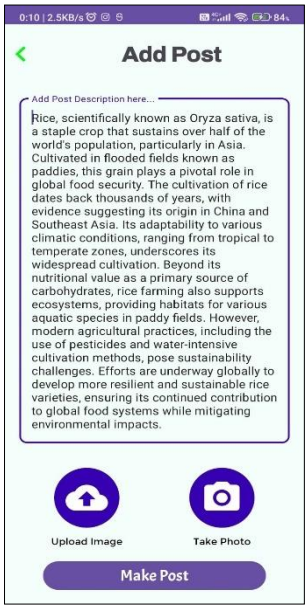
Now let us say farmer wants to predict the crop for his land area then farmer needs to click on that option which lead to open another window in which farmer needs to enter the details like Temperature, Rainfall, Humidity etc.

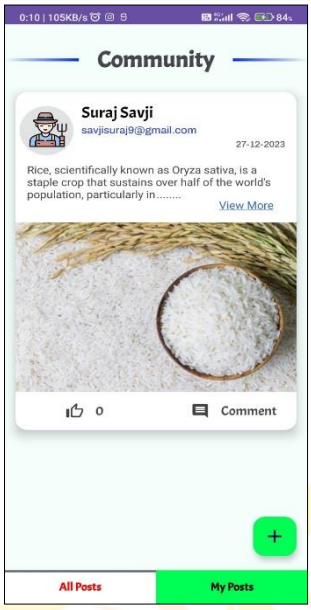


After filling all the required fields, user can click on below button to see the crop predicted by machine learning algorithms according to given parameters.

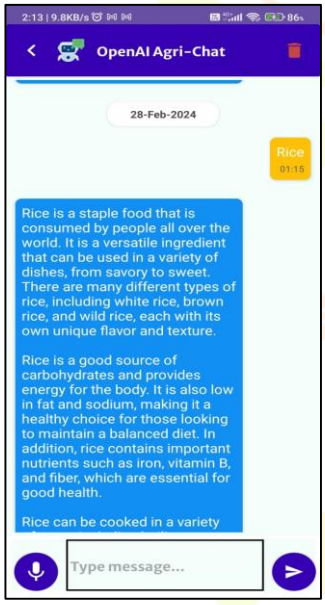
This is the main feature of the application for disease detection, where farmers can click a photo of their crop or upload an image from the gallery. The system uses a trained model to detect diseases and provides supplementary preservatives and prevention methods for the crops.

There is another feature for the farmers' community where farmers can share pictures of their crops and any other crop-related issues through image posts.





There is an Agri chatbot for farmers' queries. Farmers can ask their questions and get answers, as well as receive agriculture-related news.



There is multi-language support for the application Where farmers get the answers to their Queries in Marathi, Hindi, and English.

V. CONCLUSION

Under the current arrangement, farmers are not connected to any technology. As a result, there is a good chance of suffering financial loss. Sometimes, picking the wrong crops can make it more difficult for them to prosper financially. To reduce these losses, our Android app helps farmers select the right crops for a particular area. From crop photos, this tool can also help diagnose diseases. If there are any diseases affecting the crop, the farmer can receive a suitable solution by using machine learning and image processing techniques to identify the issue. This boosts the country's economy by raising the yield rate of crop production. This provides farmers with a platform to communicate with applications in their mother tongue and a platform for bilingual farmer communities.

Furthermore, by encouraging the economical use of resources like water, fertilizer, and pesticides, the application can support sustainable agricultural methods. Consequently, this lessens the effect on the environment and guarantees the sustainability of agricultural systems in the long run.

VI. REFERENCES

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