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Agro Farming using Machine Learning

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***Abstract:** In the agriculture sector, the farmers and Agro-businesses make many decisions which include factors influencing them. The main intention for agricultural planning is the accurate yield estimation for various crops. Data mining techniques implemented in Machine learning using Python are the approach for accomplishing practical and effective solutions for this problem. Environmental conditions, variability in soil, input levels, combinations, and commodity prices have made it all the more relevant for farmers to use the data and acquire help to create critical farming decisions. This paper focuses on the analysis of the agriculture data and finding optimal parameters to maximize crop production using Machine Learning.*
Issues like scarcity of water, natural calamities, usage of poisonous chemicals like pesticides and fertilizers for safeguarding crops are taken care of while developing this project. This paper also focuses on getting the correct fertilizers and pesticides to fight back attackers. The main objective of the project is to assist the farmer get maximum profit and to save from debts or other kinds of loss. The farmer only needs to answer few questions and see which crop would benefit him for a period of 4 to 6 months or the subsequent year.
***Keywords:** Linear Regression, Decision Tree, Python, Machine Learning, Data mining*

I. INTRODUCTION

We all know that India is one of the countries which produces an agricultural product to the fullest. Until 2017 the GDP of India is mostly from the Agricultural Sector and it is about 18%. The entire Nation takes pride in saying that India is the land of minerals and is known for the diversity of crops. This is the past glory of India and we abide by it because we have no other sources to quote in such a way. We know that the past always leads to sweet endings. We cannot live in the past while all the other nations go far ahead in the richness of their land. The reality of India today or from the past few years is worse or we can say it is worst. The pride that we take in telling, "India is known as Agricultural India", has turned out to be just India. The declining rate of GDP in agriculture year after year will haunt us in the years to come because the yearly GDP in Agriculture is not more than 8% and how can we make things possible in such a scenario? The advancement of technology has turned the focus of all the nations and forgot the importance of the richness in the natural sources available to them. We brought artificial things into existence and imposed them on natural resources. The way we give is the way we receive is an old saying and the most affected people in this venture are the farmers because they depend only on the natural resources and manipulation of resources and minerals will lead only to the shortage of resources and we do experience it in our day-to-day life. The researchers and the studies on agriculture would say, "One of the least bothered sectors in India is the Agricultural sector", and it is true in reality. The affected men of the Country (Farmers) are in a state of helplessness and require some help from the educated beings. The study on this sector has made us realize the importance and the value of agriculture and from this thought, the birth of "AGRO-FARMING WITH MACHINE LEARNING" has come forth. We have made it very easy for one of the backbones of our Nation to believe in agriculture and to invest their hard work in this sector for the upliftment of our Nation and to increase the GDP rate in Agriculture sector in the upcoming years.

II. LITERATURE SURVEY

Agriculture is a major contributor to the Indian economy. It plays a vital role in the country. Farmers find comfort in simply following the ancestral farming patterns and norms without realizing the fact that the crop output is circumstantial, which depends heavily on the present-day weather and soil conditions. A single misguided or unwise decision by the farmer can lead to undesirable results. Subhash Nadkarni described that a combination of Big Data Analytics and Machine Learning can effectively help alleviate this issue. A system called Agro consultant was implemented which assists the Indian farmers in making an informed decision about which crop to grow depending on the sowing season, his farm's geographical location, soil characteristics as well as environmental factors such as temperature and rainfall [1]. R. Kumar inspected crops and graded them depending on an examination to estimate crop yielding. This categorization is found in different data mining algorithms. The author provided perception into various grouping rules, such as K-Nearest Neighbour and Naive Bayes [2].

