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Fertilizers Recommendation System for Disease Prediction Using Machine Learning

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KEYWORDS
Machine Learning , Crop Productivity ,Crop prediction , Fertilizer Recommendation and Suggestion , Disease Detection.

ABSTRACT:
India is the world's largest agrarian economy, with arable land accounting for 54% of the total land area. Agriculture accounts for more than half of the world's gross domestic output (GDP). It has been established that increasing agricultural productivity has a significant impact on poverty reduction. A variety of factors can influence the number of harvest able crops growing in a given location. These three major groups of components (climate, soil fertility, topography, water quality, and so on) are made up of biological, technical, and environmental aspects. soil infertility caused by over-fertilization, as well as an Access concern and a lack of understanding about contemporary farming practices is two of the many factors that contribute to low agricultural productivity. The main purpose of this research project is to develop a machine learning-based recommendation system to increase agricultural productivity.In this work, sophisticated models were devised and developed to estimate crop yield, recommend fertilizer, and identify plant sickness. The XG Boost model estimates an optimal crop based on regional soil nutrients and rainfall. Rough Forest [RF] A model was used to propose fertilizers and provide ideas for improving soil fertility based on the nutrients present in the soil. The plant sickness is recognized using the NB Classifier and the Support Vector Machine [SVM], which also provides therapy. When compared to existing approaches, the proposed model provides a high degree of accuracy. Furthermore, the farmer is advised in this article to increase crop yield by entering input where the model provides 99% accurate crop recommendations.

1. INTRODUCTION

Agriculture accounts for more than half of the world's gross domestic output (GDP). It has been established that increasing agricultural productivity has a significant impact on poverty reduction. A variety of factors can influence the number of harvest able crops growing in a given location. These three major groups of components (climate, soil fertility, topography, water quality, and so on) are made up of biological, technical, and environmental aspects. A variety of factors impact agricultural practices. Fertilizers and insecticides were made more affordable to Bangladeshi farmers. That they might employ more of them, increasing agricultural output Phosphorus shortage was discovered in sugarcane crops A lime layer had developed in the subsurface, resulting in an uneven potassium/magnesium ratio. Planting too early, planting too close together, planting too deep, weeding too late, and selecting low-yielding cultivars will always result in lower yields.. soil infertility caused by over-fertilization, as well as an Access concern and a lack of understanding about contemporary farming practices are two of the many factors that contribute to low agricultural productivity. The primary purpose of this research project is to develop a machine learning-based recommendation system to increase agricultural productivity. In this study, sophisticated models were devised and developed to estimate crop yield, recommend fertilizer, and identify plant disease. To Detect and recognize plant diseases and to recommend fertilizer, it is necessary to provide symptoms in

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identifying the disease at its earliest. Hence the authors proposed and implemented a new fertilizers Recommendation System for crop disease prediction.

The digitization of agriculture has led to many aspects of agricultural management being replaced by artificially intelligent systems. There are several problems that machine learning can help to resolve when it comes to adopting knowledge-based farming systems. Artificial neural network [ANN]-based machine learning algorithms are among the most effective ones. All agriculture business stakeholders should find this study to be a helpful resource in understanding the potential advantages of machine learning. Farmers, for instance, will soon be able to identify weed-infested areas using machine learning. An example of an ML-powered robot that can distinguish weeds and spray herbicides selectively to individual plants rather than the entire field is Blue River Technology's Sight & Spray robot in California. The benefits of the technology are astounding, with an 80% decrease in chemical consumption.

To create a successful farming operation, it is crucial to make complicated judgments concerning the interactions of numerous variables, including crop specifications, soil conditions, climate change, and more. All of the machine learning models that are currently available address the following issues:

a) Predicts the fertilizer's type

b) Uses Image Processing (IP) methods to find the plant diseases.

c) Predicts the best crop for a separate area.

