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Crop Production Analysis using Machine Learning

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Abstract: ***As we all know, in the agricultural industry, farmers and agribusinesses must make countless decisions every day, and the different elements influencing them are complex. The proper yield calculation for the different crops involved in the planning is a critical issue for agricultural planning. Data mining techniques are a critical component of achieving practical and successful solutions to this issue. Agriculture has always been a natural fit for big data. Environmental conditions, soil variability, input amounts, combinations, and commodity pricing have all made it more important for farmers to use data and seek assistance when making vital farming decisions. This research focuses on analyzing agricultural data and determining the best parameters to maximize crop output using machine learning techniques such as Random Forest, Decision Tree and Linear Regression, which can achieve high accuracy. Mining current crop, soil, and climatic data, as well as evaluating new, non-experimental data, improves production and makes agriculture more robust to climate change.***
Keywords: Random Forest, Decision Tree, Linear Regression.

I. INTRODUCTION

Agriculture is a field that makes a substantial contribution to our country's economic development. Agriculture was the driving force behind the rise of civilization. India is an agrarian nation whose economy is primarily reliant on crop productivity. As a result, agriculture can be considered the economic backbone of our country. Crop selection is critical in agricultural planning, and it cannot be stressed. A multitude of factors, such as market price, production rate, and government policies, will influence crop choices. Many improvements in the agricultural sector are required to strengthen our Indian economy and one of them are implementing machine learning techniques. Machine learning techniques that are straightforward to deploy in the agricultural industry can help us enhance agriculture. Along with all of the developments in farming gear and technologies, it's also vital to have access to useful and credible knowledge on a range of issues. The purpose of this research is to put the crop selection technique into practice in order to assist farmers and farmers in solving problems. By raising crop yield rates, this helps to enhance the Indian economy. As technology has evolved, the agricultural industry, which is considered India's backbone, has grown to satisfy the needs of the population. These developments are critical, especially with population growth at an all-time high. For example, a poor decision by the farmer could put his family's financial situation under even more strain, ultimately resulting in serious loss. As a result, we understand the pressure a farmer faces while deciding which crop to plant on his land. The most pressing challenge at the moment is to create a recommendation system that can anticipate the sort of crop that can be grown on a given plot of land, as well as how much of it can be grown. With this goal in mind, we decided to create a system that analyses soil factors such as N, P, and K (Nitrogen, Phosphorus, and Potassium), as well as pH levels, and predicts the best crop for a certain region.

II. METHODOLOGY

In this paper we propose a crop production yield predictor and also to recommend a suitable crop according to the given set of inputs. To predict the crop yield we use a regression model. Because while predicting the yield the output obtained is a continuous system. Whereas to give the recommendation of the crop the obtained output is the name of the crop. Hence classification model is used for recommendation of the crop. The data set is of two types one which contains the inputs and outputs of the yield. Whereas the other data set contains parameters for the suitable crop recommendation. We train and test the data set with Random Forest algorithm with which maximum accuracy is achieved.

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III. PROPOSED SYSTEM

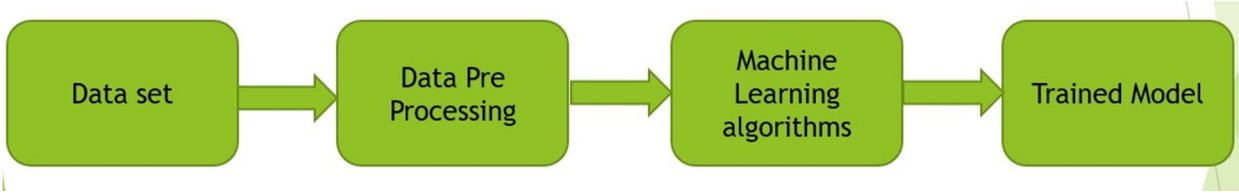

Fig:1 Block Diagram

A. Data Acquisition

The number of parameters employed, as well as the correctness of the dataset, might affect the accuracy of a machine learning system. Our collection includes the N, P, K, and pH values of several types of soils as attributes, as well as the crops that can be cultivated in those soils as labels. In addition, the data set includes agricultural yield information such as state name, crop name, area (hectares), and season.