Rahul kataraya describes different artificial intelligence techniques and has gone through machine learning algorithms, big data analysis for precision agriculture, rainfall, such as used for accelerating crop yield. The author explained about crop recommender system using KNN, Ensemble-based Models, Neural networks, ...etc [3]. Talha Siddique proposed an automated farming system designed in an android application, which has been implemented to choose the best crop before starting the cultivation process according to the area of the cultivating land. The best crop signifies the crop which will be the most cost-effective for that particular land. The total system is focused on the climate and geographical conditions of different areas of Bangladesh. It predicts the best cost-effective crop using a prediction-based algorithm. KNNR algorithm was used to compare the accuracy and error rate of the predicted yield rate [4]. Keerthan Kumar TG proposed a machine learning-based solution for the analysis of the important soil properties and based on that dealing with Grading of the Soil and Prediction of Crops suitable to the land was analyzed [5].

III. PROPOSED SYSTEM AND ARCHITECTURE

The main motive of our project is to help the farmer to know the right crop with positive results from it. We create a dataset with the parameters like area, soil, water level, etc., which would help the farmer to know the analysis of the crops that are apt for the given conditions. We generate a graph from the analysis that has all the sectors like minimum water level, medium water level, and maximum water level. Next, we will go for the crop prediction followed by analysis.

When the user gives his parameters, we develop a graph according to his requirements but there is a chance to get no crop. In such cases, we use analysis and show all the crops available in the past years After analysis the customer decides to pick up the right crop as well as the crops that would act as alternatives for the crop to cultivate. This project also displays the correct mixture of fertilizers and pesticides to produce the best crop for the year.

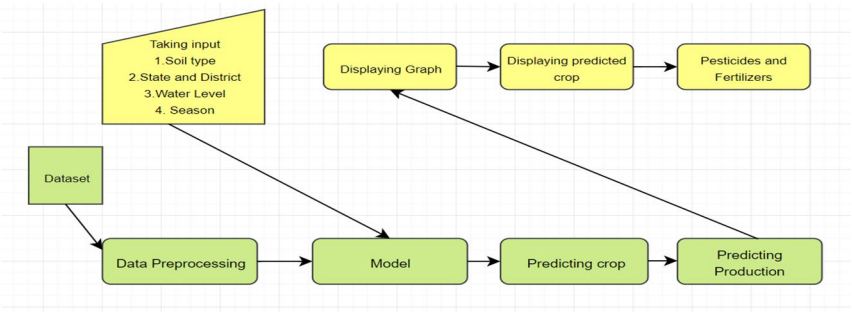

Fig. 1 System Architecture

A system architecture is very important to understand the flow of the project. We ask the user to enter the sources that they have. Based on that we try to analyze the entire project or begin our project. The input that we need is all of four components and they are soil type, state and district, water level, and season in which they want to lay the crop. We submit the input so that it can check the matching parameters and then it is pre-processed and displays the result of which crop is suitable for the year or a period of 3 or 4 months. If we do not get the right crop or a suitable crop or even no crop displayed and then we have a possibility of analyzing the crop and know which is suitable for use with the parameters that it shows. For that we pre-process the data and apply the algorithm in turn it will train the model and produce the predicted crop for us. Once the predicted crop is known we go for knowing the fertilizers and pesticides required for the crop that is displayed.

IV. IMPLEMENTATION

A. Module and its Description

1) *System Frame Work:* We incorporate the data set into the project and attach the files that we required for the execution of the project. Now, when the data is given by the user it is pre-processed and learned by the system and it becomes a model. As the model is trained, applying a suitable algorithm like a decision tree is done to have accurate results. This is to have only the suitable crop but to know the predicted crop for that particular year, we should go for analysis and generation of graphs. We do the analysis and the generation of graphs taking the linear regression, by learning the rules and optimizing the rules for a better and accurate result for user. We then go for giving the fertilizers and pesticides which are essential to save the crop from ant kind of damagers.
2) *Data owner (D.O):* We use the data owner module to test the data and to improve the execution strategy and increase the accuracy rate of the project. The data owner has nothing to do but monitor, develop and make the project easier as the number of years and clients increases.

3) *Data Users (D. U):* He is the real user or customer of the project. He gives the resources that he has and searches for the right crop to get and deploy to make better productions. Now, the problem of no crop existing is overcome by the prediction and the analysis of the crops. In this way, the data user can benefit and gain as much as he can to live a better life.

