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Crop Recommendation System Using Machine Learning

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Abstract: ***Agroecology is one of the oldest and noblest professions in India. Farmers face a lot of hardships while using traditional methods of farming in today's technologically centric world. Precision farming is a modern approach in comparison to traditional cultivation techniques. We are predicting the right crop using parameters like district, rainfall, temperature, area, a crop which would help the farmer to predict the crop yield prior to making the decision to cultivate their final crop. This method can provide the farmer with valuable insights and assist them. In this paper we are using various techniques like Ridge Regression and Classifier. We have used different datasets on these models to get a better accuracy.***

I. INTRODUCTION

Agriculture, as we all know, is the foundation of the Indian economy. Agriculture is an important occupation in India. More than 60% of the country's land is used for agriculture, which feeds 1.3 billion people. Agriculture is the cultivation of plants and animals. In India, agriculture gave rise to civilization. We need weather to cultivate crops. As a result, soil is a critical factor in agriculture. weather news is essential for good food production. It provides the roots with essential nutrients, water, oxygen, and support. soil is the foundation of the food system, as well as the location of all plants used in food production. In India, several soil varieties are available. They are alluvial soil (cotton, rice), black soil (sugarcane, sunflower), red soil (corn, ragi), laterite soil (pulses, tea, coffee), and so on. Many studies have been conducted to improve agricultural planning. The crop can be recommended using a machine learning technique.

Machine learning is an subfield of artificial intelligence that describes a machine's ability to mimic intelligent human behavior. Artificial intelligence systems are employed in the same way as humans do to automate complex tasks. Machine learning begins with data, such as financial transactions, individuals, or photos.

The information is collected and processed to be utilized as training data for the machine learning system. If the data is more then the software shows better results. After that, the developer select a ML model to use, input the data, and train the system to find patterns or make predictions on its own.

II. LITERATURE SURVEY

In Reference [1], This paper proposed a method named Crop Selection Method (CSM) to solve crop selection problem, and maximize net yield rate of crop over season and subsequently achieves maximum economic growth of the country. The proposed method may im- prove net yield rate of crops.

In Reference [6], This paper, proposed and implemented an intelligent crop recommendation system, which can be easily used by farmers all over India. This system would assist the farmers in making an informed decision about which crop to grow depending on a variety of environmental and geographical factors. We have also implemented a secondary system, called Rainfall Predictor, which predicts the rainfall of the next 12 months.

In Reference [2], This paper contains about the research and the building of an effective agricultural yield forecasting system based on real-time monthly weather. It is difficult to predict the agricultural crop production because of the abnormal weather that happens every year and rapid regional climate change due to global warming. The development of agricultural yield forecasting system that leverages real-time weather information is urgently required. In this research, we cover how to process the number of weather data(monthly, daily) and how to configure the prediction system. We establish a non- parametric statistical model on the basis of 33 years of agricultural weather in- formation. According to the implemented model, we predict final production using the monthly weather information. This paper contains the results of the simulation.

In Reference [7], This paper, proposes a recommendation system through an ensemble model with majority voting technique using Random tree, CHAID, K-Nearest Neighbor and Naive Bayes as learners to recommend a crop for the site specific with high accuracy and efficiency parameters

III. DATASET

For the system, we are using various datasets all downloaded for government website and Kaggle.

1) *Datasets Include:* Cost of cultivation per dataset for major crops in each state Yield dataset, A brief description of the datasets:
2) *Yield Dataset:* This dataset contains yield for 16 major crops grown across all the states in kg per hectare. Yield of 0 indicates that the crop is not cultivated in the respective state.
3) *Data Preprocessing:* This step includes replacing the null and 0 values for yield by -1 so that it does not effect the overall prediction. Further we had to encode the dataset so that it could be fed into the neural network.