B. Data Preprocessing

Data preprocessing, the second stage, is separated into two components. Because the original dataset may contain a large number of missing values, they should be deleted first. A dot in the dataset indicates missing values, and their presence may reduce the total value as well as the dataset's performance. The data set should be balanced before training and testing. The figures must not be too low. We should ensure that the data set is free of omitted and null values before training or testing.

C. Random Forest

Random Forest is a well-known machine learning algorithm from the supervised learning technique. It can be applied to both classification and regression problems in machine learning. It is based on the concept of ensemble learning, which is the process of combining multiple classifiers to solve a complex problem and improve the model's performance. As random forest gave us an accuracy of 86% that is the algorithm we used for our model.

IV. RESULTS

In the below figure in a webpage the input values of Nitrogen, Phosphorous, Potassium, Temperature, Humidity, PH value and Rainfall value are given as inputs to give the most recommended crop.

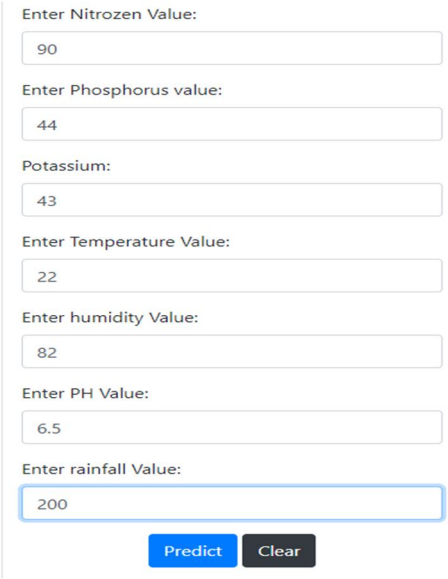

Fig 2: Inputs for crop recommendation

According to the given set of inputs in the above fig 2 the below figure predicts rice to be the most recommended crop for the given values of environmental factors.

Fig 3: Recommended output

The below figure shows a webpage in which the State name, Crop name, Area (Hectares) are taken as the inputs to predict the crop yield using random forest model. Based on these inputs the model provides the yield in tonnes of the particular crop.

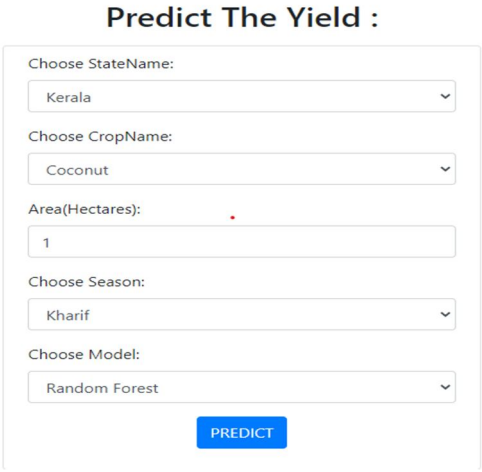

Fig 4: Inputs for crop yield

The area input given should be in hectares and need to specify it is Rabi crop or kharif crop or need to mention the season of the crop going to be cultivated.

The below figure tells that the output is 4975.68 tons for the crop coconut in the kharif season using random forest model.

Fig 5: Yield output in tonnes

V. CONCLUSION

The current study showed how data mining methodologies may be used to estimate agricultural production based on meteorological input features. Our farmers are not properly using technology and analysis at the moment, therefore there is a risk of improper crop selection. The created webpage is user-friendly, and prediction accuracy is greater than 75% in all of the crops and districts evaluated, proving higher forecast accuracy. They will have to pay for cultivation, reducing their earnings. To reduce the number of such failures, we've devised a system that is farmer-friendly. A graphical user interface (GUI) that predicts the best crop for a given situation for a specific piece of property, as well as information on the nutrients that must be added, as well as the seeds that must be used, expected yield, and market price for cultivation. As a result, farmers must choose the best option possible when choosing a crop cultivation in order for the agribusiness to succeed. The proposed method takes into account soil N, P, K, and pH levels to determine which crops are the most productive under specific conditions. Because it lists all possible crops, the system assists the farmer in deciding which crop to produce in their area. As a result, this method aids the farmer in choosing the most profitable crop and discovering new crops that he or she has not before planted. In the future, this technology could be improved by incorporating the Internet of Things (IoT) to collect real-time soil values. On the farm, sensors can be installed to collect data on current soil conditions. As a result, farming may be done efficiently.