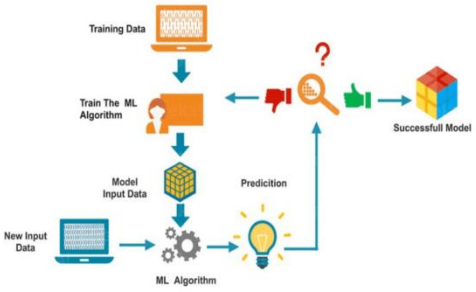

Fig 1: Machine Learning Model Diagram in Agriculture

However, these approaches have certain drawbacks, including:

• There are no recommendations made to increase soil fertility in the current system.

• The current methodology does not consider the type of fertilizer to be used, but rather the product of fertilizer to be used; • The existing system offers no advice to increase soil fertility; The existing method notifies farmers of the names of diseases but does not offer suggestions or take any action to lessen the effects of diseases on crops or increase crop yield.

• With the current arrangement, a farmer would be hard-pressed to use all of these modules simultaneously.

The present system's models are all built using machine learning techniques.

PROPOSED METHODOLOGY

A tool providing for farmers called "Agrofy" using our methodology. This application assists farmers in increasing agricultural output by assisting. Agriculture may be developed in a variety of ways. However, in our technique, we concentrated on the most critical factors influencing crop productivity. It is vital to recognize and predict crop sickness and propose ideas, anticipate an appropriate crop for the land, and provide crop fertilizer The three primary components of this online programming are identifying crop disease using an image, anticipating the most suited crops for the land using user-provided data on soil nutrients, rainfall, and temperature, and selecting the optimum fertilizer for the crop. It also suggests ways to boost soil fertility based on crop type. In this project, models are tested and trained on a range of datasets. The XG Boost and Random Forest (RF) models are used to estimate the best crop for each plot of land, while the Mobile net algorithm is utilized to detect the presence of illness. The model compares the crop type's actual nutrient requirements to the program's projections. The Mobile net algorithm is used to detect the presence of sickness. The model compares the crop type's actual nutrient demands to the program's projections.

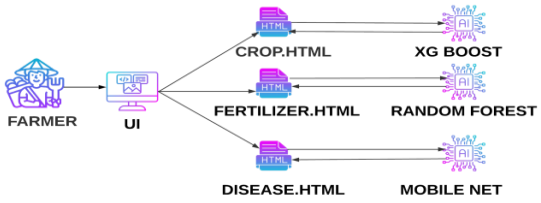

Fig 2: Flow Diagram of proposed work.

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- Crop prediction using XG Boost;
- fertilizer recommendation using Random Forest
- Mobile Net for Detecting Disease

A. XGBOOST Classifier

Researchers at the University of Washington proposed extensive gradient boosting (XG Boost), also known as XG Boost. It is a C++ library made to make Gradient Boosting training go more quickly. To determine whether adding a new "if" statement with its own unique set of predictions might enhance the model's performance, this decision tree optimization strategy, like others, examines each leaf. The performance of the model can be significantly impacted by "if" statements, and this can be assessed by examining the gradient of the loss. A scoring function in the loss is used to assess the performance of the algorithm. In contrast to other gradient boosting techniques, XG Boost the Algorithm adopts a second-order approximation of the scoring function. Calculating the best "if" scenario and its impact on This approximation are used by XG Boost for performance. XG Boost As a result, the following figure 3's decision tree won't need to be recalculated by the algorithm.

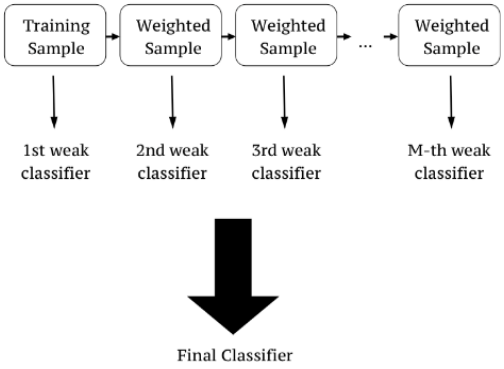

Fig 3:XG Boost Classifier working on an incremental model

Gradient Boosted Decision Trees (GBDT) are a feature of XG Boost. The most typical sort of decision tree is one that is organized sequentially. Weights have a big impact on XG Boost. The decision tree employs the weights that have been assigned to each independent variable to forecast the result. There will be an extra focus placed on elements that the tree predicted erroneously, and this new knowledge will be incorporated into the second decision tree. When used collectively, different classifiers/predictors are merged into a more accurate model. This program can be used to resolve regression issues as well as user-defined prediction jobs.

