AI-Assisted Farming For Crop Recommendation and Farm Yield Prediction Application

Komal Soni, Pragya Kumari

1. INTRODUCTION

1.1 Overview

The objective of this project is (i) to create an application that recommends the farmers about the best crops to be cultivated based on climatic parameters, and also (ii) to predict the yield and revenue that would be generated for the cultivated land using Artifical Intelligence. The key challenges that a farmer faces are identifying the profitable crop, analyzing the market demand, forecasting prices, and determining the optimal time for sowing and harvesting. All of which can be done faster with AI using predictive analytics. We have used separate datasets from data.world. For crop recommendation, we have used two models using LGBM classifier and Extra Trees classifer algorithms. For crop yield, we have used Snap Boosting Machine and Decision Tree regression models.

1.2 Purpose

With this project, we aim to create an application that recommends the farmers about the best crops to be cultivated based on climatic parameters, and also to predict the yield and revenue that would be generated for the cultivated land using Artifical Intelligence.

2. LITERATURE SURVEY

2.1 Existing problem

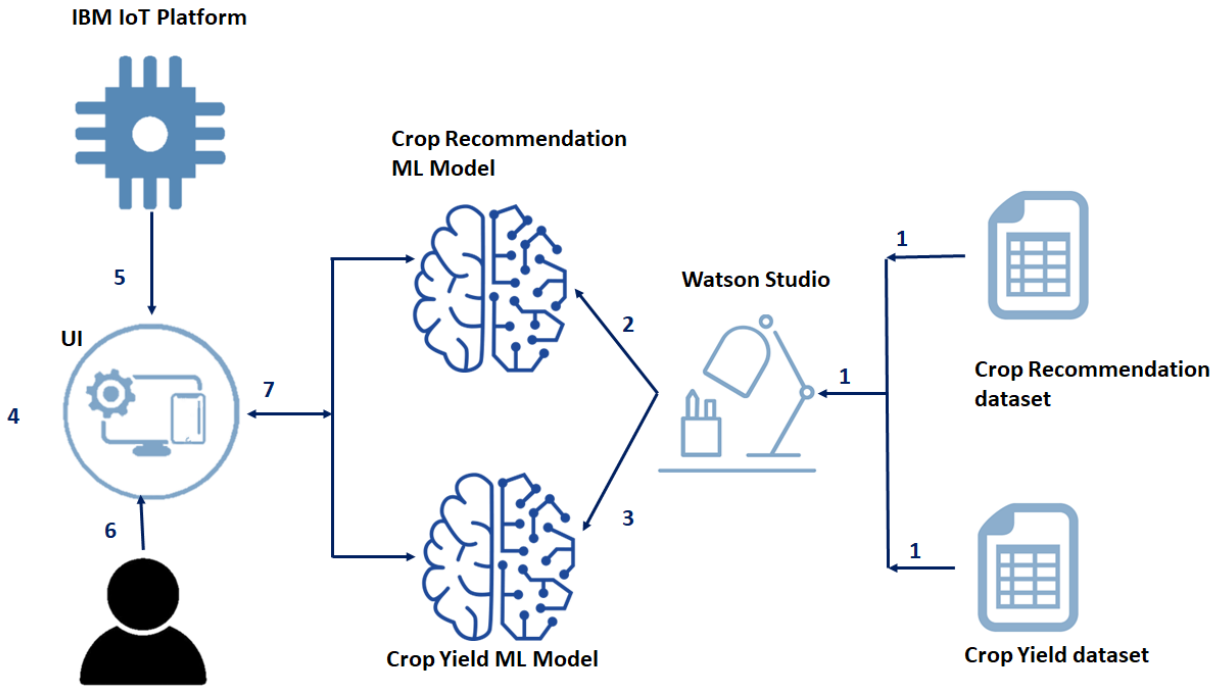
The most common problem faced by the Indian farmers is they do not choose the crop based on the necessity of soil, as a result they face serious setback in productivity. Also, most of the incentives for farmers are aimed towards post-yield/harvest effects that they face but we need more direct and useful solutions that are possible when we incorporate AI in agriculture which will enhance productivity.

