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Crop Prediction and Fertilizer Recommendation Using Machine Learning

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Abstract

India's global economy is critically dependent on agriculture, which also accounts for a sizeable portion of GDP. As the world's population grows, it is essential to maintain food security, which is made possible and managed by the country's agricultural output.Planning for agriculture is important for agro-based nations' economic development and food security. Agriculture continues to face a number of issues. The choice of the crop to be farmed presents many challenges for farmers. Farmers face a credit collapse if they grow the incorrect crop. In order to feed the world's population, agriculture's productivity must undergo massive expansion. The most widely recognised technological innovation is machine learning; however, there are several more. By investigating the composition and other traits of the soil, it is envisioned that the right crop and fertiliser would be forecast as part of this proposed work. Crop prediction assists farmers in selecting the ideal crop for planting in order to enhance output and profitability.

Keywords—Crop yield prediction, Fertilizer recommendation,

Machine learning- Support Vector Machine

I. INTRODUCTION

India is renowned for cultivating agriculture on a wide scale. Agribusiness employs a large number of professionals and likely contributes a significant portion of the nation's economic Gross Domestic Product (GDP). Predicting crop production is one of the most complicated issues in agriculture. It is crucial to decision-making at the federal, regional, and local levels. Agricultural, soil, climatic, environmental, and other indicators are used to predict crop yield.Anticipating the crop yield for a farm, a continent, or even a region is crucial yet difficult due to the amount of data needed and the sophistication of the analytics involved. Few crop projections in the past have been more than 30% accurate. Fortunately, crop forecasts now surpass 95% accuracy, including those for rice and sugar.

The key to agricultural success is choosing the ideal crop and soil fertilizer. When selecting the crop that is best for the soil, the kind of soil and the nutrients in the soil are key determinants. As a result, a prediction model must be developed to assist farmers in drawing conclusions. Based on the soil and water resources available at the site of action, the prediction model should be put in place such that it can measure crop yield with a minimal likelihood of loss. As we can discuss in our region, Dhule district, which is positioned in Maharashtra's northern province, Jowar, Bajra, maize, wheat, groundnuts, cotton, and sugarcane comprise the major food crops cultivated in the district. Ber, Guava, Pomegranate, Custard Apple, and Mango are the predominant horticultural crops.

Problem Statement: Predict yields with an efficient algorithm and suggest the amount of

fertilizer to apply to get the right yield for a specific crop.

Purpose: The purpose of the proposed system is to help farmers grow crops to increase production. The crops selected for this work are based on important crops in the selected region.Rice, Jowar, Wheat, Soybeans, Sunflower, Cotton, Sugarcane, Tobacco, Onion, Dry Chilli, etc. are the chosen crops. Crop yield data over the previous five years was gathered from various sources.

Scope: The desired results from the proposed work can be met only when the right soil composition is provided by the farmer. The constraint in the proposed work is that farmer has to externally get the soil sample for the soil composition tested and provide the test results to get the details about the right crop to be predicted.

Machine Learning:

Machine learning is a subsection of computer science that has gone through the process technological discoveries. It also facilitates in automating human evaluation and processing, which lessens the need for manual unskilled work. Machine learning is a sort of artificial intelligence (AI) that gives computers the ability to acquire knowledge without being lead to communication, according to tech-target. The goal of machine learning is to construct computer programmes that can change according to new data. For untrained farmers, picking the right crops based on the appearance of the soil becomes tiresome. Additionally, it is necessary to stop agricultural erosion.

Problem and task categories

Depending on the sort of learning "signal" or "feedback" that a learning system has reference to, machine learning tasks are often classified into three distinct types. Which are:

The goal of supervised learning is for the computer to uncover a general rule that connects inputs to outputs by being fed illustrations of inputs and the desired outputs by a "teacher."

Unsupervised learning: The learning algorithm is not assigned labels; instead, it must determine the structure of the data on its own. Discovering hidden patterns in data via unsupervised learning can be a goal in and of itself, or it can be a means to an objective (feature learning).

Reinforcement learning is when a computer algorithm interacts with a dynamic environment in which it must carry out a certain assignment (like operating a vehicle), all without a teacher explicitly indicating whether the programme has achieved its mission or not. Another illustration is mastering a game by battling against others.

