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Crop Yield Prediction and Fertilizer Usage Using Logistic Regression

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Abstract: India is an agricultural nation, hence the increase of its agricultural produce and the products of the agroindustry are the main drivers of its economy. The area of data mining is a relatively new one in crop yield analysis research. Predicting yield is a crucial problem in agriculture. Every farmer wants to know what kind of harvest he can anticipate. We examine a number of connected characteristics, such as location. It is possible to ascertain the amount of rainfall in an area, the nutrient value of the soil, and the weather and temperature using third-party apps, such as APIs. Each of these characteristics will be examined and used to train different machine learning algorithms in order to build a model. In order to accurately anticipate crop production and provide the user with appropriate advice on which crop to sow in order to improve yield and boost farmer revenue, the system is equipped with a model.

I. WHY?

Increasing crop output to the utmost is one of the objectives of agricultural production. Increased production and ensuing profit can be achieved by identifying and resolving issues with agricultural yield indicators early on. Crop managers can reduce the likelihood of losses when unfavorable conditions arise by using predictions.

Crop output is directly impacted by a wide range of variables, including soil type, precipitation, seed quality, and the availability of technological facilities. As a result, farmers must work wisely by utilizing modern technologies rather than relying on pointless ways in order to meet the expanding demand. Farmers can increase crop productivity by managing problems as soon as they arise and by detecting them early.

To improve crop yield prediction, we must analyze large amounts of data with the aid of machine learning algorithms in order to provide an accurate yield for that crop and recommend a better crop to the farmer. Fertilizer is another important component in crop growth. In the field, if fertilizer is applied more or less than necessary, the soil may become less fertile and crops may not produce as much as anticipated. Thus, forecasting the quantity of fertilizer needed for a crop is also crucial to achieving a high yield. In general, machine learning algorithms are able to forecast the yield's most productive output.

I. INTRODUCTION

Indian agriculture has a long history that begins with the Indus Valley Civilization. In this category, India comes in second. With over 31% of the workforce, agriculture and related industries like forestry and fisheries contribute 15.4% of the GDP (gross domestic product). The US and China are the countries with the next-highest net cropped areas, after India. With respect to statistics, the agricultural sector is the largest and contributes significantly to India's entire socio-economic structure.

With India's broad-based economic expansion, agriculture's economic contribution to GDP is steadily shrinking as a result of the industrial revolution. The challenge facing the Indian agriculture industry is integrating technology to provide the intended results. Temperature and rainfall patterns are changing as a result of modern technology and excessive usage of non-renewable energy sources. The adverse impacts of global warming have resulted in erratic tendencies that make it difficult for farmers to forecast their agricultural yield productivity as a result of changes in rainfall and temperature. A variety of machine learning algorithms, such as Logistic Regression , Decision Trees , Linear Regression , and others, can be used to identify patterns in temperature and rainfall in order to make accurate predictions and manage irregular trends. It will enhance farmers' quality of life overall and support India's agricultural prosperity. Numerous experts have used machine learning techniques in the past to improve the nation's agricultural growth. The sole goal of this research is to forecast crop yield using a variety of machine learning techniques. The mean absolute error is used to compare the results of these algorithms. With consideration for variables like temperature, rainfall, area, and so on, farmers may make informed decisions on which crop to produce in order to maximize yield thanks to the accurate machine learning algorithm's prediction.

II. EXISTING WORK

The industrial revolution has resulted in a steady decline in agriculture's economic contribution to India's GDP, despite the country's overall economic growth. The challenge facing the Indian agriculture sector is integrating technology to provide the intended results. Temperature and rainfall patterns are changing as a result of modern technology and excessive usage of non-renewable energy sources. Farmers' ability to accurately estimate temperature and rainfall patterns is hampered by the inconsistent trends brought about by the side effects of global warming, which in turn affects agricultural production productivity. Several machine learning techniques, such as RNN, LSTM, etc., can be used to identify patterns in temperature and rainfall data in order to handle irregular trends and provide reliable predictions.