2.2 Proposed solution

We propose a solution with which we can recommend the best crops to farmers, to be cultivated based on the climatic parameters, and also to predict the yield and revenue that would be generated for the cultivated land using Artifical Intelligence.

3. THEORETICAL ANALYSIS

3.1 Block Diagram



3.2 Hardware/Software Designing

HARDWARE REQUIREMENTS:-

- Processor: Minimum 1 GHz; Recommended 2GHz or more
- Ethernet connection (LAN) OR a wireless adapter (Wi-Fi)
- Hard Drive: Minimum 32 GB; Recommended 64 GB or more
- Memory (RAM): Minimum 1 GB; Recommended 4 GB or above

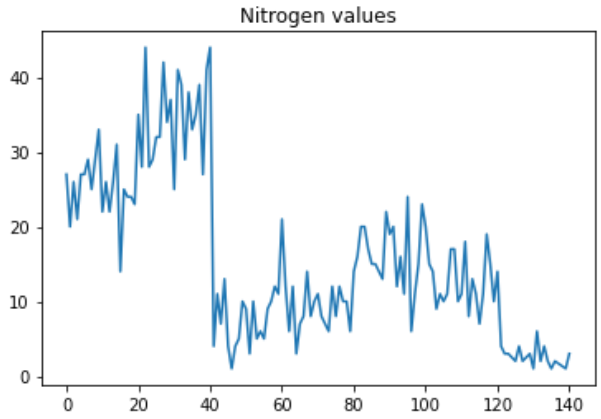
SOFTWARE REQUIREMENTS:-

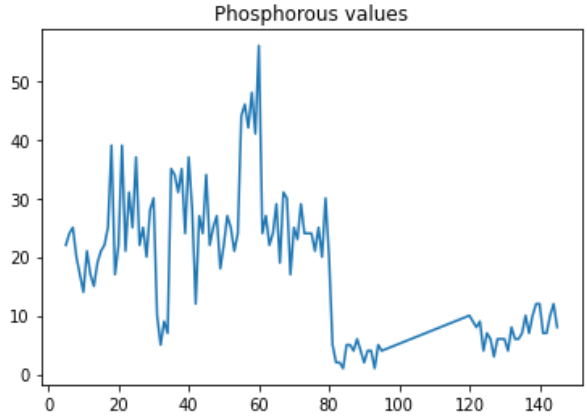
1. IBM Watsons Studio
2. IBM Auto AI
3. IBM Machine Learning
4. IBM NodeRed Service
5. IBM Cognos Analytics