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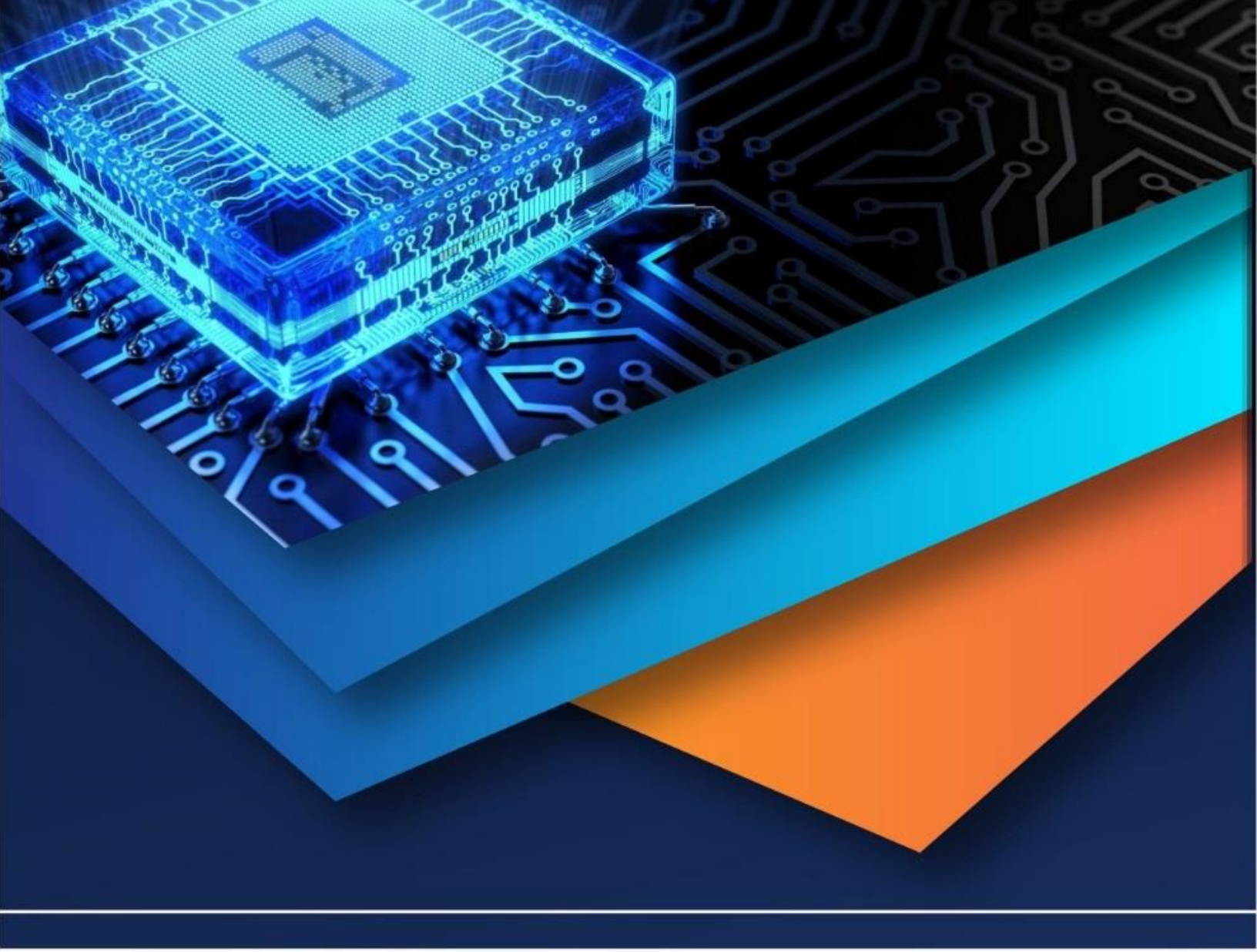

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