B. Data Preprocessing

Data preprocessing is the process where we prepare the raw data suitable for a machine learning model. It includes steps: data cleaning, finding missing values. Encoding Categorical Data, Splitting dataset into training and test set. Agro-Farming through Machine Learning uses typically two kinds of algorithms in its implementation for prediction and the analysis of the crop that has to be deployed in the system. The algorithms used here are:

C. Decision Tree Algorithm

The Decision Tree algorithm belongs to the family of supervised learning algorithms. Unlike other supervised learning algorithms, the Decision tree algorithm can be used for solving regression and classification problems too. It works for both continuous as well as categorical output variables. The general motive of using the Decision Tree is to create a training model which can be used to predict the class or value of target variables by learning decision rules inferred from prior data (training data). It consists of tree representation where each internal node of the tree corresponds to an attribute, and each leaf node corresponds to a class label.

D. Linear Regression

In statistics, linear regression is a linear approach to modeling the relationship between a scalar response (or dependent variable) and one or more explanatory variables (or independent variables). The case of one explanatory variable is called simple linear regression. For more than one explanatory variable, the process is called multiple linear regression. Learning a linear regression model means estimating the values of the coefficients used in the representation with the data that we have available.

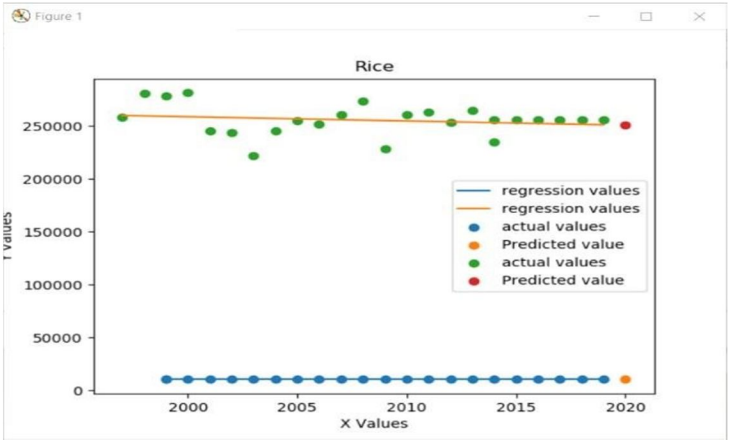

Fig. 2 Linear regression graph for production values

V. RESULTS AND ANALYSIS

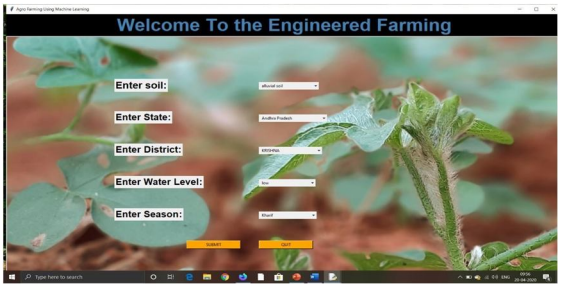

Fig. 3 User input form

Initially, the user gives input to the application. Then data pre-processing is performed and learned by the system and becomes a model. As the model is trained, applying a suitable algorithm like a decision tree is done to have accurate results. This is to have only the suitable crop but to know the predicted crop for that particular year, we should go for analysis and generation of graphs.

