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Famer assistant and crop recommendation system

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Abstract:

In India, agriculture accounted for 18% of the GDP with about 42% of the workforce. The people involved in agriculture are high in percentage but their contribution to the economy is different. In today's world, people are getting more and more digitized. As a result, most people have smartphones and internet access. In rural areas people including farmers, shopkeepers and others are using these technologies to make their life easier. By keeping technological evolution, we have developed the farmer assistant to guide farmers and improve their productivity and profits. We have developed a model that will give the profit of selling at a particular time, and location and also guide the farmers on which crop to take in which area, and weather by using the soil quality parameters. It provides all the facilities needed for farmers in one place. Farmers can use this web assistant with basic smartphone use knowledge.

Key Words: technology, profit, farmer, cost, retailers, Machine Learning.

1. INTRODUCTION:

In today's world, huge data are present in various sections, including agriculture. In 2022 the Indian government announced the scheme; every licensed shop is getting the status of a governmental shop. There will be many facilities like soil testing and guidance. But they are limited in number and everyone can't take the benefits from them. So we came up with the idea of a farm assistant website. By using modern technology like machine learning, we have the ability to provide those services online. Machine learning (ML) helps us predict results from huge amounts of present data. Figure 1 represents the machine learning algorithm working, it pre-processes data and develops the ML model, whose output is to divide the soil according to similarity and predict which crop will be suitable in such type of soil.

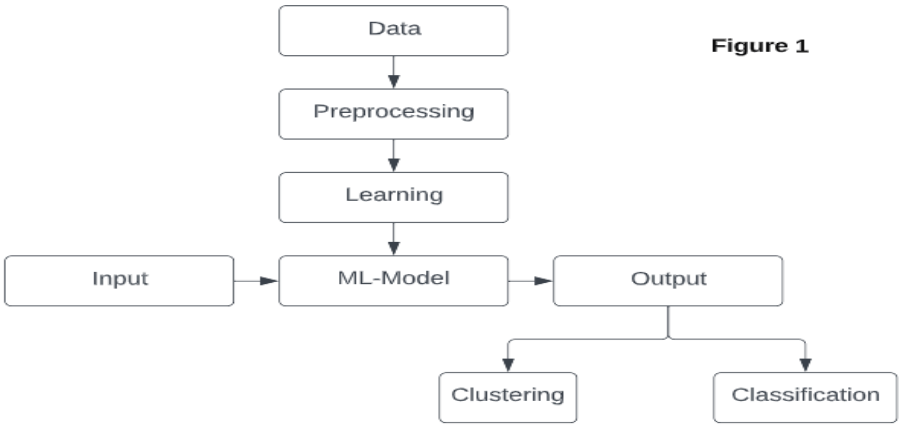

Figure 1

Fig -1: ML working

To develop a Farming Assistance Web Service application. Which consists of a login and registration E-Authentication System with OTP, so there will be no password-based vulnerabilities in the system. It helps farmers ensure greater profitability through direct farmer-to-dealer. It will have functionality like farmers can post complaints, may post their ads and notifications, farmers are notified of these notifications via SMS whenever new ads are published, prediction of selling products in different states or locations for profit, using naïve based algorithm, real-time payment by UPI as well as a credit card. Finally, we are going to host an application on the google engine.

2. LITERATURE REVIEW

2.1 Machine learning Techniques:

There are a huge amount of data available on farming, and to make a decision from that data we have different machine-learning techniques. For example Decision Tree, Gaussian Naive Bayes, Support Vector Machine (SVM), Logistic Regression, and Random Forest.

The system recommends the crop based on soil fertility. The system is based on the XGBoost algorithm. XGBoost, which stands for Extreme Gradient Boosting, is a scalable, distributed gradient-boosted decision tree (GBDT) machine learning library. It provides a parallel tree boosting and is the leading machine-learning library for regression, classification, and ranking problems.

