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Crop Prediction and Crop Quantity Suggestion Based on the Characteristics of Agricultural Environment using Machine Learning Techniques

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Abstract

An expanding area of study is agriculture. Agriculture, in particular, depends heavily on soil and environmental factors including temperature, humidity, and rainfall. Crop forecast is also crucial. The choice of the crop to be grown, its development, and its harvesting date could all be controlled by farmers in the past. However, the community of farmers now finds it challenging to carry on as a result of the quick changes in the environment. Therefore, machine learning methods have largely replaced traditional prediction methods in recent years. This work has used a number of these methods to calculate agricultural yield. Efficient feature selection techniques must be used to preprocess the data in order to guarantee that a given machine learning (ML) model operates with a high level of precision.

Keywords: Agriculture, Classification, Crop prediction, Feature Selection.

1. Introduction

Crop recommendation system using machine learning is an innovative technology that helps farmers to make better decisions about what crops to grow based on various factors such as

soil quality, weather conditions, and previous crop yields. The system collects and analyzes data from multiple sources, including satellite imagery, soil sensors, and weather forecasts, and uses machine learning algorithms to generate recommendations tailored to each farmer's specific needs. Machine learning models are trained using historical data on crop yields, soil conditions, weather patterns, and other relevant factors to predict which crops are likely to perform best in a given area. These models can be continually updated and refined over time as new data becomes available, resulting in increasingly accurate recommendations. Crop profits, while also promoting sustainable agriculture practices. By providing customized recommendations based on real-time data, these systems empower farmers to make informed decisions about which crops to plant, when to plant them, and how to manage them for optimal results. Method that involves using advanced algorithms and statistical models to forecast crop yields based on various environmental factors such as weather conditions, soil characteristics, topography, and vegetation indices. Machine learning techniques have the ability to process large amounts of data and identify complex patterns that are not easily detectable by humans. This makes them an ideal tool for predicting crop yields and understanding how different environmental factors influence crop growth. Crop prediction using machine learning algorithms involves training the models on historical data such as previous crop yields, weather conditions, and soil properties, and then using this data to make predictions for future crop yields. The algorithms learn from the patterns in the data and can adjust their predictions based on changes in environmental conditions. The benefits of crop prediction using machine learning are numerous, including improved crop management, reduced risk for farmers, increased efficiency, and better resource allocation. By accurately predicting crop yields, farmers can optimize their farming practices, make informed decisions on planting and harvesting, and improve their overall productivity and profitability. Crop prediction is a vital aspect of modern agriculture that allows farmers to optimize their production and ensure food

security for growing populations. Accurately predicting crop yields can help farmers make informed decisions about planting, harvesting, and resource allocation, ultimately leading to improved productivity and profitability. In recent years, advances in machine learning and artificial intelligence (AI) have made it possible to predict crop yields with greater accuracy, using data from a variety of sources including weather data, soil characteristics, and crop phenology. Machine learning algorithms have been successfully applied to crop prediction, by analyzing large datasets of environmental data and past crop yields, and using these data to create models that can predict future crop yields. These models are trained on a variety of environmental factors, including weather data, soil characteristics, and crop phenology, and they can take into account complex interactions between these factors to produce accurate predictions. One of the key benefits of using machine learning for crop prediction is the ability to process large amounts of data quickly and accurately. This is particularly important in agriculture, where there are many different variables that can influence crop yields. By using machine learning algorithms, farmers can analyze data from multiple sources to gain a comprehensive understanding of the factors that affect crop yields in their region. Another benefit of using machine learning for crop prediction is that it can help farmers to optimize their use of resources. By accurately predicting crop yields, farmers can make informed decisions about how much fertilizer, water, and other resources they need to allocate to their crops. This can help to reduce waste and increase the efficiency of their operations. There are several different approaches that can be used to predict crop yields using machine learning. One approach involves using remote sensing data, such as satellite imagery, to monitor crop growth and predict yields. Another approach involves using climate data, such as temperature and precipitation, to predict crop yields based on historical patterns. Other approaches include using machine learning to predict disease outbreaks, soil fertility, and other factors that can

affect crop yields. In order to develop accurate crop prediction models, it is important to have access to high-quality data.

Figure.1. Corp System

1.1. Machine learning

Machine learning (ML) is a topic of study focused on comprehending and developing "learning" methods, or methods that use data to enhance performance on a certain set of tasks. It is considered to be a component of artificial intelligence.

Without being expressly taught to do so, machine learning algorithms create a model using sample data, sometimes referred to as training data, to make predictions or judgments. Machine learning algorithms are utilized in a broad range of applications, including computer vision, speech recognition, email filtering, medicine, and agriculture when it is challenging or impractical to create traditional algorithms that can accomplish the required tasks.Computational statistics, which focuses on utilizing computers to make predictions, and a subset of machine learning are closely connected

1.2. Decision tree:

A decision tree is a hierarchical decision support model that uses a tree-like representation of options and their potential outcomes, including utility, expenses for resources, and chance event outcomes. One technique to show an algorithm that solely uses conditional control statements is to use this method.

In order to determine the approach most likely to succeed, decision trees are frequently used in operations research, more specifically in decision analysis[1]. They are also a well-liked technique in machine learning.

