SOIL ANALYSIS, DISEASE DETECTION AND PESTICIDE RECOMMENDATION FOR FARMERS USING AI AND ML

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ABSTRACT

Our project aims to analyze the soil and detect plant disease and pesticides recommendation using AIML. The model gives the related information of the crop that can be grown in that soil using the soil test results. Plant disease detection help farmers use appropriate pesticide. As Agriculture is the backbone of our country. We aim to benefit farmers to minimize the losses in farming by providing rich recommendations and insights about the crops using current technology like machine learning which allows more efficient and precise farming with less manpower with high- quality production. Artificial Intelligence and machine learning are efficient ways to monitor and identify possible crop health issues or nutrient deficiencies in the soil and minimize post-harvest processing, to fortify agricultural sustainability and maximize productivity. Advancement in the area of machine learning has helped improve gains in agriculture. Machine learning is the current technology which is benefiting farmers to minimize the losses in farming by providing rich recommendations and insights about the crops.

KEYWORDS

Disease detection, CNN, Soil analysis, XG Boost

1. INTRODUCTION

One of the primary occupations and sources of income for a large population in India is Agriculture. There has been an exponential increase in the demand for production over time. However, with the increase in industrialization, there has also been a huge reduction in the number of farmlands. The principal objective is to distinguish the illness introduced in a plant by watching its morphology through picture handling and machine learning. Pests and diseases result in the destruction of crops or part of the plant resulting in decreased food production and leading to food insecurity. Also, knowledge about pest management or control and diseases are less in various less- developed countries. Toxic pathogens, poor disease control, and drastic climate changes are one of the key factors which arise in dwindled food production. To make accurate decisions based on the type of crops to be planted and to achieve a good harvest, data such as the use of pesticides, fertilizers, meteorological, and information must be made available to the farmers in an accurate and timely manner.

2. RELATED WORKS

S. Ramesh et al [1] introduced a system that enables plant disease detection using Random Forest machine learning algorithm. It only detects disease detection but our project detect disease detection and also it recommend pesticides for the detected diseases. Gang Pan, Feng-min Li and Guo-Jun Sun [3] introduced a system that allows Digital camera based measurement of crop cover for wheat yield prediction. V. Rajesh Kumar, K. Pradeepan, S. Praveen, M. Rohith and V. Vasantha Kumar[5] allows Identification of Plant Diseases Using Image Processing and Image Recognition.

3. METHODOLOGY

3.1. Disease Detection and Pesticide Recommendation

The first step is to collect the data from various sources through different methods and cleaning of the data so that all the null, duplicate, repetitive and unformatted data are removed from the obtained dataset. The cleaned data will be used to train the model which is used for the classification and identification. Using this module, the first functional requirement is the detection of diseases in plants using images of the leaves of diseased plants is achieved.

This method has the following steps:

1. Read diseased plant image as input.
2. Converting the image to the required dimension which is compatible with the model.
3. Predicting diseases using the trained CNN model.
4. Suggesting pesticides for the identified diseases.

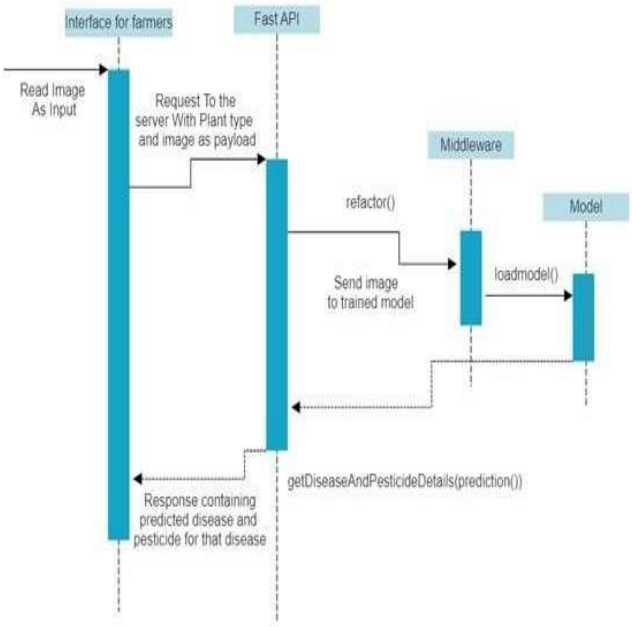

Fig. 1 Disease detection and pesticide recommendation

3.2. Soil Analysis

The second method is to analyse the soil using the soil report.
This module has the following steps.

1. Farmer should collect the soil test report from the laboratory. 2.The test results parameters such as NPK, temperature, humidity, pH and rainfall should be given as input.
2. Based on the parameters, XG Boost algorithm analyses and classifies soil for different crops.