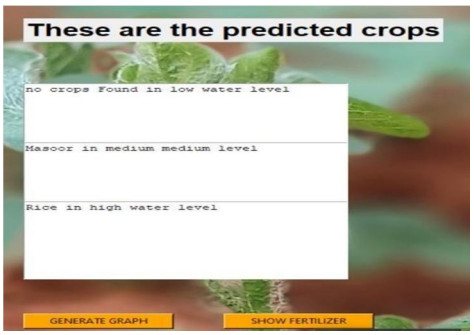

Fig. 4 Predicted crops

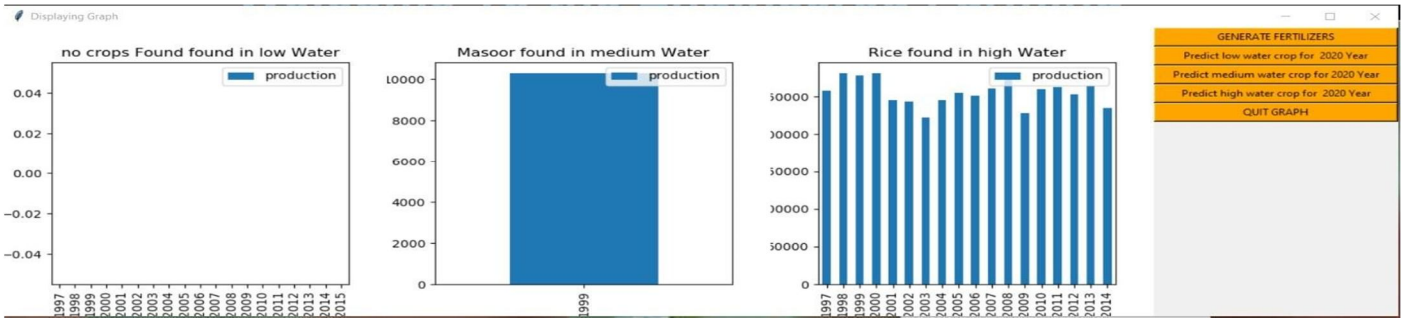

Fig. 5 Bar chart of predicted crops

Once the accuracy of prediction is good, we will go through the process of predicting the right crop from the data available in the data set. We display the predicted crops in the form of bar charts and the production rate on the y-axis by taking the year on the x-axis. The predicted crop will also get the fertilizers and the pesticides attached to it in the next screen.

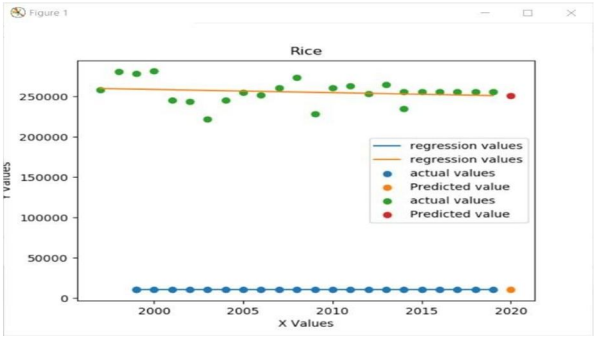

Fig. 6 Regression graph for production values

Fig. 7 Fertilizers for crops

This is how the system works and generates the right crop and the right pesticides and fertilizers for the year or the duration of four to six months.

VI. CONCLUSION

The main goal of our project is to help the farmer to know the right crop with positive results from it. We completed the crop and production prediction by using Machine Learning. On testing accuracy, we got an accuracy score of 98 percent and an error rate of 2 percent. we conclude that this project will help the farmers in predicting the crops.

Error rate	0.031963869
Accuracy	0.968036131
Sensitivity (or) True Positivity rate (or) Recall	0.952346896
Specificity (or) True Negative rate	1
Precision (or) Positive Predicted Value	1
False positive rate	0
Matthews correlation coefficient	28309296288
F_0.5	0.54052957
F_1	0.975591887
F_2	0.96151069

Fig. 8 Testing Accuracy

VII. FUTURE ENHANCEMENTS

Some of the works that we planned are as follows:

A. We would like to make the project dynamic by including every year's data into the database and making it a more reliable source for the farmers.

B. We are uncertain about the weather forecast and it has to be taken care of. Merging of yearly forecast into the dataset and allowing the farmer to get a clearer idea of cultivating the right crop is our idea.

C. The contamination of the soil has to be reduced for a better environment to live in. We do take steps to control it making the soil tests and encouraging organic farming than using fertilizers and pesticides in the field.