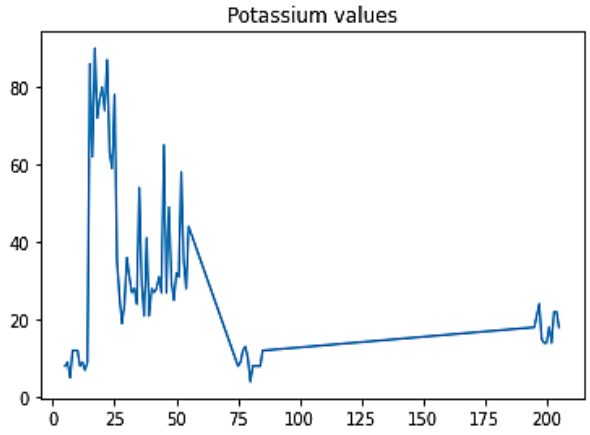
6. IBM Cloud

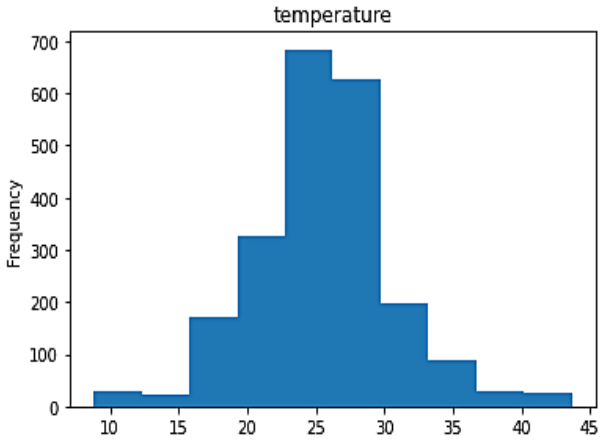
4. EXPERIMENTAL INVESTIGATIONS:

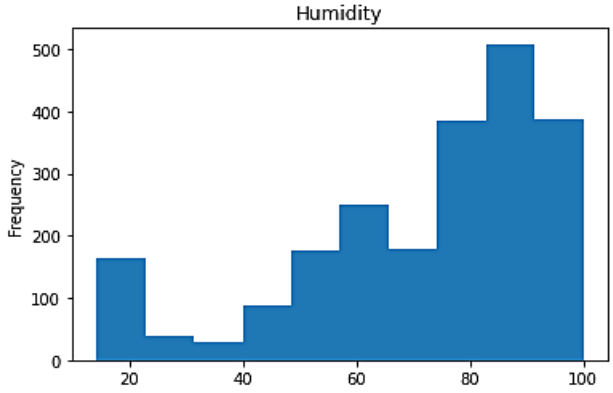
The datasets under consideration for crop recommendation and yeild prediction are datasets taken from kaggle. On studying the datasets we can achieve in depth knowledege of features of data and its nature. For the same purpose we plot the data to know the nature of various features present in data. These features are shown in the plots below.