In past, many researchers have applied machine learning techniques to enhance agricultural growth of the country.

III. WORK

The seasonal climate and the amount of nitrogen in the soil influence crop output, and the choice of crop to plant should be made based on these factors. Our system estimates future data by utilizing a dataset containing crop season, area, and production in hectares data from prior years, which is then examined using a variety of algorithms. Crop yield data, along with information on nutrients and geography, can be used to predict crop production. Fertilizer recommendations can be made based on crop location, fertilizer data, and crop health. Information about the weather and temperature is obtained through third-party applications. We build the functionality of crop yield prediction utilizing the most accurate algorithm in our suggested system.

The anticipation of crop output is a major problem in agriculture. The climate is the primary determinant of agricultural yield. Precise information regarding the historical harvest output is important when making decisions related to agricultural risk overall and expectations for the future.

This prediction is divided into four parts. They are: Crop prediction, model selection, data preprocessing, and overview of the data.

A. About Data

The agricultural data set from India was used in this experiment to make predictions. This is the sample data collection that was utilized for the study. the information utilized to calculate agricultural yields using several factors. By building a machine learning model and using these elements to train it, we can forecast the output and determine how much fertilizer will be needed based on the data set in order to get the desired yield.

B. Data preprocessing

As information pre-preparing is a tactic used to transform unclean information into a pristine collection of information. In the end, when information is acquired from multiple sources, it is usually done so in an unrefined manner that isn't practical for the investigation. At this moment, the yield information has been cleaned, and the metadata is being appended to it by removing the items that have been updated to the entire number. Thus, it is not at all difficult to prepare the information. Hear all that is spoken. As of right now, we load the metadata into this first, and then it will be linked to the information and replace the updated information with metadata. The information will then be carried one step further, the unwanted information in the rundown will be removed, and the information will be divided into the train and the test information. We must import train_test_split in order to divide the data into train and test. It, when combined with the scikit-gain proficiency, will aid in the pre-prepared data's division into train and test, as indicated by the code's assigned weight. Test and train are divided into two groups of 20 and 80 percent, respectively.

C. Data Explorition

In this, we used different machine learning algorithms for prediction purpose we use Logistic Regression A popular statistical technique for binary classification problems is logistic regression. It simulates a categorical outcome's likelihood depending on one or more predictor variables. Logistic regression is a useful tool in agriculture that may be applied to forecast crop production and optimize fertilizer application. With respect to agricultural yield prediction, logistic regression can categorize yields based on characteristics such as seed type, weather, soil quality, and historical yield data to determine if they will be above or below a given threshold. This aids farmers in making well-informed choices to optimize prospective production. Similar to this, logistic regression can be used to optimize fertilizer consumption by predicting the probability of obtaining desired crop growth and health outcomes with various fertilizer delivery tactics, taking into account variables like crop type, environmental circumstances, and soil nutrient levels.

D. Crop Prediction

The program begins by gathering data on the yield of that crop in that particular state during the preceding years and using that data to predict the yield based on historical yields. By accessing and processing the data of elements in the state over the previous almost no years, the program then forecasts the estimates of the variables impacting the harvest yield in that particular year.

E. Accuracy

Given information about the location and crop name, this model is used to forecast which crop will perform better. With the help of this model, farmers can choose which crop to plant for the highest yield and how much fertilizer to use to get there. For the prediction, the system examines the crop and fertilizer datasets from the prior year. The crop dataset's primary attributes are yield, crop name, and location. When this software is compared to earlier methods of crop prediction based on farmer experience, the accuracy will be far higher. Additionally, the algorithm's accuracy is 87%.

IV. CONCLUSION

Crop yield forecasts and efficient compost usage are effectively expected, and the most efficient yield of the yield is obtained by finding the productive calculation from both calculations. In order to forecast the crop output and amount of fertilizer to be applied, we compared two machine learning algorithms in this project and picked the most effective one. Rather than relying just on farmers' past experience, this research also suggests the optimal crop to plant for maximum yield and calculates the appropriate amount of fertilizer to apply based on historical data.

