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Productivity and Season Based Crop Yield Prediction Using Machine Learning Algorithm

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ABSTRACT—

Agriculture is the pillar of the Indian economy and plays a critical role in the global economy. Crop yield prediction is the most important agricultural problem. Agriculture yield is primarily determined by weather conditions such as rain, temperature, and so on. Variations in weather, climate, and other such environmental conditions are the primary cause of agriculture's decline in health. A single misguided decision by farmers, such as agriculture patterns and starter, can have negative consequences for both themselves and the agricultural economy of the region. In this paper, we present an intelligent system that will assist farmers in making the best decision about which crop to grow based on productivity and season. Most existing systems are hardware-based, which makes them expensive and difficult to maintain, as well as providing inaccurate results. So, in this current scenario, the ability to apply modern technological methods in the field of agriculture is desirable. Machine learning is important because it has a decision support tool for crop yield prediction, including advice on which crops to grow and what to do during the crop's growing season. Machine learning techniques use data to create a well-defined model that can be used to make predictions. This could help aspiring farmers improve their farming practices. Crop Dataset has been analyzed, and crop yield recommendations are made with 92 percent accuracy based on productivity and season.

Keywords—Agriculture, Detecting Crop, Detecting Crop yield prediction, Duration of Cultivation, Machine learning method, Decision Tree Classifier.

1.INTRODUCTION

Crop yield is the measure of crop produced per area of land. It’s an important thing to understand because it helps us understand food security and also explains why your crops can cost more one year and then less the one year. Crop yield is the measure of seeds or grains which is produced from a given land plot. It is usually expressed in kilograms per hectare or in bushels per acre. Such an indicator as the average crop yield per acre serves as the evaluation of a farmers agricultural output on a particular field over a specified time period. From the past decades agriculture is the backbone of the economic system of a give country. In addition to food and raw materials. Agriculture also employs a significant proportion of the population. In order to improve crop yield forecasting.

There are numerous factors that can be used to increase crop yield prediction. Rainfall, temperature, soil type, and other factors all have an impact on crop yield. The primary goal of improving high yielding crop varieties is to increase yield by increasing crop productivity per acre, and to obtain crop products of higher quality. The main reason for India's crop yield decline is due to irrigation issues. Rainfall has become extremely unpredictable as a result of recent climate changes.

A smart system that can solve the problem of decreasing crop yield is required. To address this issue, we propose a system that will provide crop selection based on season and environmental factors to maximize yield for farmers, thereby helping to meet the country's increasing demand for food supplies. The system forecasts crop production by analyzing factors such as rainfall, temperature, season, and so on. The system also assists in determining which crops should be planted.

Crop yield prediction is a significant agricultural issue. Every farmer wants to know how much yield will be produced and if it will meet their expectations. Previously, yield prediction was calculated by analyzing a farmer's previous experience with a specific crop. The agricultural yield is primarily determined by weather conditions, pests, and harvest operation planning. Accurate information about crop yield history is essential for making agricultural risk management decisions. The project's goal is to assist users in selecting a suitable crop to grow in order to maximize yield and thus profit. The proposed system attempts to overcome the shortcomings of existing systems and make. The solution we propose is to design a system that takes into account the most influencing parameters for growing a crop in order to obtain a better selection of crops that can be grown throughout the season.

1.1 Existing System

Tripathy developed a data mining-based system for pesticide management in crop cultivation. Pritam Bose created an SNN model for spatiotemporal analysis and crop estimation. Crop and yield forecasting Shreya S.Bhamose's model, which employs the Modified K-means clustering algorithm, forecasts crop harvest and water requirements. There is an existing software solution that recommends crops based on a variety of factors such as soil type and weather components such as temperature and rainfall. And the existing systems are hardware-based, which makes them expensive and difficult to maintain.

1.2 Proposed System

Many agricultural parameters influence crop production. The proposed work is based on crop production in previous years; crops can be recommended to farmers. This type of advice will let farmers know that the weather in question has been producing well in recent years. Crop production may be reduced due to crop disease, water issues, and a variety of other factors. When making predictions, farmers may learn which crops are in high demand in the market that year. Based on this, farmers can make decisions about crop trends in recent years. Farmers will be given recommendations based on crop production season. By predicting yield, it can precisely predict the most profitable crop for the farmer. While there are numerous ways to improve the lives of our target audience, our task was to use data to predict a valuable result so that farmers and aid workers could make informed planning decisions. Finally, the goal of this project was to conduct audience research that would guide the product's design and to create a data model that would produce the desired result.