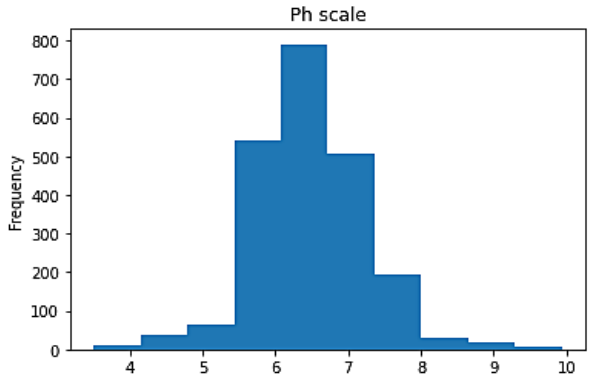


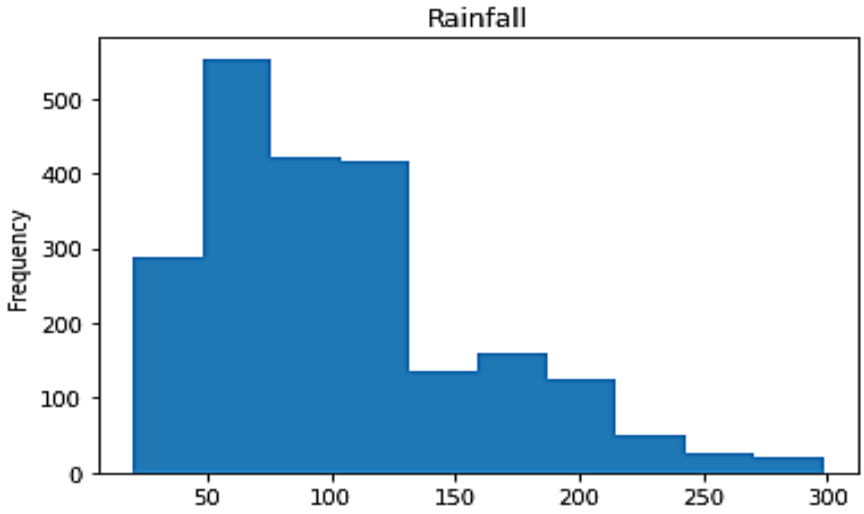






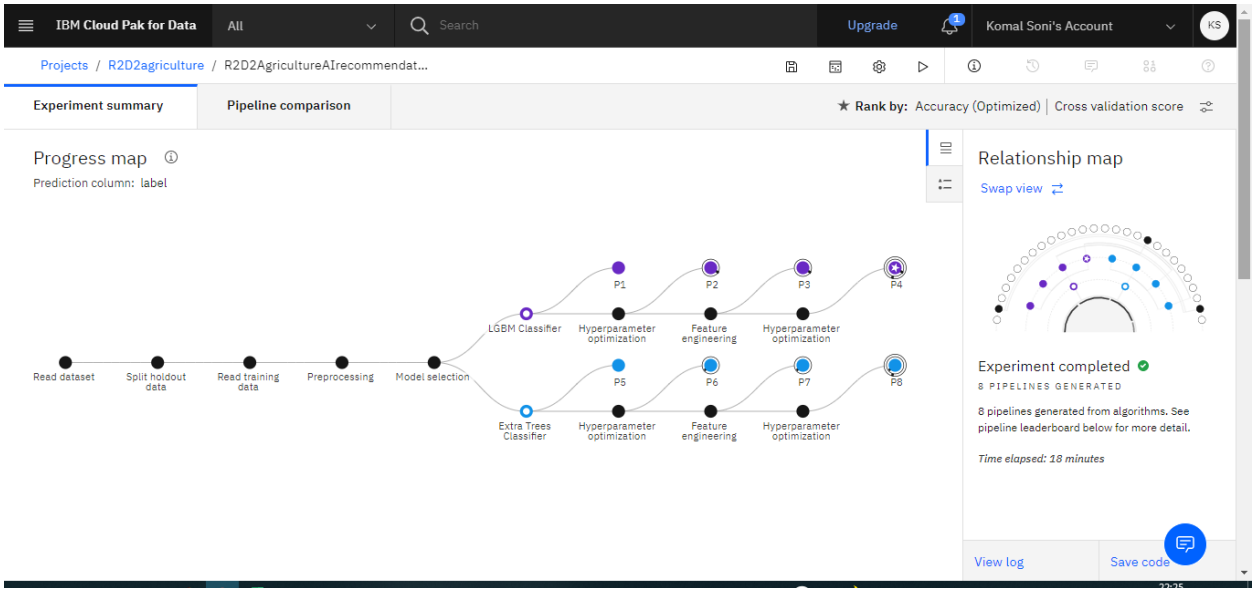




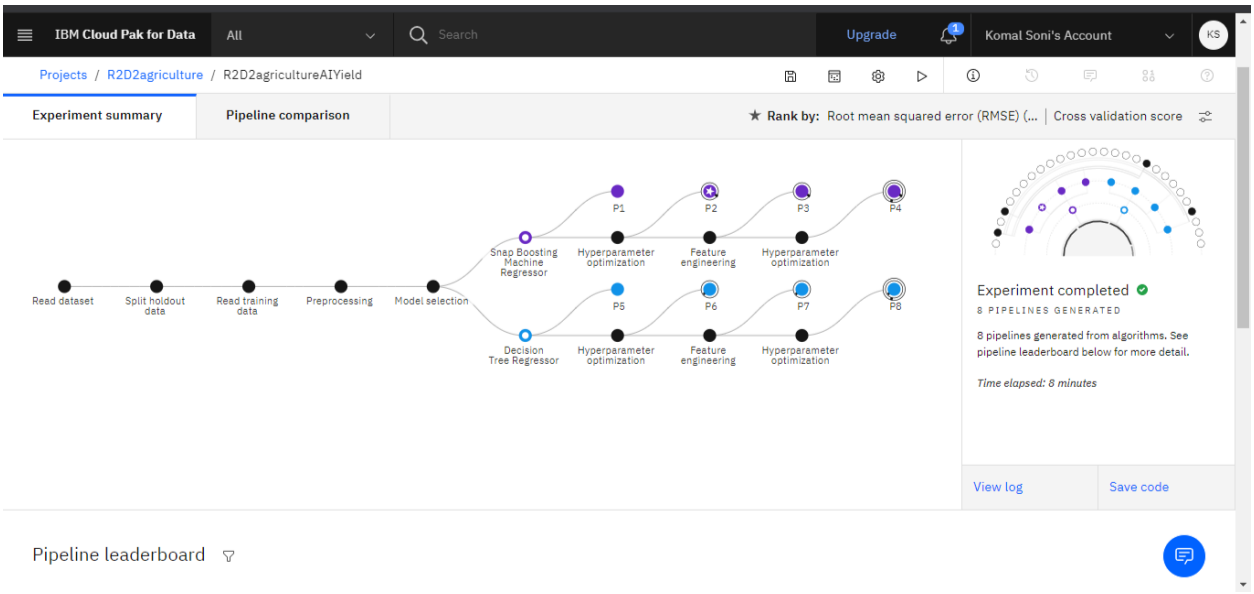


5. FLOWCHART

For the project we have developed two different models one for crop recommendation and the other for crop production or yeild prediction. Hence we obtain two different flows for both the models. For crop recommendation model in the first step dataset is split in train and test data. Then the holdout data is split and then the model reads training data. The model then preprocesses the data and then we select the best possible models. The models selected for crop recommendation are LGBM classifier and Extra Trees Classifier. Then for both the models we perform hyperparameter optimization, feature engineering followed by hyperparameter optimization using various pipelines to obtain the best performing model.