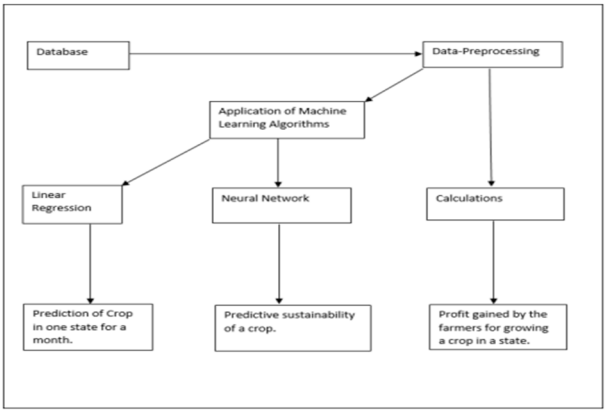
```
In [20]: crop_df=crop_df.dropna().reset_index(drop=True)
         crop_df
```

Out[20]:

	State_Name	District_Name	Crop_Year	Season	Crop	Area	Production
0	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Arecanut	1254.0	2000.0
1	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Other Kharif pulses	2.0	1.0
2	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Rice	102.0	321.0
3	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Banana	176.0	641.0
4	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Cashewnut	720.0	165.0
...	...	...	...	...	...	...	...
242356	West Bengal	PURULIA	2014	Summer	Rice	306.0	801.0
242357	West Bengal	PURULIA	2014	Summer	Sesamum	627.0	463.0
242358	West Bengal	PURULIA	2014	Whole Year	Sugarcane	324.0	16250.0
242359	West Bengal	PURULIA	2014	Winter	Rice	279151.0	597899.0
242360	West Bengal	PURULIA	2014	Winter	Sesamum	175.0	88.0

242361 rows × 7 columns

IV. SYSTEM ARCHITECTURE



System Architecture

A system architecture is a conceptual model using which we can define the structure and behaviour of that system. It is a formal representation of a system. Depending on the context, system architecture can be used to refer to either a model to describe the system or a method used to build the system. Building a proper system architecture helps in analysis of the project, especially in the early stages. Figure 6.2 depicts the system architecture and is explained in the following section.

V. PROPOSED SYSTEM

1) In this project, we have proposed a model that addresses the existing issues. The novelty of the proposed system is to guide the farmers to maximize the crop yield as well as suggest the most profitable crop for the specific region.
2) The proposed model provides crop selection based on economic and environmental conditions, and benefit to maximize the crop yield that will subsequently help to meet the increasing demand for the country's food supplies. The proposed model predicts the crop yield by studying factors such as State, District, area, season. The system also helps to determine the best time to use fertilizers.

3) The user provides an State, District, Season, Crop and Area as inputs for Production. The user provides an State, District, Season and Area as inputs for Crop Recommendation. According to the requirement, the model predicts the crop yield for a specific crop. The model also recommends the most profitable crop and suggests the right time to use the fertilizers.

4) The main objective is to obtain a better variety of crops that can be grown over the season. The proposed system would help to minimize the difficulties faced by farmers in choosing a crop and maximize the yield.

A. Advantages Of Proposed System

1) The proposed model predicts the crop yield for the data sets of the given region. Integrating agriculture and ML will contribute to more enhancements in the agriculture sector by increasing the yields and optimizing the resources involved. The data from previous years are the key elements in forecasting current performance.

2) The proposed system uses recommender system to suggest the right time for using fertilizers.

3) The methods in the proposed system includes increasing the yield of crops, real-time analysis of crops, selecting efficient parameters, making smarter decisions and getting better yield.