XG Boost re aggression:

Gain = Left Similarity + Right Similarity-Root Similarity_____1

Then we predictions:

Initial Predicated Value+Learning Rates Output Value_____2

XG Boost uses loss function

The objective is to minimize the overall equation by locating an optimum leaf output value. So, we swap out the first portion as follows.

I. Random Forest

A discovery algorithm for use with computers This group includes unsupervised learning methods like Random Forest. This approach can be applied to regression analysis and classification in machine learning. Based on the concept of ensemble learning, this technique integrates and enhances the performance of the model using an ensemble of classifiers. In Figure 4, the working model is displayed.

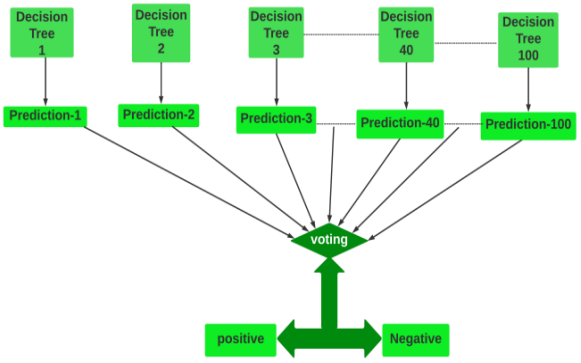

Fig 4:Working Model of Random forest Algorithm

It needs a shorter training time than other algorithms. It can predict output with a high degree of accuracy even with a large datasets. It is still possible for the data to be accurate even when a sizable portion of it is missing.

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B. Mobile net Algorithm

Since it is a great starting point, we may train our ultra-compact and ultra-fast classifiers using Google's open-source Mobile Net class of CNN. Convolutions used by Mobile Net can be divided based on their depth. As a result of this network, there are far fewer As compared to a network with traditional convolutions of the same depth, parameters may be altered.

C. Proposed Implementation Steps

Step 1:start

Step2: By using the navigation bar, the user can choose whether to go to the crop/fertilizer/disease page.

Step3:If the crop page option is chosen,

Step3.1:Read the inputs

Step3.2: When you press the submit button, the anticipated ideal crop is shown.

Step 4: When the fertilizer page is chosen,

Step4.1: Observe the inputs

Step4.2: After pressing the submit button, the appropriate fertilizer is shown.

Step4.3: The inputs are used to provide suggestions for improving soil fertility.

Step5: When the disease page is chosen

Step5.1:Input the photograph of a leaf

Step5.2: After you press the "submit" button, the name of the anticipated disease will appear.

Step5.3: Control procedures are demonstrated to lessen the impact of sickness.

Step6: Stop

V IMPLEMENTATION

Fig 5:Home Page of Agrofy

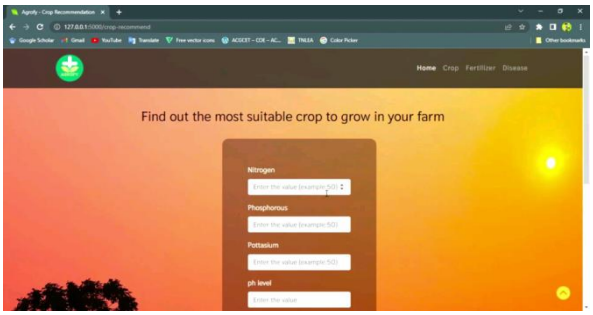

Fig 6:Crop Prediction

Crop recommendation using XG Boost involves using historical crop data and environmental factors such as soil nutrients and rainfall to predict the optimal crop for a given location. The general steps involved in building a crop recommendation system using XG Boost .