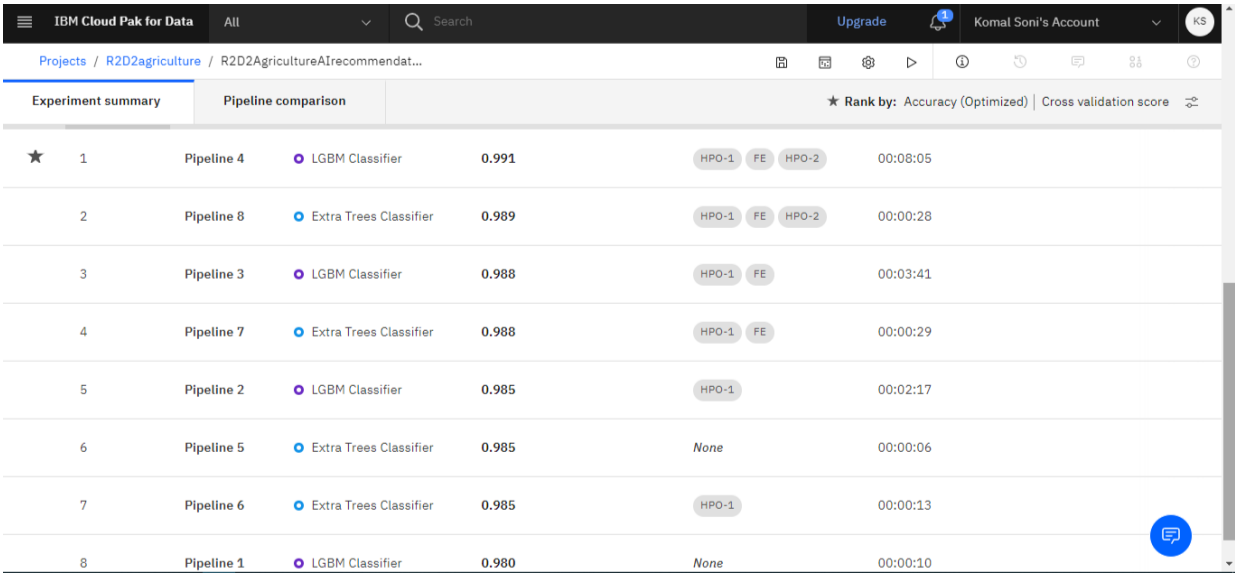


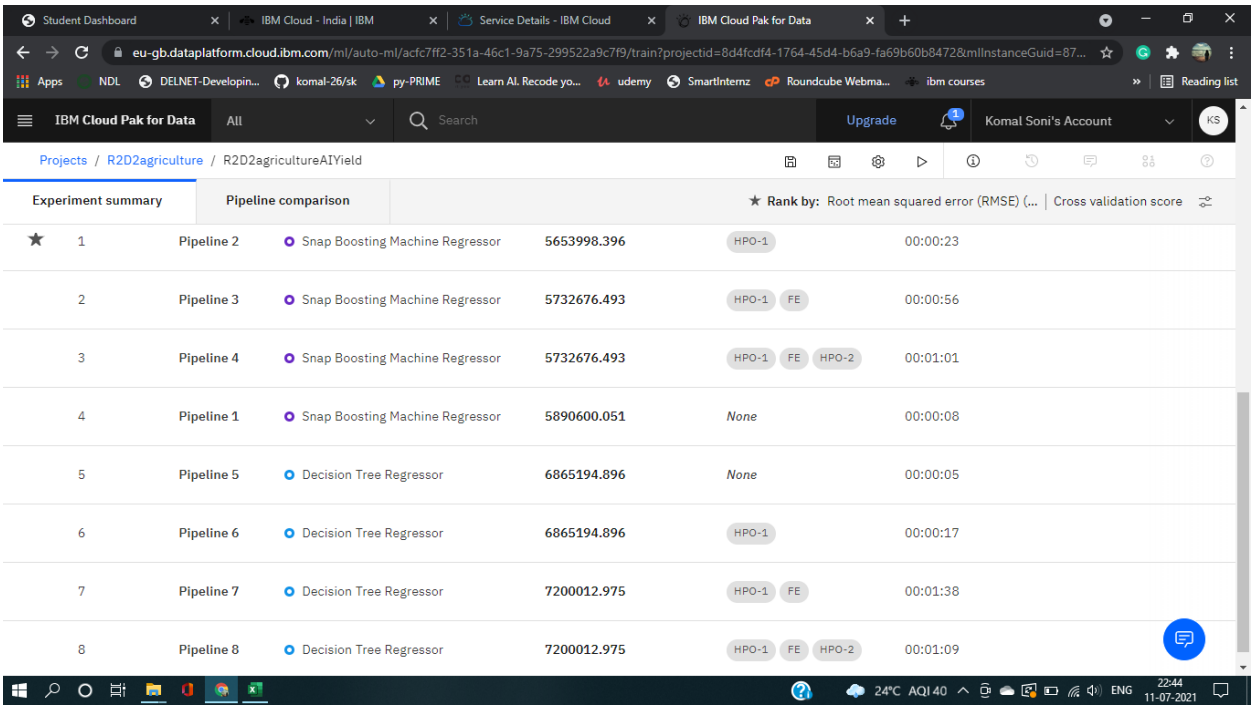
For crop yeild prediction model in the first step dataset is split in train and test data. Then the holdout data is split and then the model reads training data. The model then preprocesses the data and then we select the best possible models. The models selected for crop yeild prediction are Snap Boosting Machine Regressor and Decision Trees Regressor. Then for both the models we perform hyperparameter optimization, feature engineering followed by hyperparameter optimization using various pipelines to obtain the best performing model.



6. RESULT

On building the models successfully we come to a an conclusion that, for crop recommendation model LGBM classifier provides the best results with the accuracy of 0.991 and for crop yeild prediction the Snap Boosting Machine Regressor provides the best results with RMSE value 5653998.396





7. ADVANTAGES AND DISADVANTAGES:-

Predictive analytics can be a real game-changer. Farmers can collect and process significantly more data and do it faster with AI than they would otherwise. Analyzing market demand, forecasting prices, and determining the optimal time for sowing and harvesting are key challenges farmers can solve with AI.

