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Crop Prediction and Fertilizer Recommendation Using Machine Learning

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ABSTRACT: A predominant role in the economic growth and development of country is played by agriculture. The major seriousissues in the crop productivity is that the farmers do not choose the right crop for cultivation. To improve the crop productivity, a crop recommendation system is to develop that uses to provide machine learning technique. Our research goal is to help farmers pick the best crop for their situation environment by predicting which crops fit well with the factors that influence crop growth such as soil pH, soil nutrients, rainfall, Temperature and humidity. The crop recommendation system classifies the input soil dataset into the recommendable the crop type, Kharif and Rabi. Machine Learning algorithms allow choosing the most profitable crop or predicting the yield for a user-selected crop. This paper presents the utilization of machine learning approaches like Random forest and Decision tree to predict which crop is best for which soil type based on the datasets. Machine learning approaches which could solve the mentioned issues and increase the yield.

KEYWORDS: Crop Recommendation, Machine Learning, Soil, Random Forest etc.

I. INTRODUCTION

One of the established nation that has agriculture as its primary source of income is India. India is the highly populated country and randomly change in climatic condition need to secure the world food resources. A lot of issues in terms of efficiency, cost-effectiveness, and resource utilization are being proposed by the conventional agricultural practices and techniques. For the better yield we need to consider soil type and soil fertility things and also one of the major factor rainfall. Improving the quality of the crop is the key goal of precision agriculture means obtaining a better understanding of the crop using the information technology methods.
In India today, agriculture has made significant advancements. Precision farming's secret weapon "area specific" cultivation.

This paper aims to recommend the most suitable crop based on inputs parameters like soil pH, soil nutrients, rainfall, humidity and temperature .This paper predict the accuracy of the future predictions a special concern has always been shown in case of how to increase the productivity of the crops. There have been various methods design and other improvised technique that are used to boost the yield of the crops. The challenge in it is to build the efficient model to predict the output of the crop so try with the different and compare all the algorithms and which one has the less error and predict the yield the particular crop.

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II. LITERATURE REVIEW

There are several research papers and studies that have explored the use of machine learning in crop recommendation systems. Here is a brief literature review of some notable works:

1. "Agricultural Crop Recommendation System using Machine Learning Techniques" by Sathish Kumar and S. Siva Sathya: This paper proposes a crop recommendation system that uses machine learning techniques such as decision trees, k-nearest neighbors, and support vector machines. The system considers factors such as soil type, climate, and historical crop yield data to provide personalized recommendations to farmers.

2. "Crop Recommendation System using Machine Learning Algorithms" by Anitha and P. Sivakumar: This study presents a crop recommendation system that utilizes machine learning algorithms like random forest and logistic regression. The system takes into account factors such as soil pH, temperature, rainfall, and nutrient content to suggest suitable crops for cultivation.

3. "Crop Recommendation System using Machine Learning Techniques for Precision Agriculture" by Rajkumar and M. Chandrasekaran: This research paper proposes a crop recommendation system that combines machine learning algorithms with precision agriculture techniques. The system considers factors such as soil moisture, temperature, and nutrient levels to provide real-time recommendations for optimal crop selection and management.

4. "Crop Recommendation System based on Machine Learning Algorithms for Precision Farming" by Gopinath and R. Ramprabha: This study presents a crop recommendation system that utilizes machine learning algorithms like decision trees and support vector machines. The system considers factors such as soil type, climate, and historical crop yield data to provide personalized recommendations to farmers.

5. "Crop Recommendation System using Machine Learning Techniques for Sustainable Agriculture" by Prabu and A. Rajesh: This research paper proposes a crop recommendation system that focuses on sustainable agriculture practices. The system uses machine learning algorithms like neural networks and genetic algorithms to suggest crops that require fewer resources and have a lower environmental impact.

These studies highlight the potential of machine learning in crop recommendation systems and demonstrate the benefits of using such systems in improving crop yields, reducing costs, and promoting sustainable agriculture practices.networks world. This competition begins in one's life from schools and colleges.

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III. WORKING OF PROJECT

Various applications of ML model in agriculture have been listed, such as crop yield prediction, Temperature, soil pH, soil nutrients, rainfall and humidity.

The system used supervised and unsupervised Machine Learning algorithms and compares results. With specified data, this technique is used to identify a specific crop. To improve precision and productivity, a Support Vector Machine was deployed.