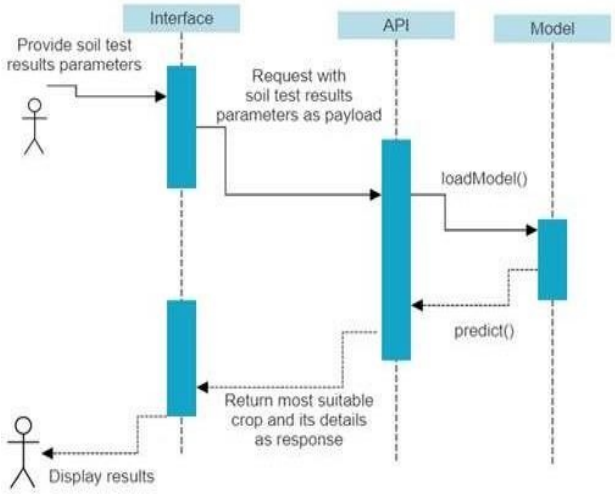

Fig. 2 Soil analysis

3.3. Model Training

For training the CNN model, we used plant image dataset from Kaggle. It is a dataset consisting of more than 60,000 images of plant leaf. We split the dataset into training, testing and validation in 90%,5% and 5% respectively. Then we reshaped the images into 256*256 pixels. For training the model 16 filters are applied with an activation function as ReLU in the convolution layer. After that, in the max-pooling layer, the pool size of 2*2 matrix is applied. Repeat the same process with 64 filters as the convolution layer. Now, we need to convert our layer into one dimension using flatten function. After flattening, the layer's size is 500 by applying a dense function with an activation function as ReLU. The dense function is applied again for the layer's size 26 with an activation function as 'softmax'. This 'softmax' layer returns maximum value class as predicted class. Similarly, we train other CNN models as well. Lastly, we compile and fit the model followed by saving this model.

For the soil analysis XG Boost (Extreme Gradient Boosting) model is used. A dataset of soil test reports is used to train the model. The dataset is split into training and testing dataset in 70% and 30% respectively. Once the model is fitted the model is saved for the further use.

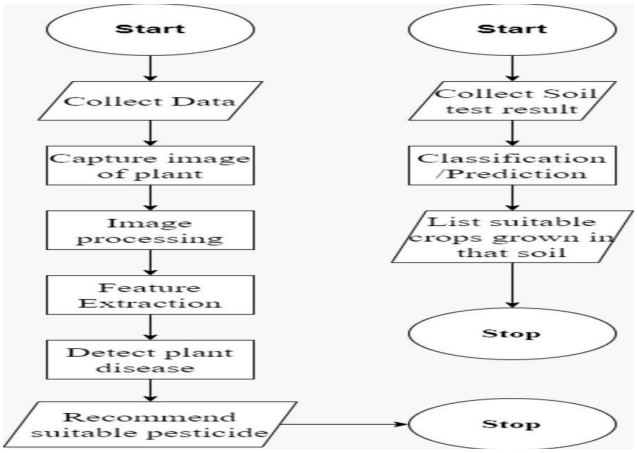

Fig. 3 Proposed Methodology

4. RESULTS

The proposed project aimed to develop a system for new farmers to detect plant diseases based on the diseased plant leaf images and recommend suitable pesticide for the identified disease and brief information about how to use that pesticide. The proposed system also recommends proper crop which gives maximum yields on the farmer's land based on the soil parameters such as nitrogen, potassium, phosphorus, temperature, humidity, rainfall from soil test report. Apart from these the system also provides this information in the regional language.

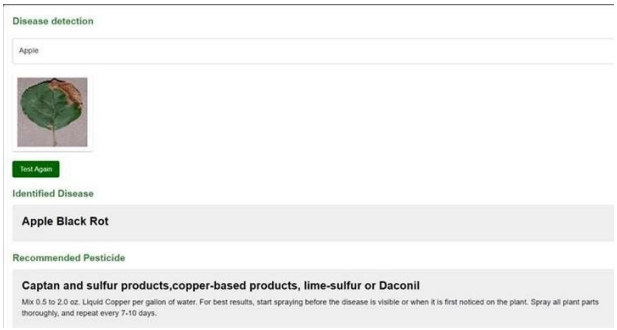

Fig. 4 Disease detection

Fig. 5 Soil analysis

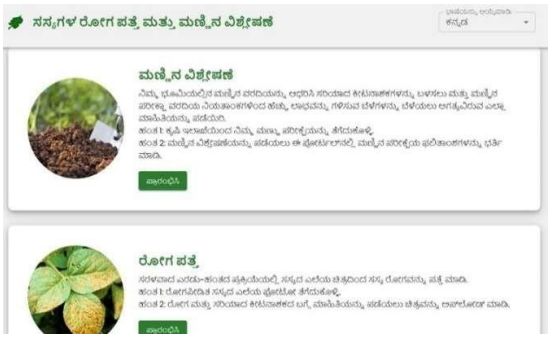

Fig. 6 Language selection

5. CONCLUSION

In recent years, artificial intelligence and machine learning have proven to be worthy in the field of real-time data monitoring. So, these fields are implemented in every sector there is agriculture field is no exception. Artificial intelligence methods and techniques can assure the peasants of suitable field management and healthier crops. timely information is given by the AI from the right channels and can therefore establish flexibility among the farmers. This system uses various machine learning and artificial intelligence algorithm for improving the effectiveness of farming. These techniques can be used by the peasants to know more about the crops, diseases, pests, weeds, and pesticides.

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