Combining artificial intelligence and agriculture can be beneficial for the following processes.

Analyzing market demand-AI can simplify crop selection and help farmers identify what produce will be most profitable.
Managing risk-Farmers can use forecasting and predictive analytics to reduce errors in business processes and minimize the risk of crop failures.

Monitoring soil health- AI systems can conduct chemical soil analyses and provide accurate estimates of missing nutrients.

Protecting crops-AI can monitor the state of plants to spot and even predict diseases, identify and remove weeds, and recommend effective treatment of pests.

Harvesting- With the help of AI, it's possible to automate harvesting and even predict the best time for it.

Disavantage- IOT sensors are not used in this model so we have to manually enter the inputs and make the prediction out of it.

Hence making prediction is quite difficult and time consuming.

8. APPLICATIONS

Agriculture- This is a project which is mainly based on recommending profitable crops based on the climatic parameters following which we predict the yield and revenue thus generated for the cultivated land.

9. CONCLUSION

After analysing various models for crops recommendation and crop yeild prediction, we can conclude that LGBM classifier and Snap Boosting Machine Regressor are the best model for crops recommendation and crop yeild prediction respectively.

10. FUTURE SCOPE

The major advantage of focusing on AI based methods is that they tackle each problem separately and rather than generalising, provide customised solutions to a specific problem.

Predictive and Recommendation Analytics – AI and Machine learning can help farmers by recommending the sowing dates for different crops based on weather conditions. ML models can also suggest tweaks in cropping patterns to boost yields. Using the historic production data, weather forecasts, seed information, and demand and supply information, ML can be used to forecast the amount of seed that should be grown to fulfil the growing needs.

Supply Chain management- AI can be used to predict the demand by analysing inputs like rate of population growth, historical demand patterns of food commodities, region wise staple food patterns, among other inputs. This information can be used to efficiently modify the cropping patterns and also minimise wastage of crop yields and increase profits to farmers.

Identifying Plant Diseases – Crop images are analysed using computer vision technology and segmented into areas like background, healthy part and diseased part. The diseased part is then captured and sent to remote labs for further diagnosis.

11. BIBLIOGRAPHY

[1]Prashant Banarjee "Breast cancer prediction Dataset"

https://www.kaggle.com/prashant111/lightgbm-classifier-in-python

[2]Siddharth Sharma ""Maximize agricultural yield by recommending appropriate crops"

https://www.kaggle.com/siddharthss/crop-recommendation-dataset

[3]Alexander Larko "Homesite Quote Conversation"

https://www.kaggle.com/alexxanderlarko/extratreesclassifier

[4]Yuhai " BNP Paribas Cardif Claims Management

"https://www.kaggle.com/yuhaichina/extratreesclassifier-score-0-45911

[5]Mark Kazazgarian" Bike Sharing in Washington D.C. Dataset

"https://www.kaggle.com/marklvl/decision-tree-regressor-on-bike-sharing-dataset

[6]Muralish"multiple data sources"

https://www.kaggle.com/mcmuralishclint/decision-tree-regression

APPENDIX

Crop Recommendation Code:

https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/8d2fabc5-a9cd-410c-8ad3-7546f2fa8bd3/view?access_token=7dbbb2bd4aeee80ea0c1b2c734f2632c507f914eef5929c1731590c4d80e42a5

Crop Yeild Prediction Code:

https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/b554295e-54da-4c00-9f9b-613f1ebe17da/view?access_token=dafe7194163348e06421fcea019a756421806890159e50b02200e18aa1b232de

Dashboard Code:

https://github.com/smartinternz02/SBSPS-Challenge-5215-AI-Assisted-Farming-for-Crop-Recommendation-Farm-Yield-Prediction-Application/blob/master/flows%20(7).json

Dashboard URL:

https://node-red-aptbf-2021-06-27.eu-gb.mybluemix.net/ui/#!/0?socketid=cQyK2jOk-neYHKfPAAAD