Extensive work has been done by many resources and many ML algorithms have been applied in the agriculture sector. The biggest invention in agriculture is to increase farm production and offer it to the end-user with the best possible quality and predict suitable crop. Predicts the crop productivity for the specific year with the help of latest techniques. Machine Learning algorithms are used to make the decision. major factors we are going to take it into consideration is nitrogen, type of soil and yield analysis of previous data of these factors are helpful to make the accurate decision and predict the yield and helps the farmer.

Shruti Mishra et al 2018 [3] have indicated that applying the data mining techniques on historical climatic condition and crop production data predictions are made which increase the crop productivity. The system has to be implemented for the farmers to take exact decisions about soil and crop to be cultivated. They have collected the dataset with attributes of the crop season. We use Random forest algorithm, it is commanly used for predicting crop yield reason behind this because of they are easy to understand and simple to implement machine learning algorithm because they handle complex dataset with ease and simplicity.

LIMITATIONS

While machine learning-based crop recommendation systems have shown great potential, they also have some limitations that need to be considered:

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1. Data availability and quality: These systems heavily rely on accurate and up-to-date data, such as soil type, climate, and historical crop yield data. However, obtaining reliable and comprehensive data can be challenging, especially in developing countries or remote areas with limited access to technology and resources.

2. Generalization: Machine learning models are trained on historical data, which may not account for all possible variations and scenarios. As a result, the recommendations provided by these systems may not always be accurate or applicable in every context.

3. Lack of domain expertise: While machine learning algorithms can analyze large amounts of data and identify patterns, they may not fully capture the complexities and nuances of agricultural practices. Expert knowledge and domain expertise are still crucial for interpreting and validating the recommendations provided by these systems.

4. Limited interpretability: Some machine learning algorithms, such as neural networks, are considered black-box models, meaning they provide results without clear explanations or justifications. This lack of interpretability can make it difficult for farmers to understand and trust the recommendations given by the system.

5. Adoption and acceptance: Farmers may be hesitant to adopt new technologies, especially if they have been practicing traditional methods for generations. Convincing farmers to trust and rely on machine learning-based crop recommendation systems may require education, training, and demonstration of their effectiveness in real-world settings.

IV. PROPOSED SYSTEM

1 In this project, we have proposed a model that Predict the existing issues. This system is used to guide the farmers to maximize the crop yield as well as suggest the most profitable crop for the specific Area.

2 The proposed model provides crop selection based on economic and weather conditions, and used to maximize the crop yield that help to the increasing demand for the country's. The proposed model predicts the crop yield by studying factors such as season like Kharif, Rabi,Hangam The system also helps to determine the best time to use fertilizers.

3. The user provides an Season, Crop and Area as inputs for Production. The user provides an Season and Area as inputs for Crop Recommendation According to the Specific requirement, the model predicts the crop yield for a crop. The model also recommends the most beneficial crop.

4. The main objective is to obtain a better variety of crops that can be grown over the season .The proposed system would help to minimize the difficulties faced by farmers in choosing a crop

and maximize the yield looking upon all issues that the current facing agriculture, the proposed system helps in determining the best crop yield .
The proposed system is distributed into parts:

1. Crop Recommendation System
a. Best suitable crop that can be grown
b. Crops as per suitable conditions
2. Fertilizer Recommendation System

a. As per soil content and crop predict the soil quality
b. Based on soil condition give suggestions about the crop and recommendations about to improve it.

The process of checking answer sheets using generative ML involves the following steps:

1) Data Collection: Data collection is the most common method for gathering and analysing information from the technique. The dataset must have the following qualities to provide an particular data set for the system. These criteria will be considered for crop prediction: 1) soil PH 2) Humidity 3) crop data 4) temperature.