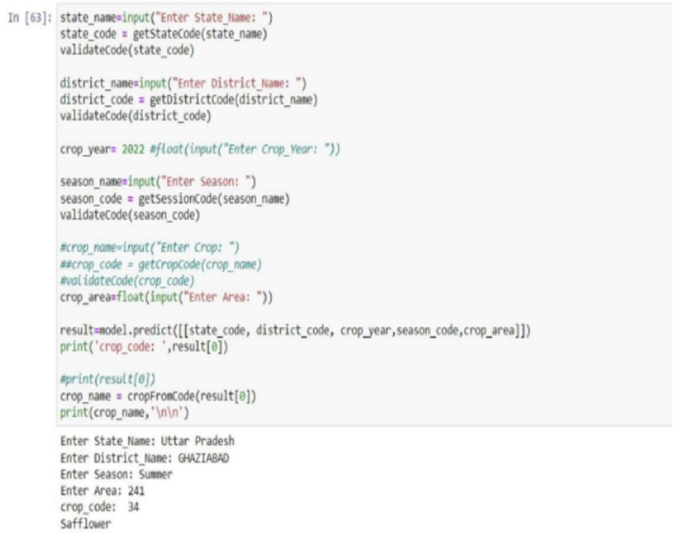
VI. CONCLUSION

At the conclusion of this project, I would say that I had learnt a lot from several resources to finish it. I used a variety of algorithm, technology and techniques to finish this project successfully. At the starting of this project, we applied KNN models of the algorithm of machine learning to the project and after applying the algorithm on the dataset we get the accuracy of 65.05%. Now we are applying the project on various algorithm such as ANN (artificial neural network), SVM (support vector machine). To increase the efficiency of the project and accuracy in this project we take the datasets from the various government websites such as - https://data.gov.in/ and KAGGLE and apply various parameters and algorithm's to get the maximum accuracy. The maximum accuracy we attain after applying algorithm's is 65.05%. this is the Accuracy we achieved after applying the KNN algorithm. At the last, we have discovered that our models trained to helps the farmer to choose the right crop by providing insights that ordinary farmers don't keep track of thereby decreasing the chances of crop failure and increasing productivity. It can also help in the following factor such as It also prevents them form incurring losses. The system can be extended to the web and can be accessed by millions of farmers across the country. By creating our own training datasets and fine-tuning our architecture, we were able to overcome data mismatch concerns and run on-device with low memory, storage, and compute needs. Further development is to integrate the crop recommendation system with another subsystem, yield predictor that would also provide the farmer an estimate of production if he plants the recommended crop.

VII. RESULTS AND PERFORMANCE ANALYSIS

For the purposes of this project we have used popular algorithms: Linear regression, Logistic regression and Neural network and KNN. All the algorithms are based on supervised learning. Our overall system is divided into three modules:

1) Output of Crop Recommender:

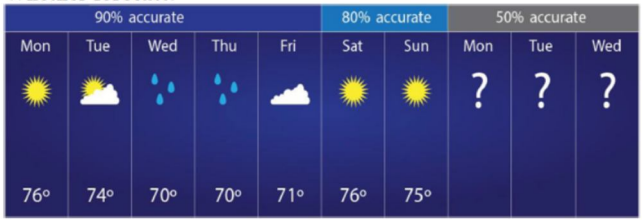


```
In [63]: state_name=input("Enter State_Name: ")
         state_code = getStateCode(state_name)
         validateCode(state_code)

         district_name=input("Enter District_Name: ")
         district_code = getDistrictCode(district_name)
         validateCode(district_code)

         crop_year= 2022 #float(input("Enter Crop_Year: "))

         season_name=input("Enter Season: ")
         season_code = getSessionCode(season_name)
         validateCode(season_code)

         #crop_name=input("Enter Crop: ")
         ##crop_code = getCropCode(crop_name)
         #validateCode(crop_code)
         crop_area=float(input("Enter Area: "))

         result=model.predict([[state_code, district_code, crop_year,season_code,crop_area]])
         print('crop_code: ',result[0])

         #print(result[0])
         crop_name = cropFromCode(result[0])
         print(crop_name,'\n\n')

         Enter State_Name: Uttar Pradesh
         Enter District_Name: GHAZIABAD
         Enter Season: Summer
         Enter Area: 241
         crop_code:  34
         Safflower
```

2) Output For Production Analysis

```
In [53]: state_name=input("Enter State_Name: ")
state_code = getStateCode(state_name)
validateCode(state_code)

district_name=input("Enter District_Name: ")
district_code = getDistrictCode(district_name)
validateCode(district_code)

crop_year= 2022 #float(input("Enter Crop_Year: "))

season_name=input("Enter Season: ")
season_code = getSessionCode(season_name)
validateCode(season_code)

crop_name=input("Enter Crop: ")
crop_code = getCropCode(crop_name)
validateCode(crop_code)
crop_area=float(input("Enter Area: "))

result=model.predict([[state_code, district_code, crop_year,season_code, crop_code,crop_area]])
print('Production: ',result[0],'\n\n\n\n\n\n\n')

Enter State_Name: Uttar Pradesh
Enter District_Name: BIJNOR
Enter Season: Rabi
Enter Crop: Potato
Enter Area: 861
Production:  2487
```

3) Whether forecast:



VIII. FUTURE WORK

1) The number of additional and other features can we added to the system.
2) At now currently, it take a necessary datasets as input from various government sites and KAGGLE and indicate a very appropriate crop to be cultivated.
3) But as in future, the automation property is added to the system as the response given to the feedback.
4) This can be updated to give the result with according to the humidity, water levels and temperature in the surrounding.
5) This can be updated such as that it will suggest the crop that give high production in that area and the crop will not harm the soil fertility and the environment due to some of it's chemical components.