There are lots of systems based on other methods we have studied in the literature survey. Vrushali Bhuyar uses classification techniques to predict soil fertility by the decision tree method, naive Bayes, and random forest. They found out decision tree is the best technique for classification. D Ramesh uses Multiple Linear Regression for predicting rice yield. Sandesh Ramesh, Department of Information Science and Engineering Nitte Meenakshi Institute of Technology, uses regression and neural networks for crop yield prediction.

S.S.Bhaskar made a study of soil classification of JRip, naïve bayes, and J48. They found J48 to be the best method. They also used regression techniques like linear regression and least square Median. They found least median squares regression produces better results for prediction than the classical linear regression technique. Jay Gholap uses the J48 algorithm for predicting soil fertility class. Also for performance tuning of the J48 algorithm, he uses attribute selection and boosting techniques. Suman cluster the data using the K-means Clustering on the soil dataset then the linear regression is applied to classify the clusters.

Fatih Bal and Fatih Kayaalp's "Review, of machine learning and deep learning models in agriculture" the identification of the plant species have been realized with ML and DL Methods depending on classification algorithms in smart agriculture applications based on artificial intelligence 126 citrus images obtained in different sizes and under various lighting conditions were trained with ML algorithms and a study was carried out to determine the green fruit.

"Machine Learning Applications for Precision Agriculture: A Comprehensive Review" by Abhinav Sharma, Arpit Jain, Prateek Gupta, (Student Member, IEEE), and Vinay Chowdary develop the manual spraying method for pesticides led to improper usage of resources and harms the environment. AI and IoT-enabled precision agriculture remove the randomness and assist new-age farmers to optimize every step of the farming process.

Gaitán provided a systematic study of the impact of extreme weather events, such as hail events, cold waves, and heat waves, and their impact on agricultural practices. The author reported floods, droughts, frost, hail, heatwaves, and pest outbreaks are impacted by climatic conditions.

Acar employed an extreme learning machine (ELM) based regression model for the prediction of soil surface humidity. The author selected two terrains having areas 4 KM2 and 16 KM2 located on the Dicle university campus for experimental analysis. The real-time field data was extracted using polarimetric Radarsat-2 data, which was pre-processed using the SNAP toolbox [18] and features were added with the help of local measurements by separating the field into square grids. Once the pre-processing and feature extraction is done the data is passed to ELM based regression model to predict the soil surface humidity. The algorithm was tested with 5 different kernel functions and the prediction was validated using a leave-one-out cross-validation technique.

Y. Mekonnen developed a power-efficient WSN using an Arduino microcontroller and ZigBee module to monitor and control essential parameters that affect crop growth such as soil and weather conditions in Florida, USA. Pise and Upadhye [164] explored Naive Bayes and SVM ML techniques for grading harvested mangoes based on their color, size, features, quality, and maturity. Grading fruits increases the profit of the agriculture and food industries. A mango image dataset comprising three different colors red, green, and yellow is created and used for training and testing the ML algorithm. The proposed approach presents limited scope as it can detect defects in a particular surface area which can be overcome by creating a dataset of rotational view images.

2.2 XGBoost as classifier:

Gradient Boosting is a boosting algorithm, in which each predictor corrects its predecessor's error. XGBoost is an implementation of Gradient Boosted decision trees. In this algorithm, decision trees are created in sequential form. Weights play an essential role in XGBoost. Weights are assigned to all the independent variables which are then fed into the decision tree which predicts results. The significance of variables predicted wrong by the tree is increased and these variables are then fed to the second decision tree. These individual classifiers/predictors then ensemble to give a strong and

more precise model. It can work on regression, classification, ranking, and user-defined prediction problems.

3. PROPOSED SYSTEM

3.1 Problem statement

"To develop a Farming Assistance Website that will help farmers in ensuring high profitability by predicting suitable crops according to soil fertility ."

3.2 Problem Elaboration

In Maharashtra, people say "Farmers know how to yield crops but don't know how to sell". This one-line statement hardly damaged the economic condition of farmers. To address this problem we are developing this system, which will help farmers to get maximum profit. It has functionality that predicts where to sell, by calculating the selling price, and transport costs of a particular city.