2) Data Pre-Processing: After collection of data from different sources, the next step is to pre-processed it before the model can be trained Starting with reading the whole dataset and going through data filtration, data pre- processing can be conducted in various ways. When absolve information, Some dataset characteristics are duplicate are not taken into

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account while cropping prediction. As a result, we must remove unwanted properties and datasets that contain some missing data. We must drop or fill these missing

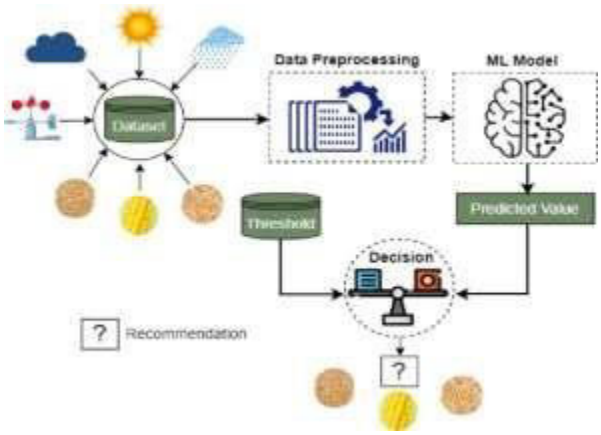

Fig1. System Architecture

ALGORITHM

Random Forest - Random Forest is a supervised machine learning algorithm used classification as well as regression problems. It contains several decision trees and an average of it is taken so as to give the result It is based on the concept of bagging where in multiple decision trees are makes and an average of them is taken so as to give the specific output. As decision tree are useful to overfitting, random forest is useful in reducing the effect of accurate and hence giving a more accurate output.

Decision Tree- Decision Tree is one of the most unique and significant machine learning algorithms used various Classification problems but can also be used for regression type of problems. The working of it is based on a easy technique, where it is answer in yes/no question is asked and according to the answer the tree is split in nodes. The split of the nodes can either happen by calculating impurity or information gain. Decision Trees are usrful to overfit.

Logistic Regression It is one of the algorithms in machine learning. It is used for solving classification problems. It uses a sigmoid function to mathematically calculates the probability of an observation and accordingly, the observation is then into its respective class.

TECHNOLOGY

Crop recommendation systems using machine learning leverage data and algorithms to provide farmers with personalized recommendations for crop selection and management practices. Here's an overview of the technology behind these systems:

1. **Data Collection:** Crop recommendation systems gather various types of data, including historical climate data, soil characteristics, satellite imagery, and crop performance data. This information is crucial for training the machine learning models.

2. **Preprocessing and Feature Engineering:** The collected data needs to be preprocessed and transformed into a suitable format for analysis. Feature engineering techniques are applied to extract relevant features from the raw data, such as temperature patterns, rainfall distribution, soil fertility indicators, etc.

3. **Model Selection:** Different machine learning algorithms can be used for crop recommendation, including decision trees, random forests, support vector machines (SVM), neural networks, and ensemble methods. The choice of model depends on factors like the size of the dataset, complexity of relationships, interpretability requirements, and computational resources available.

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4. Training the Model: The selected machine learning model is trained using labeled historical data, where the input features are combined with corresponding crop outcomes (e.g., yield, disease incidence). The model learns patterns and relationships between the input features and the desired output.

5. Model Evaluation: The trained model is evaluated using validation datasets to assess its performance anddetermine its accuracy in predicting crop outcomes. Various evaluation metrics such as accuracy, precision, recall, and F1 score are used to measure the model's effectiveness.

6. Deployment: Once the model is deemed accurate and reliable, it is deployed as a recommendation system accessible to farmers. This can be in the form of a web or mobile application that takes input parameters like location, soil type, and climate conditions to provide personalized crop recommendations.

7. Continuous Learning and Improvement: Crop recommendation systems can be designed to continuously learn and improve over time. New data collected from farmers' feedback, field observations, and updated climate information can be used to retrain the model periodically, ensuring it stays up-to-date and adapts to changing conditions.

8. Integration with IoT and Sensors: Advanced crop recommendation systems can integrate with Internet of Things (IoT) devices and sensors installed in the fields. These devices can collect real-time data on soil moisture, temperature, humidity, and other environmental factors. This data can be fed into the recommendation system to provide more accurate and timely recommendations.Overall, the technology behind crop recommendation systems using machine learning combines data analysis, predictive modeling, and continuous learning to provide farmers with optimized crop choices and management strategies, leading to improved yields, reduced costs, and sustainable agriculture practices.