1.3 Plan of Implementation

In this project, we are creating a machine that can predict crop yield based on season by comparing various parameters.

- We use a Decision Tree Classifier algorithm to predict crop yield.
- Using this algorithm, we will create a model with high accuracy.
- For execution, we use the Python IDLE tool
- Using the above two models, we will create a static web page that users can easily interact with.

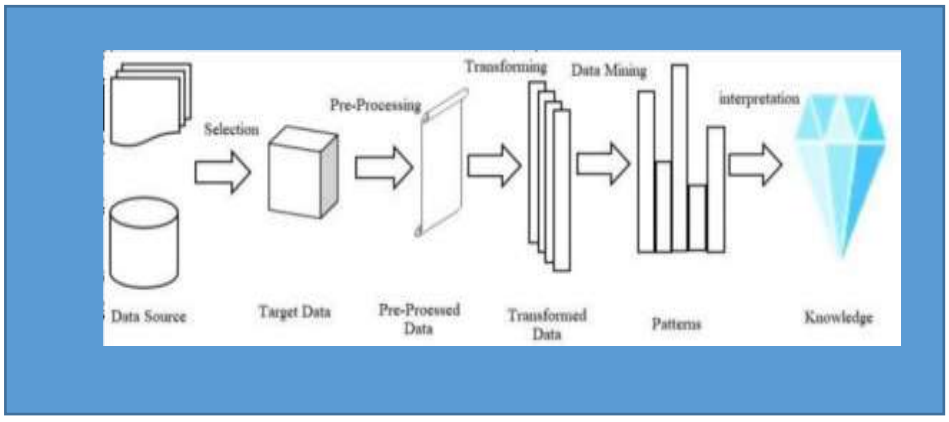
1.4 Problem Statement

The problem statement revolves around crop recommendation prediction based on season using machine learning techniques. The project's goal is to assist users in s electing a suitable crop to grow in order to maximize yield

1. Collect the weather data, crop yield data, soil type data and the rainfall data and merge these datasets in a structured form and clean the data. Data cleaning is done to remove inaccurate, incomplete and unreasonable data that increase the quality of the data and hence the overall productivity.
2. Divide the analyzed crop data into training and testing sets and train the model using the training data to predict the crop yield for given inputs.
3. Test the implemented system to check for accuracy and failures.

2.SYSTEM DESIGN

2.1 System Development Methodology



Data mining techniques are classified into two types: descriptive (based on existing data) and predictive (based on probability for future analysis). • Collect, clean, and load data into data warehouse system • Stores data in multidimensional format • Provides information access to analysts and decision makers • Presents data using various patterns

2.2 Model Phases

1. Data Collection:

Data collection is the first real step toward the actual development of a machine learning model. This is a critical step in determining how good the model will be; the more and better data we collect, the better our model will perform. The crop recommendation in India dataset was obtained from another source.

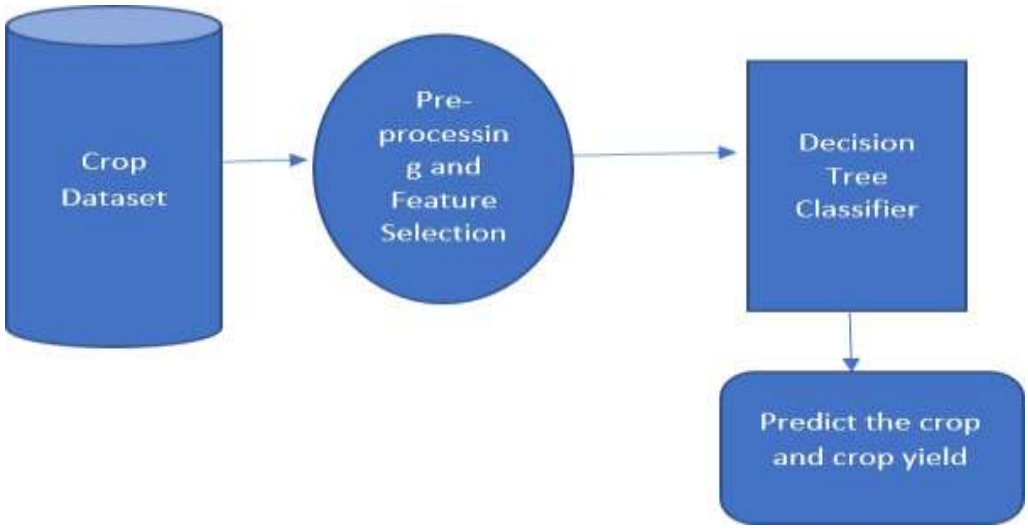
2. Model Selection:

A decision tree is a tree structure that looks like a flowchart, with an internal node representing a feature, a branch representing a decision rule, and each leaf node representing the outcome. The root node is the node at the top of a decision tree. It learns to partition based on attribute value. It partitions the tree recursively, which is known as recursive partitioning. This flowchart-like structure assists you in making decisions. It's a flowchart diagram-style visualization that easily mimics human level thinking. As a result, decision trees are simple to understand and interpret.

3. Saving Trained Model:

When you're ready, take your trained and tested model into production-ready environments. The first step is to save it as an.h5 or.pkl file with a library such as pickle. Check that Pickle is installed in your environments. Next, import the module and dump the model into the .pkl file.

2.3 System Architetcture



3. Algorithm

Decision Tree Classifier:

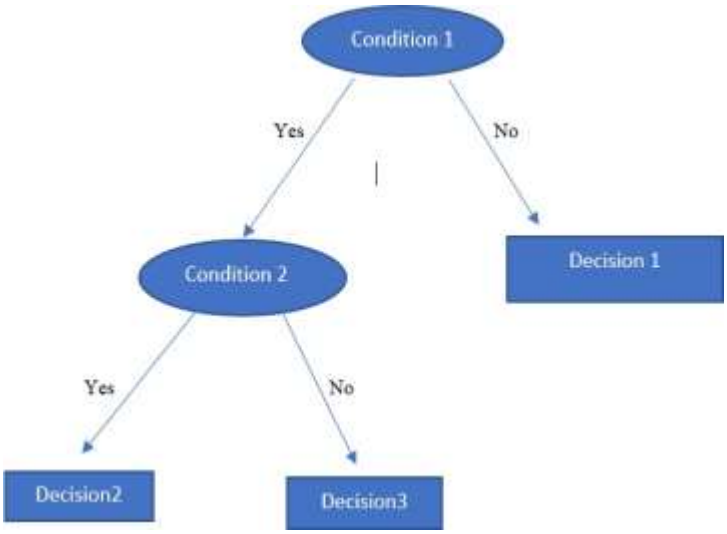
One of the most popular machine learning algorithms is the Decision Tree algorithm. To solve a specific problem, it employs a tree-like structure and all of its possible combinations. It belongs to the supervised learning algorithm class and can be used for both classification and regression. A decision tree is a hierarchical structure composed of a root node, branches, and leaf nodes. Each internal node represents a test on an attribute, each branch represents the result of the test, and each leaf node represents a class label. The root node is the tree's highest node. CART, which stands for Classification and Regression Trees, is the modern name for the Decision Tree algorithm. Classification and Regression Trees are Decision Tree algorithms that can be used to model classification and regression problems.

Working of Decision Tree algorithm:

To predict the class of a given dataset in a decision tree, the algorithm begins at the root node of the tree. This algorithm compares the values of the root attribute and the record attribute and, based on the comparison, follows the branch and jumps to the next node.

The algorithm compares the attribute value with the other sub- nodes for the next node and moves on.

It continues the process until it reaches the tree's leaf node.



Conclusion

In this paper, significance of management of crops was studied vastly. Farmers need assistance with recent technology to grow their crops. Proper prediction of crops can be informed to agriculturalist in time basis. Many Machine Learning techniques have been used to analyze the agricultural parameters. Considering the parameters like production and season, more personalized and relevant recommendations can be given to farmers which makes them to yield good volume of production.

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