# Agricultural_Crop_Recommendations Using Machine Learning Techniques

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## *Abstract:*

***In India, agroecology has a long and distinguished history. Farmers face several obstacles in today's technology-driven environment when they endeavor to use conventional farming methods. Compared to traditional farming practices, precision farming is more modern. In order to help farmers make better planting choices, we are creating a system to predict crop yields using variables including area, rainfall, temperature, and district. This approach might be useful and insightful for the farmer. This article uses a variety of approaches, including Ridge Regression and Classifier. After applying these models to other datasets, we were able to significantly enhance their accuracy.***

## I. INTRODUCTION

Everyone knows that India's economy is built on agriculture. For the Indian people, farming is a way of life. The nation's 1.3 billion inhabitants are fed by the agricultural sector, which occupies over 60% of the landmass. Plants and animals are cultivated in agriculture. Civilization in India began with agriculture. Cultivating crops requires weather. This means that soil is very important for farming. If you want to grow healthy food, you need to know the weather. It lends a hand to the roots by supplying them with water, oxygen, and vital nutrients. In addition to being the home of all plants used in food production, soil is the bedrock of the food system. Various types of soil may be found in India. Cotton, rice, sugarcane, sunflower, maize, ragi, beans, tea, coffee, and laterite soil are all examples of these types of soil. The goal of better agricultural planning has been the subject of several research. Using a machine learning method, the crop may be suggested.

The capacity of machines to learn and do tasks normally performed by humans is known as machine learning, and it is a branch of AI.

To automate complicated jobs, artificial intelligence systems are used in the same manner as people. Data, whether monetary transactions, people, or images, is the starting point for machine learning.

To feed into the machine learning system's training data set, the data is gathered and processed. The software's performance improves as the data volume increases. The developer then chooses an ML model, loads the data into it, and trains the system to autonomously detect patterns or provide predictions.

## II. LITERATURE SURVEY

In order to achieve maximum economic development for the nation, this study offered a technique called the Crop Selection technique (CSM) in Reference [1] to solve the crop selection issue and optimize the net yield rate of the crop throughout the season. Crop net yield rate may be improved by the suggested technique.

All over India, farmers may make use of the intelligent crop recommendation system that was suggested and developed in this study (Reference [6]). Based on a number of geographical and environmental parameters, this technology would help farmers choose the best crop to cultivate. An additional system, Rainfall Predictor, has been put into place by us; it forecasts the amount of rain that will fall over the following twelve months.

According to Reference [2], this article details the study and development of a reliable method for predicting agricultural yields using monthly meteorological data in real-time. The fast regional climate change caused by global warming and the yearly occurrence of unusual weather events make it impossible to forecast agricultural crop output. There is an immediate need to create a system for predicting agricultural yields that makes use of real-time meteorological data. This study explains how to set up the prediction system and how to handle large amounts of weather data (monthly, daily). We use 33 years of agricultural weather data to build a non-parametric statistical model. Using the monthly weather data, we can forecast final production based on the model that

has been put into place. The outcomes of the model are detailed in this article.
By combining the strengths of many ensemble models—including Naive Bayes, CHAID, K-Nearest Neighbor, and Random Tree—this study suggests a strategy for making site-specific crop recommendations that are both highly accurate and efficient (Reference [7]).

## III. DATASET

We are using a variety of datasets for the system, all of which were acquired from official government websites and Kaggle.

1) Collections Contain: Production expenses for key crops in each state's dataset Data set yield, Some basic information about the datasets:

Secondly, the Yield Dataset includes, in kilograms per hectare, the yield for sixteen different important crops cultivated in every state. If the yield is zero, it means that the crop is not grown in that particular state.

Third, prepare the data by changing the null and 0 values for yield with -1. This will ensure that the forecast is unaffected. In order to feed the dataset into the neural network, we had to encode it further.

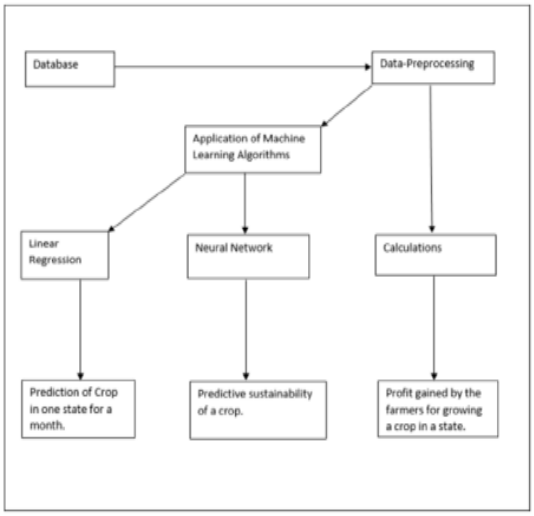
```
In [20]: crop_df=crop_df.dropna().reset_index(drop=True)
         crop_df
```

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




***Architecture of the System***

The structure and behavior of a system may be defined with the use of a conceptual model called a system architecture. A formal model of a system is what it is. There are two possible meanings of the term "system architecture," depending on the setting: a model to explain the system and a way to create it. Particularly in the beginning phases of a project, constructing a suitable system architecture facilitates analysis. The system architecture is shown in Figure 6.2 and is described in the section that follows.