IX. CODE

We have tried to develop the code on the basis of the requirement of the project in the language python with using the different library.
We do the code on the Jupyter notebook of the anaconda Application.
We also make the front-end code by using the language hyper text markup language, cascading style sheet and the JavaScript and also the some CSS framework like bootstrap.

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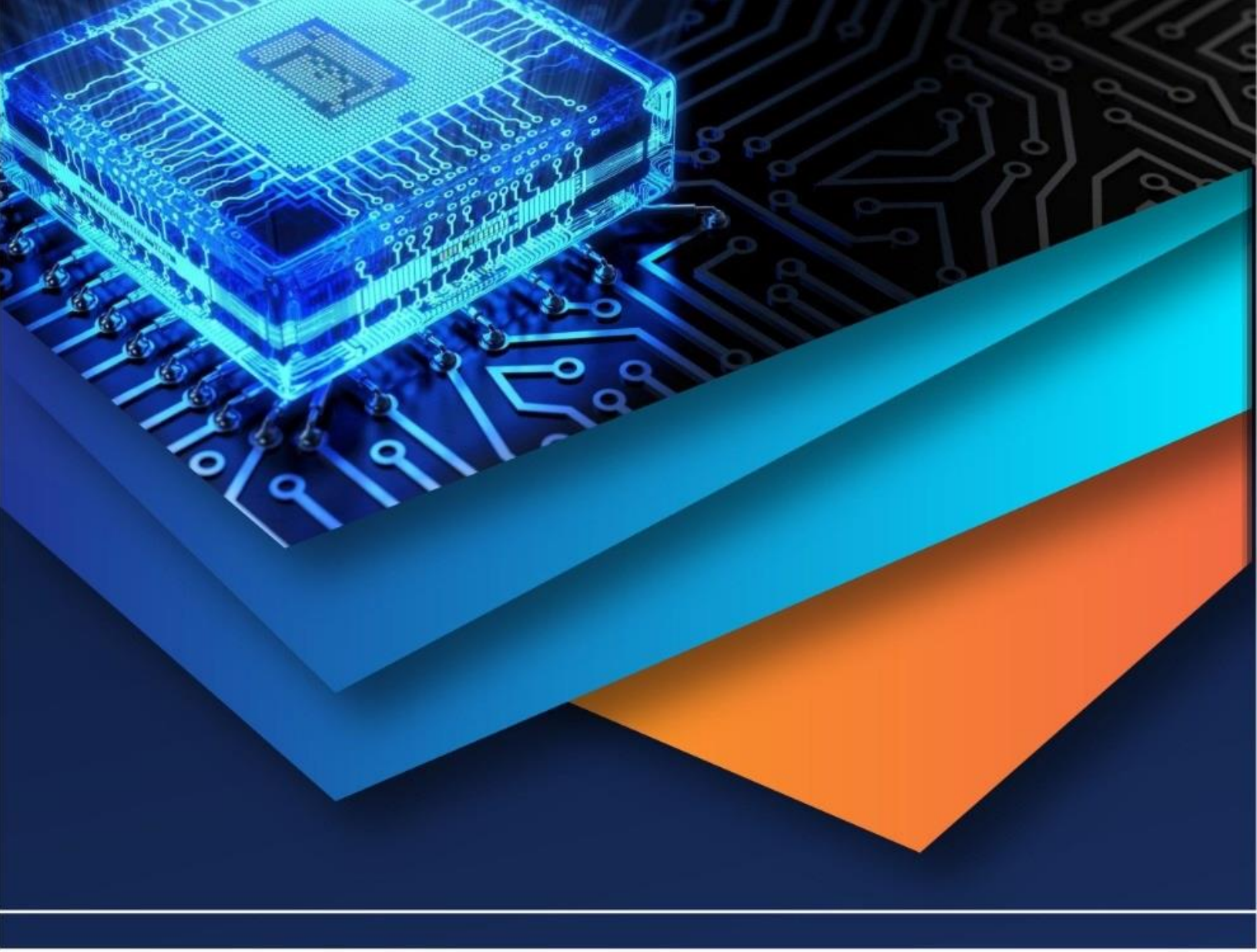

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