

MaxHarvest A Machine Learning Based Website Which Recommends Best Crop to Grow, Fertilizers to use and the Diseases Caught by Crops

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Abstract:

In country like India, majority of the population is dependent on agriculture for their livelihood, its economy largely depends on agriculture yield growth and agro industry products. so to give a boost to our agriculture industry Artificial intelligence has a vital role to play in the future of humankind. The potential of machine learning and continuously improving AI means that the ceiling for growth within the agricultural sector is huge. The smart implementation of Artificial intelligence into agriculture would help ensure the sustainability of the industry in the future!

Any farmer is interested in knowing best suitable crop, fertilizers and crop disease prediction of his land. Analyzing the various related attributes like location, pH value from which alkalinity of the soil is calculated. Along with it, percentage of nutrients like Nitrogen (N), Phosphorous (P), and Potassium (K) Location is used along with the utilization of third-party applications like APIs for weather and temperature, type of soil, nutrient value of the soil in that region, amount of rainfall in the region, soil composition can be determined. All of these attributes of data will be analyzed and then train the data with various suitable machine learning algorithms for creating a model. The structure comes with a model to be precise and accurate in predicting best suitable crop, fertilizer recommendation, crop disease prediction and deliver the end user with proper recommendations, which enhance to increase the crop yield eventually it will increase farmer revenue.

This Research Work Deals With Random Forest Algorithm, Vector Machine Algorithm and CNN Algorithm.

Introduction:

Humans can trace the foundations of their social and economic development to the time when agriculture developed. To this day, the agriculture sector serves as the base of the world's economy. With an ever-increasing population, the agriculture sector will only grow, but it faces some problem. This problem requires a intelligent solution and the role of artificial intelligence is going to be critical to solving this problem. The role of artificial intelligence in agriculture steps up in other supplemental areas of agriculture to lift the entire agriculture industry. Now a days Farmers grow crops which have higher demand in market, eventually gets less quantity of harvest or poor quality harvest , Because of nutrient deficiency in soil, lack of knowledge in which crop is best for their soil and enviournmental conditions and also lack of information in some crop diseases and their cure. due to this, the cultivated crop may not give expected results.

Machine Learning behaves like self-learning concept which can work without any interruption of a human. Now a day's self-driving cars, e-commerce, hand-writing recognition, Stock market trends prediction, robots, social media are some of the examples of Machine Learning concepts. Machine learning will be able to predict the future based on the historical data or past data. The proposed research work (maxharvest) applies the concept of ensemble learning, that is implemented through machine learning algorithms. After implementation the result will help farmers to increase their yield. maxharvest can predict which crop is best suitable, also give fertilizer recommendations and crop disease prediction with their cure by fully analyzing the previous data we can suggest the farmer for a better crop for the healthier yield. For the better yield we need to consider soil type and soil fertility things and also one of the major factors rainfall and groundwater availability if it is dry land it is better to go for cash crops and if it is wetland it is better to go for wheat and sugarcane. There are almost 15 agro-climatic regions in India these regions are divided on the bases of a type of the land. Each agro-climatic region can grow some specific crops. Based on that we are suggesting the farmer that which crop is best among those crops which belong to those climatic regions. Various Laboratory based approaches like polymerase chain reaction, gas chromatography, mass spectrometry, thermography and hyper spectral techniques have been employed for disease identification. However, these techniques are not cost effective and are very time consuming. In recent times, server based and mobile based approach for disease identification has been employed for disease identification. Several factors of these technologies being high resolution camera, high performance processing and extensive inbuilt accessories are the added advantages resulting in automatic disease recognition. Modern approaches like machine learning and deep learning algorithm has been employed to increase the accuracy of the results.

Literature Review:

1. S. S. Sannakki and V. S. Rajpurohit, proposed a "Classification of Pomegranate Diseases Based on Back Propagation Neural Network" which mainly works on the method of Segment the defected area and color and texture are used as the features. Here they used neural network classifier for the classification. The main advantage is it Converts to L^*a^*b to extract chromaticity layers of the image and Categorisation is found to be 97.30% accurate. The main disadvantage is that it is used only for the limited crops.
2. P. R. Rothe and R. V. Kshirsagar introduced a "Cotton Leaf Disease Identification using Pattern Recognition Techniques" which Uses snake segmentation, here Hu's moments are used as distinctive attribute. Active contour model used to limit the vitality inside the infection spot, BPNN classifier tackles the numerous class problems. The average classification is found to be 85.52%.
3. Aakanksha Rastogi, Ritika Arora and Shanu Sharma, "Leaf Disease Detection and Grading using Computer Vision Technology & Fuzzy Logic". K-means clustering used to segment the defected area; GLCM is used for the extraction of texture features, Fuzzy logic is used for disease grading. They used artificial neural network (ANN) as a classifier which mainly helps to check the severity of the diseased leaf.
4. P. R. Reddy, S. N. Divya, and R. Vijayalakshmi, "Plant disease detection technique tool—a theoretical approach," International Journal of Innovative Technology and Research, pp. 91–93, 2015.

