An Approach Towards Crop Recommendation System Using Random Forest Machine Learning Algorithm - A Review

P M Paithane[1], Gaikwad Pruthviraj[2], Joshi Atharva[2], Kakade Atharv[2], Parkale Yash[2]

[1]*Student, Asst. Prof., Department of Computer Engineering, VPKBIET, Baramati, Pune, India.*

[2] *UG student, Department of Computer Engineering, VPKBIET, Baramati, Pune, India.*

Corresponding Author: paithanepradip@gmail.com

Abstract: - With the use of an intelligent system called Crop Recommender, this project attempts to help Indian farmers choose the best crop to grow based on the qualities of the soil, as well as external parameters like temperature and rainfall. Indian economy is significantly influenced by the agricultural sector. The majority of Indians rely on agriculture for their living, either overtly or covertly. Thus, it can be said with certainty that agriculture is important to the nation. The majority of Indian farmers think that when choosing a crop to plant in a given season, they should rely on their instincts or simply they use their traditional methods which they have been using since old era. Instead of understanding it completely the crop productivity, is contingent on the current weather and soil conditions, they are more at ease merely adhering to established agricultural practices and standards. A single poor choice made by the farmer could result in unintended loss for both himself and the local agricultural sector. As the whole lateral system based on the agricultural industry. The machine learning algorithm can be used to solve this issue. The implementation of a recommendation system uses decision trees. The main objectives of this system are to advise farmers on which crops to plant which is suitable to its soil and seasonal rainfall.

Key Words: — ***Crop Recommendation, Web Application, Random Forest Algorithm.***

I. INTRODUCTION

India has a long history of agriculture. India is currently rated second globally for farm output. Forestry and fishing, two businesses closely allied to agriculture, made up almost 50% of all employment and 16.6% of the nation's GDP in 2009. India's agricultural sector's financial contribution to GDP is declining. The main financial contributor to agriculture is to predict the best crop. Numerous variables, including meteorological, geographic, organic, and economical aspects, affect crop output. Farmers find it challenging to make decisions about when and what crops to grow due to shifting market pricing.
In the last ten years. Due to the unpredictability of the weather, farmers are unsure of which crop to plant and when and where to begin.

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This could be the also reason for the suicides of farmers. The crop production rate is steadily decreasing in this situation. Giving the farmers access to an intelligent, user-friendly recommender system will solve the issue.
In this study, we offer a model that takes these issues into account. The new aspect of the suggested approach is that it gives farmers instructions on how to select the best crop which is suitable for their soil system as well as weather present at that place. While also recommending the most lucrative crop for a given area. The suggested approach offers crop selection based on economic and environmental factors, with the goal of minimizing the wastage of crop seeds, efforts to take them, elements given to them like water and fertilizers. The suggested approach makes crop predictions by looking at many variables like rainfall, temperature, area, soil type, etc. The technique aids in choosing the ideal moment to apply fertilizers. The current crop production prediction method is either hardware-based, expensive to maintain, or difficult to use.

1.1 The major contributions of the paper are enlisted below

- Prediction of the crop for specific regions by executing various Machine Learning algorithms, with a comparison of error rate and accuracy.
- A user-friendly web application to recommend the most profitable crop by which a farmer (or any user) can easily access this system through web application.
- A GPS based location identifier to retrieve the rainfall and weather data estimation at the given area.

1.2 Crop recommender system using machine learning approach

The user provides the area and soil type as input. Machine learning algorithms allow choosing the most profitable crop list or predicting the crop yield for users elected crop. To predict the crop yield, selected Machine Learning algorithms such as Support Vector Machine (SVM), Artificial Neural Network (ANN), Random Forest (RF), Multivariate Linear Regression (MLR), and K-Nearest Neighbor (KNN) are used. Farmers are unaware of which crop to grow, and what is the right time as well as place to start due to uncertainty in climatic conditions. The usage of various fertilizers is also uncertain due to changes in seasonal climatic conditions and basic assets such as soil, water, and air. In this scenario, the crop yield rate is steadily declining.

Table.1. Algorithm Accuracy Table

Algorithm	Accuracy (%)
K-Nearest Neighbour (KNN)	90
Support Vector Machine (SVM)	75
Multivariate Linear Regression (MLR)	60
Random Forest (RF)	95
Artificial Neural Network (ANN)	86

1.3 BIoT. Blockchain based IoT for Agriculture

The most fundamental promise of blockchain for the agricultural sector is that it eliminates the need for third parties to guarantee trust in buyer-seller relationships or any source-destination relationship. Transactions become peer-to-peer in an environment made possible by blockchain technology, with no need for middlemen. Blockchain can create "smart contracts" that carry out the terms of any agreement when specified conditions are met, in addition to providing the means for peer-to-peer transactions. Each time esteem changes hands, whether actual items, administrations or on the other hand cash, the exchange can be recorded, making an extremely durable history of the item or exchange, from source to final location Blockchain could be very helpful in this area. Putting all of the information about agricultural events on a blockchain can be used to build a system that is trustworthy and transparent. Farmers can also get immediate information about the quality of their seeds, the climate and environment, payments, soil moisture, demand, and sale price, among other things. All running on the same platform. This project aims to store sensor data on a blockchain and create a smart contract that will be used on the Ethereum blockchain to make the purchase and sale of crops and land easier.