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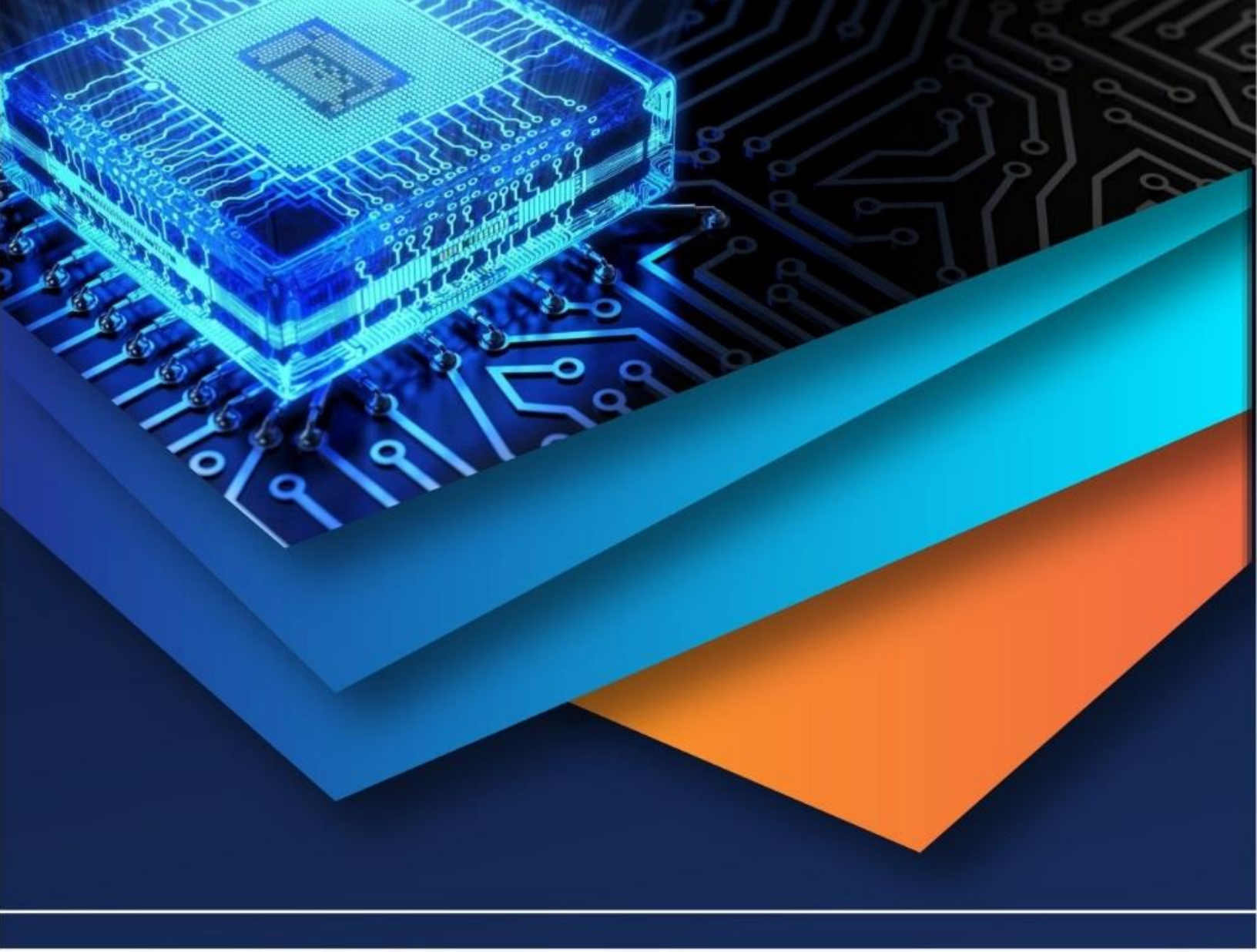

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