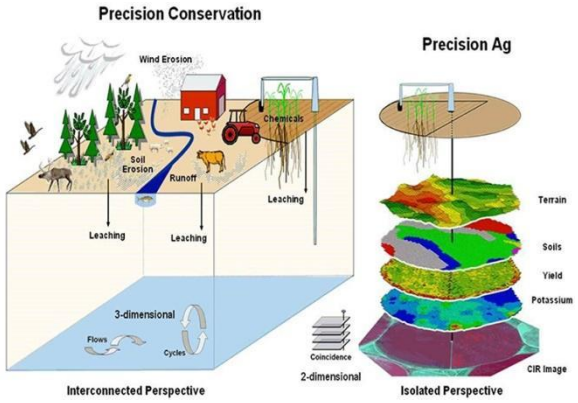

Figure.2. Decision Tree

1.2.1. Algorithm

Step 1: Collect for the Dataset according to the requirements from Kaggle/github

Step 2: Choose the appropriate dataset among the collected dataset

Step 3: Preprocess the data obtained from the dataset

Step 4: Train the preprocessed data

Step 5: Read the Temperature, Humidity, PH Values

Step 6: Predict the rainfall for current year from the preprocessed data

Step 7: Append all the values in the list

Step 8: Predict the crop using decision tree algorithm

Step 9: Classify the crop using the predicted values

Step 10: Get the Area of the land from User

Step 11: Display the suitable crop, quantity of the crop and moisture content of the land

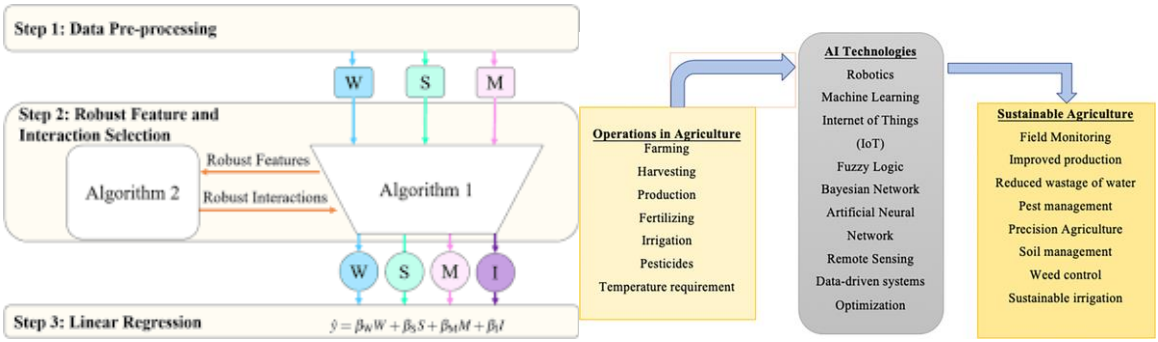

Figure.3. Algorithm

1.3. System Architecture

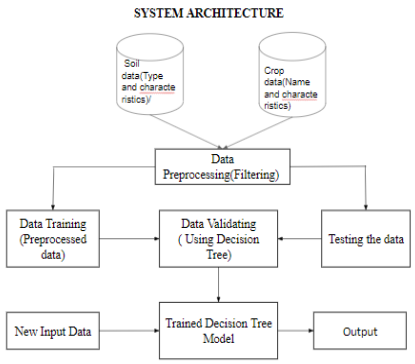

Figure.4. System Architecture

1.4. Flowchart

Figure.5. Flow Chart

2. Result

A machine learning model can analyze data on soil type, climate, and historical crop yields to suggest which crops are most likely to succeed in a particular area.Based on historical data and current environmental conditions, a machine learning model can estimate the expected yield of a given crop for a given season.Machine learning models can be trained to identify patterns in data related to disease and pest outbreaks, allowing farmers to take preventative measures and minimize crop loss.A machine learning model can analyze data on weather patterns, soil moisture levels, and other environmental factors to recommend the best time to plant a particular crop for optimal yield.

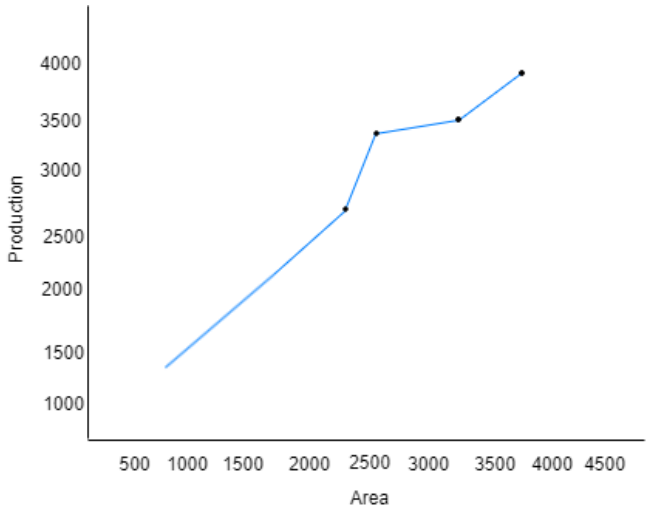

Figure.6. Result

3. Conclusion

Seed suggestion using a decision tree is an effective approach for recommending suitable seeds for different types of crops. The decision tree model helps in identifying the key factors that affect seed selection, such as soil type, climate, water availability, and crop type. By analyzing these factors, the decision tree can recommend the most suitable seed type for a particular crop.

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