1.4 Analysis of growth and instability in the area, production, yield, and price of rice in India

In India, agricultural growth that is stable has been a concern. In order to comprehend the issue of instability in India's rice production, this paper conducts an analysis of 41 years' worth of data on paddy yield, area, and production from 1970-1971 to 2011- 12. According to the analysis, the area, production, and yield of rice all over India had a positive compound annual growth rate, but they had been steadily decreasing over time. In the new ten years (2000-01 to 2011-12) there is expansion in precariousness at all India level in region, creation and yield of rice. A decrease in the use of seeds, manure, and other agricultural inputs, as well as a low proportion of irrigated area to total cropped area, could have contributed to the increase in instability. In the years following the reform, from 1990-1991 to 2016-17, the wholesale price of paddy has become more volatile across states, while the farm harvest price of paddy has experienced less volatility.

1.5 Supervised Machine learning Approach for Crop Yield Prediction in Agriculture Sector

AI (ML) is a pivotal point of view for securing genuine world and usable answer for crop yield issue. From a given arrangement of indicators, ML can foresee an objective/result by utilizing Directed Learning. To obtain the desired outputs, a suitable function must be generated by a set of variables that will map the input variable to the goal output. Predicting a crop's yield from historical data, such as temperature, humidity, pH, rainfall, and the crop's name, is part of crop yield

prediction. It informs us of the best crop that can be anticipated to be grown under field conditions. Random Forest is a machine learning algorithm that can be used to make these predictions. It will achieve the most accurate crop prediction possible. The best crop yield model is selected by taking into account the fewest possible models using the random forest algorithm. Predicting a crop's yield is extremely useful in the agricultural industry.

II. Crop Description

2.1 Materials

The datasets which are used in system is enlisted below

2.1.1 Crop Dataset

This system needs some training and testing first, for that we are using crop datasets, which have attributes like total set of crops which is available for recommendation, basic need of that crop (like N, P and K values as well as need of Rainfall, pH, Humidity and Temperature). Using this dataset, we are going to train our model by the rules of machine learning algorithms.

2.2 Open Weather Map API

Instead of taking inputs about weather from user (it could be less accurate or approximate), the use of a real time weather data which is taken through an open-source API namely OpenWeatherMap API. It consists of all kind of weather information based on cities. All we need to do is just give the city name, after that we can get the information about weather (like Humidity, Temperature) in that area. Using such kind of not only to make simplifications, but also increase the accuracy about the prediction rate in the system.

III. Modeling And Analysis

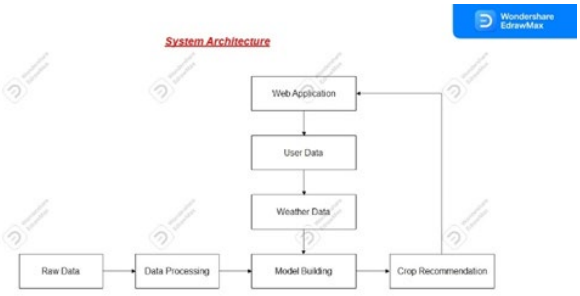

Fig.1. System Architecture

Above figure is the system architecture of proposed model. It's a web app that has a prediction module. Farmer needs to register with the app through registration process. Once the registration is complete, the farmer can use this Web application service. The prediction module predicts the crop need to be taken using selected attributes from data sets for the specific crop.

The very first step to use the services of the app is to register. During registration, user need to enter a city name that will locate the geographical location and fetch the weather data from API that we are using. On successful login, the service we can use is to recommend a crop based on our given inputs using a crop recommender system. In the prediction service, the user needs to input basic details of soil and Rainfall and Location then our app fetches the weather data (like Humidity and Temperature need for that Location). The system predicts which crop should be taken based on our given inputs after model training.

While model building and training, the model uses machine learning algorithm to train the model which is done by **'Random Forest Algorithm'**. A dataset used for model training.

IV. Conclusion

The limits of current technologies and their usefulness for crop recommendation were emphasized in this paper. The proposed solution then introduces a workable crop recommender system to the farmers, connecting them via a web application. Users of the that web application can choose from a variety of features to help them choose a crop. The built-in recommendation technology aids farmers in forecasting crop yields. The built-in recommender system enables a user to investigate potential crops in order to make more informed judgments. On the provided datasets from the Kaggle as well as the rainfall data and live weather data, machine learning algorithm (Random Forest) is deployed and assessed for prediction to accuracy.

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