D. Some more parameters or attributes can be included in the system such that all these can help us to be accurate of the results in the production of the crop.

VIII. ACKNOWLEDGEMENT

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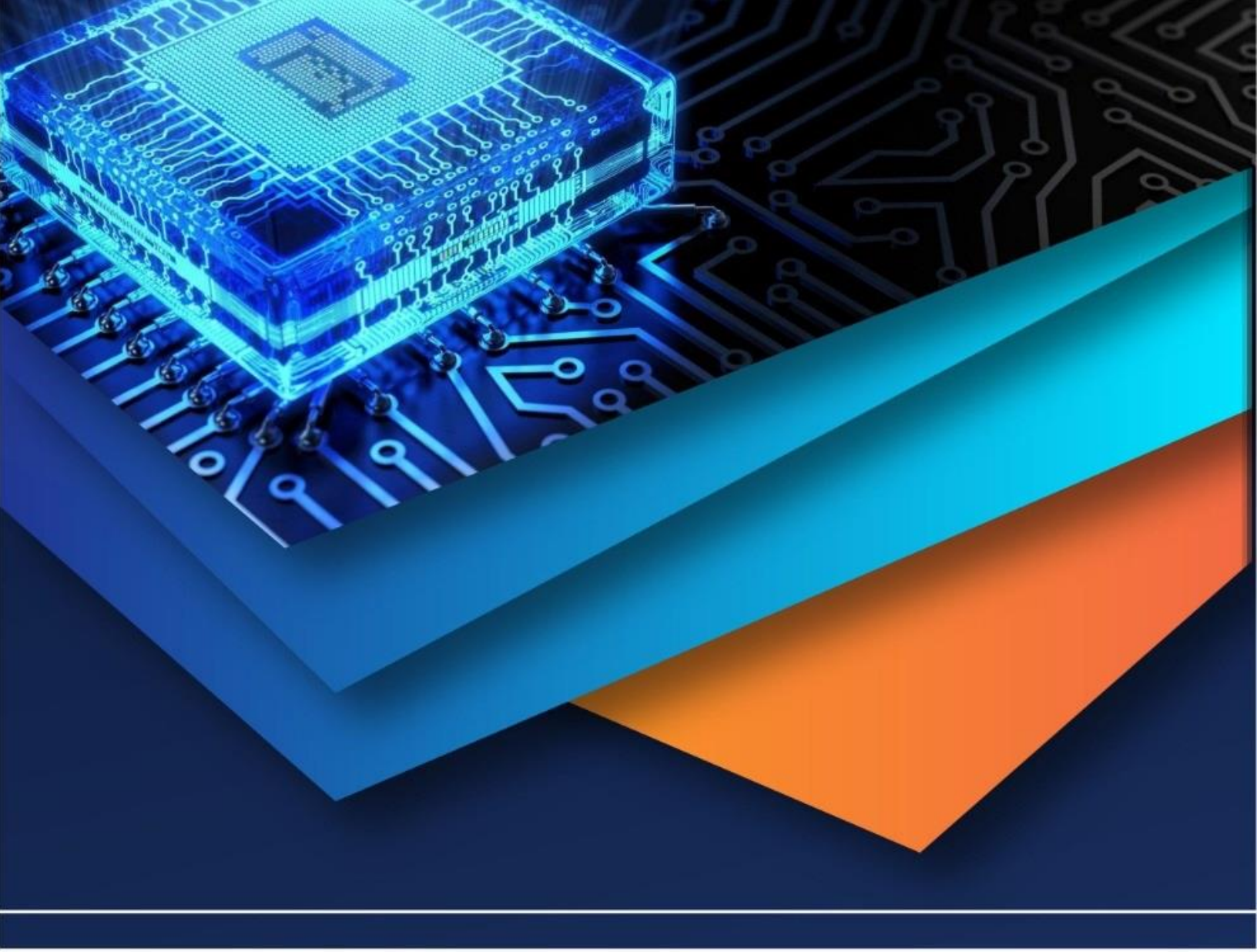

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