FLOWCHART

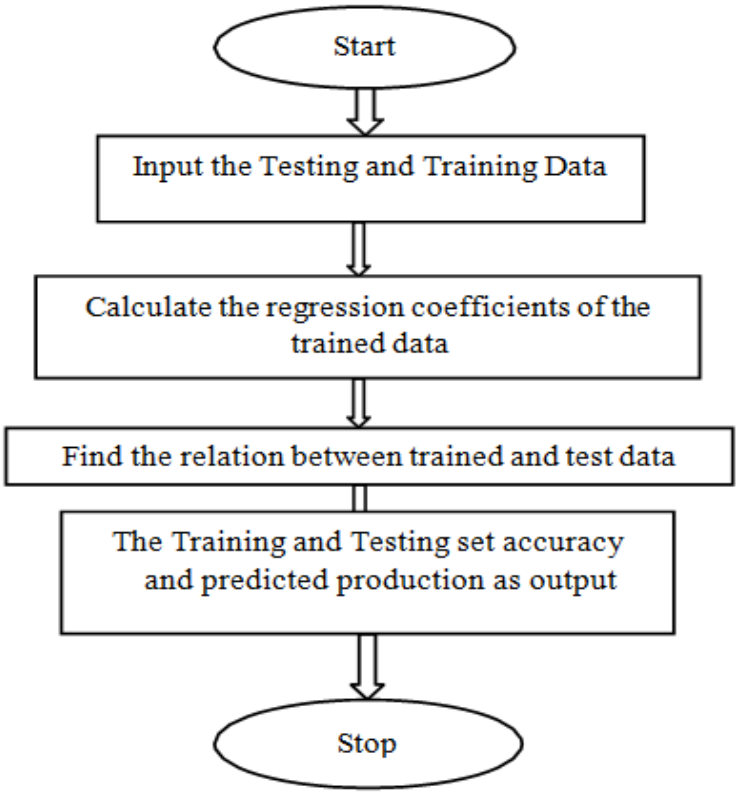

Fig 2. Flowchart

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ADVANTAGES

1. Personalized Recommendations: Crop recommendation systems using machine learning can provide personalized recommendations based on specific factors such as climate, soil characteristics, and historical data. This allows farmers to make informed decisions tailored to their unique farming conditions.

2. Increased Crop Yields: By leveraging historical data and patterns, machine learning models can identify optimal crop selection and management practices that can lead to increased crop yields. Farmers can maximize their productivity by choosing the most suitable crops for their land.

3. Cost Reduction: Machine learning models can help farmers optimize resource allocation, such as water usage, fertilizer application, and pest control. By providing precise recommendations, farmers can reduce unnecessary expenses and minimize waste, leading to cost savings.

V. CONCLUSION

As we all know, agricultural research has been conducted and continues to be conducted in order to improve productivity of the crop .This system helps the farmers to choose the suitable crop by providing information that ordinary farmers don't keep track of thereby decrease the chances of crop failure and increasing productivity of the crop. In future developing the web application based on this methodology and make the user use this easily and help the user to understand the yield of the crop.

REFERENCES

[1] Rakesh Kumar, M.P. Singh, Prabhat Kumar and J.P. Singh (2015), "Crop Selection Method to Maximize Crop Yield Rate using Machine Learning Technique", International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM).

[2] Kumar, Y. Jeevan Nagendra, V. Spandana, V. S. Vaishnavi, K. Neha, and V. G. R. R. Devi. "Supervised Machine learning Approach for Crop Yield Prediction in Agriculture Sector." In 2020 5th International Conference on Communication and Electronic Systems (ICCES), pp. 736-741. IEEE, 2020

[3] Kulkarni, Nidhi H., G. N. Srinivasan, B. M.Sagar, and N. K. Cauvery. "Improving Crop Productivity Through A Crop Recommendation System Using Ensembling Technique." In 2018 3rd International Conference on Computational Systems and Information Technology for Sustainable Solutions (CSITSS), pp. 114-119. IEEE, 2018.

[4] Thoranin Sujjaviriyasup, Komkrit Pitiruek,"Agricultural Product Fore- casting Using Machine Learning Approach". Int. Journal of Math. Analysis, Vol. 7, no. 38, 1869 1875, 2013.

[5] Jharna Majumdar, Sneha Naraseeyappa and Shilpa Ankalaki, Analysis of agriculture data using data mining techniques: application of big data, Springer journal, 2017

[6] Niketa Gandhi," Rice Crop Yield Forecasting of Tropical Wet and Dry Climatic Zone of India Using Data Mining Techniques", IEEE International Conference on Advances in Computer Applications (ICACA) , 2016.

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