5. A.-K. Mahlein, T. Rumpf, P. Welke et al., "Development of spectral indices for detecting and identifying plant diseases," *Remote Sensing of Environment*, vol. 128, pp. 21–30, 2013.
6. Godliver Owomugisha, John A. Quinn, Ernest Mwebaze and James Lwasa, proposed" Automated Vision-Based Diagnosis of Banana Bacterial Wilt Disease and Black Sigatoka Disease "Color histograms are extracted and transformed from RGB to HSV, RGB to L*a*b. Peak components are used to create max tree, five shape attributes are used and area under the curve analysis is used for classification. They used nearest neighbors, Decision tree, random forest, extremely randomized tree, Naïve bayes and SV classifier. In seven classifiers extremely, randomized trees yield a very high score, provide real time information provide flexibility to the application.

Experimental Analysis:

1.plant disease detection using cnn algorithm:

Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resembles the organization of the animal visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field referred as the receptive field. The receptive fields of various neurons partially overlap such that they cover the whole visual field.

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects within the image and be able to differentiate one from the another.

Database collection: Initial step for any image processing based project is acquiring proper dataset which is valid . Most of the time the standard database is preferred but in certain circumstances we do not get proper dataset .Dataset used in this project for crop disease detection is from kaggle. Data available here is not labeled .So the first task is to clean and label the dataset. There is a huge dataset so basically the images with better resolution and angle are selected . this dataset contains different plant diseases images of multiple plants.

Preprocessing and Training the model (CNN): The dataset is Preprocessed such as Image reshaping ,resizing and conversion to an array form. Similar processing is also done on the test image. A database consisting of different plant species is obtained , out of which any image can be used as a test image for the software. The train database is used to train the model (CNN) so that it can identify the test image and the disease it user has .

After the cleaning and preprocessing of dataset is done ,main algorithm is implemented input image is converted into matrix(array) for comparison.CNN has different layers that are Dense, Dropout, Activation, Flatten,Convolution2D, MaxPooling2D. After the model is trained successfully ,the algorithm can identify the disease if the plant species is contained in the dataset. After successful training and preprocessing ,comparison of the test image and trained model takes place to predict the disease.if crop do have any disease it will display corresponding remedy for that disease that can be taken as cure.

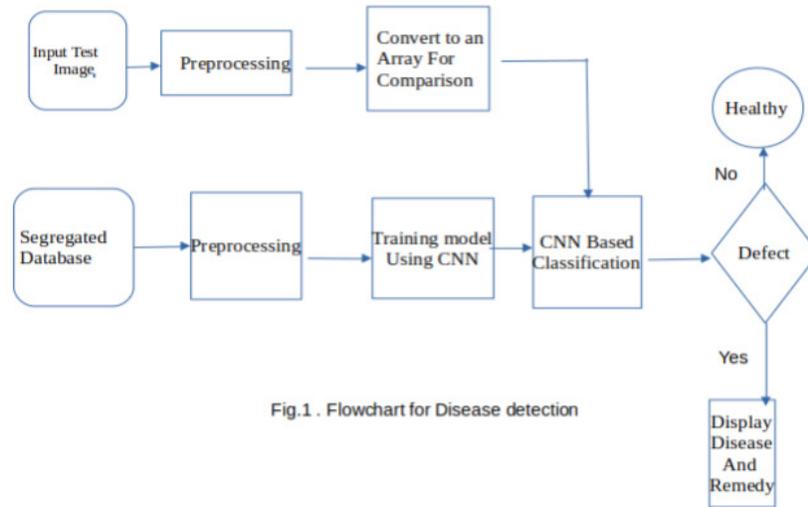


Fig.1 . Flowchart for Disease detection

2. Best suitable crop and fertilizer prediction using random forest and support vector machine algorithms:

There are three steps:

1) soil classification:

Soil classification are often done using soil nutrients data. Analyzing the different related attributes like location, pH value from which alkalinity of the soil is determined. Along with it, percentage of nutrients like Nitrogen (N), Phosphorous (P), and Potassium (K) .Location is also used with the utilization of third-party applications like APIs for weather and temperature, Also along with it type of soil, nutrient value of the soil in that region, amount of rainfall in the region, soil composition can be determined. Two Machine learning algorithms used for soil classification are Random Forest and Support Vector Machine. These two algorithms will classify, and display confusion matrix, Precision, Recall, f1-score and average values, and at the end accuracy in percentage as output.