II. LITERATURE SURVEY

An Efficient Analysis of Crop Yield Prediction: In this paper, various parameters, from soil to atmosphere, are taken into account to predict an appropriate harvest. Soil parameters such as type, reaction, iron, copper, manganese, sulphur, organic carbon, potassium, phosphate and nitrogen are taken into account. Random Forest. The algorithm is used to classify a data set that gives a result with good accuracy and low error rate. Because this framework can handle a large dataset by processing it in the MapReduce programming model.The phases of the proposed work are: data collection, data classification (random forest algorithm), Hadoop framework - MapReduce programming model and final prediction. The implementation is in Ubuntu 14.04 LTS with Hadoop 2.6.0 and the dataset is collected from various online sources to predict the correct culture. Accuracy: The accuracy achieved by this methodology is 91.43

Crop Selection Method to Maximise Crop yield rate: This work demonstrates a technique called CSM for selecting a sequence of crops to be planted in a season. The CSM method can improve the net yield rate of crops for planting throughout the season. The proposed method solves crop selection based on expected yield, which is influenced by parameters (e.g. weather conditions, soil type, water density, crop type).The sowing data considered were collected from a farmer in Patna District, Bihar (India). It takes crops, their planting time, planting days, and expected yield rate per season as inputs, and finds the order of crops with the highest daily production in the season.

Analysis of Soil Behaviour and Prediction of Crop Yield: In this work Experiments are performed with Rapid-Miner 5.3. Two important and well-known classification algorithms, K-Nearest Neighbor (KNN) and Naive Bayes (NB) are applied to the soil data set prepared by Jabalpur Soil Research Laboratory, M.P. Soil classification into low, medium and high categories is performed to predict yields using the available data set.This study can help soil analysts and farmers decide where to plant and on which soils better crop production can be achieved.

III. DESIGN AND IMPLEMENTATION

1. Existing System

The intentions and investigations made by the model will establish the level of sophistication required. The quantity of data and the length of time available for model creation and evaluation are other concerns. demonstrated how increasing The model grew increasingly complete after starting out with only empirical models. However, they argued that entirely empirical models, including multiple regression, would not be viable for extrapolative prediction (beyond the limitations of the data base) or for explanatory interpretation (cause and effect) of experimental results. They suggested using purely empirical methods like multiple regression to aggregate historical data and perhaps even do reconstruction within the historical data's range.

2. Proposed System

The support vector machine (SVM), a machine learning method, will be used in the system. Support vector machines (SVM), one of the most popular supervised learning techniques, are used to address classification and regression problems. However, it is mostly used for classification problems in machine learning. We will forecast the maximum crop yield that farmers may accept using the SVM algorithm, and as a result of the recently put into place system, the production ratio of a certain crop is also sharply rising.

- Architectural Design

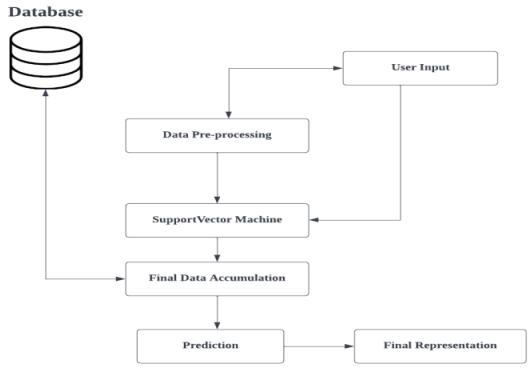

Fig. 1 System Architecture diagram

In our implementation, we are constructing web applications that are useful to local farmers and are based on machine learning technology. The above architectural design will show us how our design will be implemented. The user or customer first registers on our website using the required credentials, then enters the soil details that are present in the required document, and our system collects the data, which is then processed and the user receives the output.

The following variables were utilised in this model:

For predicting agricultural yield:

- Location
- Weather
- Plant
- Area
- Productivity

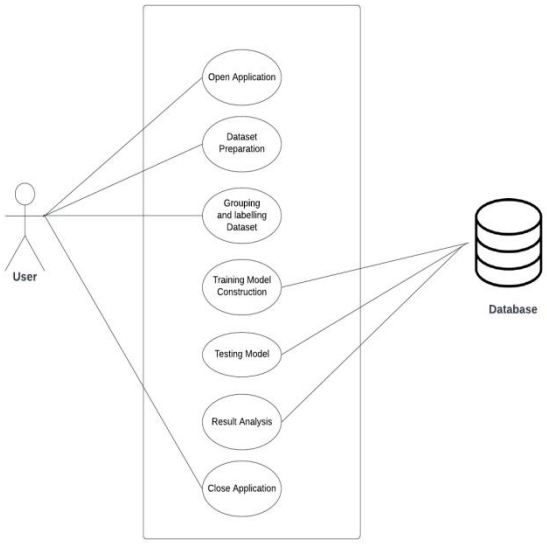

Fig. 2 System use case diagram

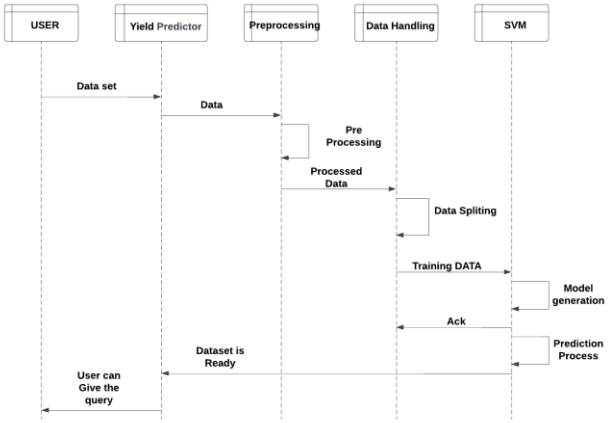

Fig. 3 System Sequence diagram

3. Methodology

The implementation can be done in two steps:

- Dataset collection and pre-processing

- Building the Model

In the first step, data is collected from Kaggle. There are 1600 datasets. So select anyone's dataset, or we can take the dataset from the district agriculture college or any government agriculture organisation. The features considered in the dataset are calcium (Ca), magnesium (Mg), potassium (K), sulphate (S), nitrogen (N), lime (L), carbon (C), phosphorus (P), moisture (M), and target (class). Depending on the soil type, or taking into account the weather in that area, as well as which village or its soil properties based on the crops, are divided into four classes or "targets." After data collection, data pre-processing is done by removing redundant and missing values and replacing the null values. Because data is not always ready for analysis, it must undergo some processing, which is completed in the data preprocessing setting.

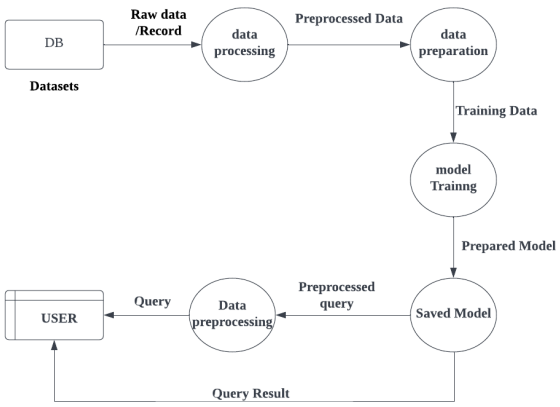

Fig. 4 System dataflow diagram

After the preprocessing, now train that data using the machine learning algorithm. Here we are going to use SVM because, on our dataset, it gives maximum accuracy. After all of the steps have been completed, our model is saved with our given dataset. Now, whenever the user sends the query or the request to our model, the data is processed; it will accept the request, consider it, process it, and then generate the result.

In the subsequent stage, the model is constructed. SVM is the model taken into account in the outlined work. Next, the dataset is divided into training and testing data, or 80% and 20%, respectively. Utilizing the current dataset, the model is trained and tested. The model is now ready to accept new queries, predict crops that can be produced based on the soil information provided, and print the details of fertiliser that can be used to improve crop growth.

4. Support Vector Machine

A supervised machine learning approach called Support Vector Machine (SVM) can be applied to classification and regression problems. However, the most common are classification problems. This algorithm represents each data point as a point in n-dimensional space, where n is the number of features it has and the value of each feature is a specific coordinate value.Then, we accomplish classification by identifying the hyperplane that effectively distinguishes the two classes.

IV. CONCLUSION

Agriculture is the backbone of many countries including India. Since integrating the information technology with the agriculture will guide the farmer to improve the productivity. In this proposed work the system described works faster and gives better accuracy in prediction to predict the suitable crops and fertilizers for the field. It includes various parameters of soil to analyse the crop. This prediction makes the farmers to improve the productivity, growth, and quality of the plants.

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