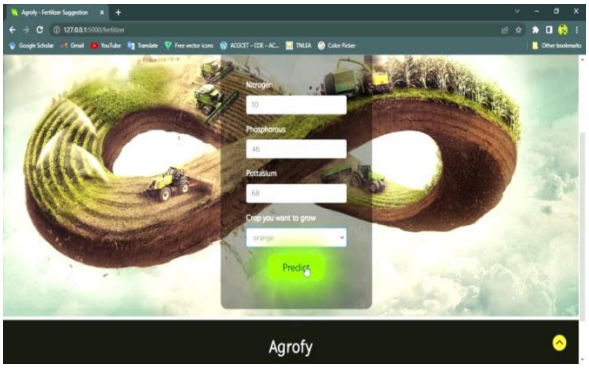

Fig 7:Input values for fertilizer recommendation

Fertilizer recommendation using Random Forest algorithm involves using historical data on crop yields and soil properties to predict the best fertilizer for a given soil type. The general steps involved in building a fertilizer recommendation system.

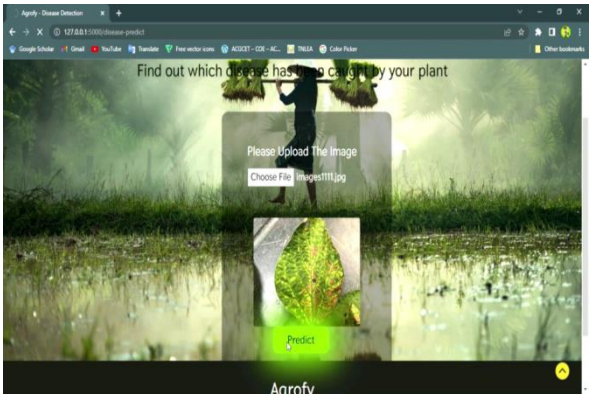

Fig 8:Input images of Disease Plants

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Disease detection using Mobile Net algorithm involves using deep learning techniques to analyze images of plants and identify any signs of disease.

V1 RESULTS AND DISCUSSION

The screenshots of our work's execution are shown in Figures 5 through 10. This study explores many approaches to book recommendation. Some of the current classifiers for fertilizer are SVM, KNN, Decision Tree, and Random Forest. recommendation. RF has a 95.7 percent accuracy rate in all other respects. For crop prediction, XG Boost and Gradient Boosting are contrasted. The most effective option is XG Boost.

Table1:List of algorithms that got good accuracy.

List of Methods Used for Training	Accuracy
Crop Prediction XGBOOST	99%
Fertilizer Recommendation RANDOM FOREST	98%
Disease Detection Mobile Net	92%

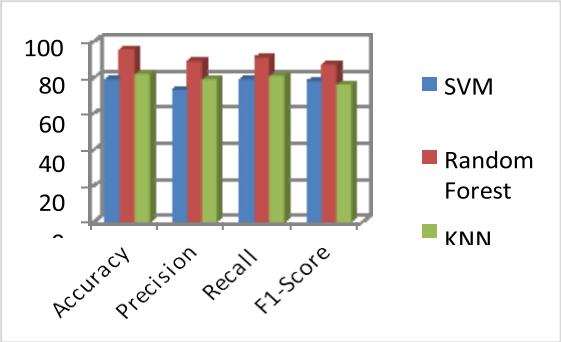

Fig 11: Comparison of various algorithms for Fertilizer Recommendation

VII CONCLUSION AND FUTURE SCOPE

Agriculture is the most significant industry in today's society. A vast range of bacterial and fungal diseases afflict the majority of plants. Plant diseases were a serious restraint on productivity and a big danger to food security. As a result, early and precise detection of plant diseases is critical to ensuring high production and quality.

The number of plant illnesses and the extent of damage inflicted have grown in recent years as a result of pathogen variety diversity, changes in cultivation practices, and inadequate plant protection systems. The use of such applications might assist farmers in taking the required safeguards to avoid loss.In this generation, sentiment analysis has become an important tool in analyzing and understanding people's emotions toward a particular product, movie, and many other things. Predicting a customer's emotion accurately is vital for a brand to improve or shape its quality to fulfill the customer's requirements. Thus, there is a need for a better model that could handle voluminous data and still give results with better accuracy. The current project is aimed at bringing better results and in the future, can also be improved using a better hybrid approach that could further improve the performance of the model.

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