## V. PROPOSED SYSTEM

1) We have presented a model that solves the current problems in this project. What makes the suggested system unique is its ability to both advise farmers on the most lucrative crops to grow in their area and help them optimize their crop production.
2) To assist satisfy the rising need for food in the nation, the suggested model offers crop selection based on environmental and economic factors, with the goal of maximizing crop production. State, district, region, and season are some of the variables that the suggested model uses to forecast agricultural yields. Fertilizer application timing is another area where the system shines. Production takes the following parameters from the user: State, District, Season, Crop, and Area. In order to utilize Crop Recommendation, the user must provide the following information: State, District, Season, and Area. The model estimates the harvest for a particular crop based on the need. Additionally, the program indicates when to apply fertilizers and which crops will provide the most profit.
4) Improving the range of crops that can be cultivated seasonally is the primary goal. Farmers would have an

easier time selecting crops and getting the most out of them with the suggested approach.

C. Benefits of the Suggested Approach

1) The crop production for the provided region's data sets is predicted by the suggested model. More improvements to the agricultural industry will result from integrating ML with agriculture, since yields will increase and resources will be optimized. To predict how things will go in the present, you need to look at the numbers from the past.

2) The recommended approach makes use of a recommender system to determine when fertilizers should be applied.

3) The suggested system's methodologies allow for greater crop yields, real-time crop analysis, efficient parameter selection, wiser decision-making, and increased yields.

## VI. CONCLUSION

In order to do my homework, I learnt a lot from a range of sources. I employed a variety of techniques, technologies, and strategies to make sure this job was finished well. We ran the software and got a 65.05 percent accuracy using the KNN models of the machine learning approach applied to the dataset. In this research, we are now exploring a variety of techniques, including artificial neural networks (ANNs) and support vector machines (SVMs). In order to make our project more efficient and precise, we take datasets from several government websites, such as https://data.gov.in/, and employ various factors and algorithms to reach the highest level of accuracy. We are able to get a maximum accuracy of 65.05 percent by using algorithms. This is the accuracy that was achieved by using the KNN algorithm. Finally, our trained algorithms help farmers make better crop choices by increasing production and decreasing the chance of crop failure by providing insights that typical farmers miss. Furthermore, it might have applications in the following domains: In addition, it protects them from any financial losses. Millions of farmers throughout the country will have access to the system thanks to an online extension. By creating custom training datasets and honing our architecture, we were able to overcome data mismatch issues and run on-device with low storage, processing, and memory requirements. The farmer would have a better notion of how much food he can anticipate to harvest if he followed the crop recommendations if the crop recommendation system and a yield predictor were integrated in the future.

## VII. RESULTS AND PERFORMANCE ANALYSIS

Several well-known methods, including logistic regression, neural networks, and KNN, were used for this research. Supervised learning is the foundation of all the algorithms. There are a total of three parts to our system:

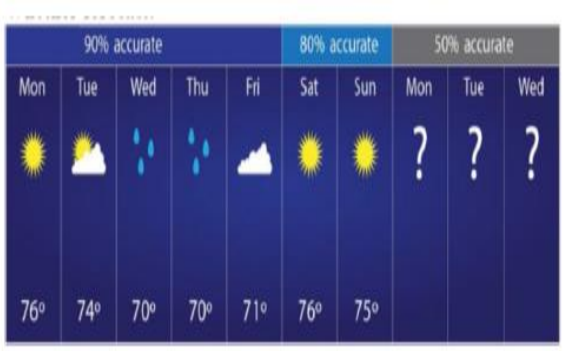
2) Crop Recommender Output:

```
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 [51]: 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 amount of supplementary and alternative features that can be included into the system.
2) Currently, it suggests a very suitable crop to grow based on datasets provided by KAGGLE and other government sites.
Thirdly, in response to comments, the system will soon include an automated feature.
4) The outcome may be adjusted based on the surrounding temperature, humidity, and water levels.
5) It is possible to update this such that it recommends crops with high yields in that region, avoiding those that are harmful to soil fertility and the environment because of their chemical components.

## IX. CODE

We have done our best to build the code in Python using various libraries according to the project requirements. The code execution takes place in the anaconda application's Jupyter notebook.
Additionally, we generate front-end code utilizing languages like JavaScript, HTML, CSS, and other frameworks like Bootstrap.

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