The system uses ML technologies to provide suitable solutions to farmers. We have used the J48 Decision tree Classifier to predict soil fertility and predict which crop will be suitable in such conditions. Also, suggest fertilizers to get nutrients that are lost.

3.3 Proposed Methodology

There are a number of ways in machine learning by which I can find out the fertility of the soil but the accuracy, space complexity, and time complexity are different for different models. The models are XG Boost, Decision Tree, Logistic regression, Random Forest, etc.

For efficient working of our proposed model and after learning from the given literature survey XG Boost Technique in machine learning works very fine as compared to other supervised learning techniques.

The working algorithm is as follows:

- Step 1: Make an Initial Prediction and Calculate Residuals
- Step 2: Build an XGBoost Tree
- Step 3: Prune the Tree
- Step 4: Calculate the Output Values of Leaves
- Step 5: Make New Predictions
- Step 6: Calculate Residuals Using the New Predictions
- Step 7: Repeat Steps 2–6

3.4 Proposed System Architecture

The proposed system workflow:

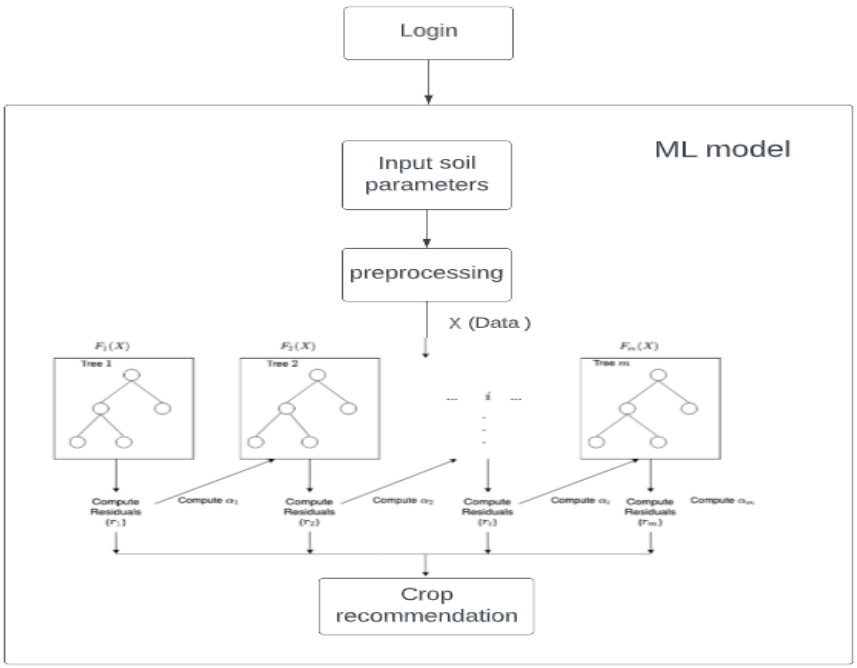

Fig -2: Workflow

The above block diagram shows us the working of the ML model. The user has to login into the system and after that, he is able to see the system's functionalities. It takes soil parameters as input which includes nitrogen (N), phosphorus (P), potassium (K), temperature, humidity, ph, and rainfall. Then XGBoost model gives us the crop that should be taken in such a condition. XGBoost work on boosting mechanism where the attempts to build a strong classifier from the number of weak classifiers.

Apart from the machine learning part, there are lots of functionality provided in the system. Those are providing the most profitable place to sell farm products, farmers can advertise their farm products, online selling between farmers and retailers, and secure payment gateway for transactions.

4. CONCLUSION

The proposed system has the best combination of machine learning functionality and other functionality. By using the XGBoost ML model, the ML model provided the crop recommendation with 99.31% accuracy whereas by comparing with other ML models it has maximum accuracy. The system has a UI that is easy to understand for farmers.

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