All these attributes of data will be analyzed, train the data with various suitable machine learning algorithms for creating a model.

2) Crop Yield Prediction:

most suitable Crop Prediction can be done using crop yeild data, nutrients and location data. These inputs are passed to Random Forest and Support Vector Machine algorithms. These algorithms will predict most suitable crop based on present inputs.it will also give details information about than crop and favourable condition for that crop to maximize yeild .

3) Fertilizer Recommendation:

Fertilizer Recommendation can be done using fertilizer data,nutrient lacking in the soil also expected diseases crop may get in future also crop and location data. In this part most suitable crops and required fertilizer for each crop is recommended.

RESULT

Find out the most suitable crop to grow in your farm

Nitrogen

Phosphorous

Pottasium

ph level

Rainfall (in mm)

State

City

Predict

You should grow *{{ prediction }}* in your farm

Get informed advice on fertilizer based on soil

Nitrogen

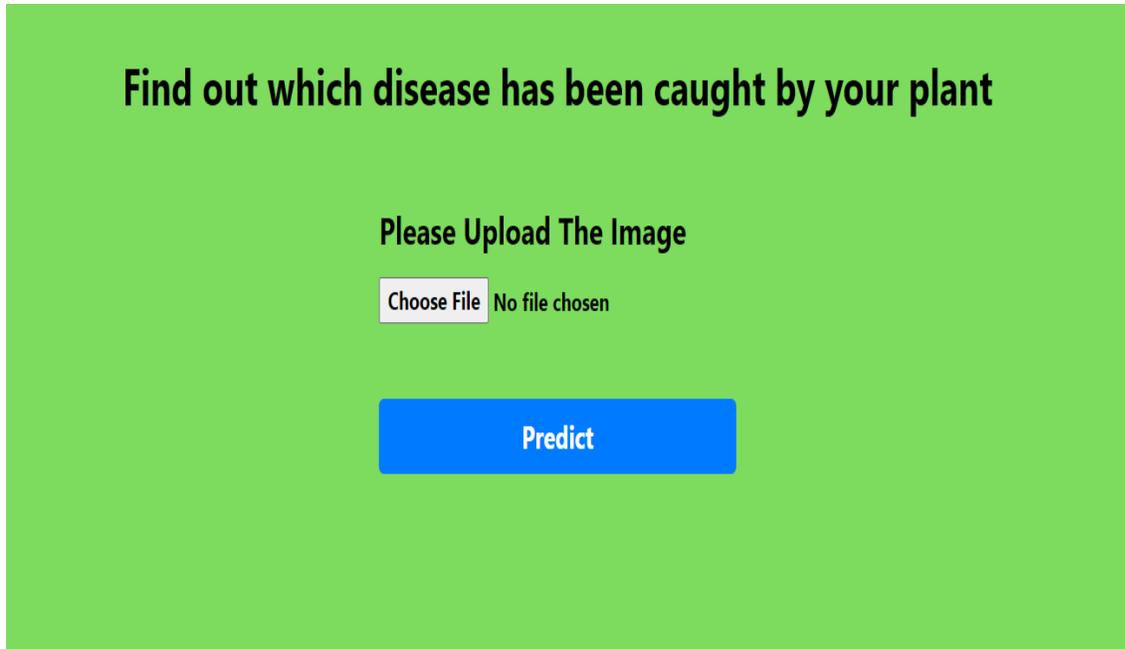
Phosphorous

Pottasium

Crop you want to grow

 ▼

Best suitable fertilizers for your farm{{ recommendation }}



THis crop get{{ prediction }} disease

Conclusion:

Thus, it is concluded that maxharvest, can be effectively use by farmers for diagnostic purposes for early detection of crop diseases, also for fertilizer recommendation and crop recommendation . It will help farmers To reduce the crop failures , To increase food quality and quantity,healthy disease free and nutrient dense harvest from farms,eventually Improve the management of farms and their economic and environmental sustainability.

Conflicts of Interest

Background/existing system

There is crop disease detection website available in market

Disadvantages of existing systems:

1. It detect diseases of only one plant e.g disease detection in cotton plant or disease detection in mango plant.
2. It only detect disease ,not give any cure or preventions.
3. there is no such system for Crop recommendation, Fertilizer recommendation and Plant disease prediction together.

Advantages of this project over existing system:

1. we can get Crop recommendation, Fertilizer recommendation and Plant disease prediction in **one website**.
2. very easy to handle and **user friendly** website.
3. we can detect diseases of **15 crops** despite of existing system which can detect only one plant.
4. It will provide you detail **cure of diseases** that your crop caught.

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