Crop Prediction Using Machine Learning

Mohd Farhan & Mohit Kumar Srivastawa

Department of CSE
Galgotias University
Greater Noida, Uttar Pradesh, India

Abstract*—Agriculture is a crucial occupation in India, serving as a cornerstone of the country's development. In fact, approximately 60nation's land is devoted to agriculture in order to meet the needs of its vast population of 1.2 billion individuals, wherefore further developing yield creation is thus considered a critical part of agribusiness. Essentially assuming we have a portion of land, we want to realize what sort of crops are beneficial to grow here. Farming relies upon the different soil properties. A good yield of crops is a troublesome assignment since it includes different variables like soil type, temperature, humidity and so on. Be that as it may, in the present time, food production and expectations of yield is getting hampered because of unwanted weather changes, that will unfavourably influence the economy of the people involved in the farming business, especially the farmers, by getting a destitute yield and furthermore causing the farmers to stay less recognizable in determining the future harvests. In the event that it is feasible to track down the It would be incredibly helpful for farmers and others to know the expected yield before planting their crops decide and take decisions which are beneficial for their business. The proposed project would take care of agricultural issues by considering the farming region based on soil properties and suggesting the most fitting crops to grow to the farmers, subsequently assisting them with fundamentally increasing the yield and diminishing the chance of a misfortune. Our proposal is a framework which utilizes diverse machine learning methods like unsupervised learning, K-Means clustering, Predictive Mod- elling, Logistic Regression, and so on with the end goal being that it suggests the most reasonable crop to grow according to the given soil conditions. The data required for seed of the crop are gathered here, with the other suitable conditions such as temperature, moisture content (humidity) and rainfall, which assist an effective yield. This framework subsequently reduces the monetary misfortunes that a farmer can face brought about by taking a baseless decision to grow a crop without analysing the conditions on a microscopic level. Furthermore, this framework also assists the farmers by letting them explore future prospects and educating them on what other kinds of crops are more suitable to grow in their region

***Keywords*—Machine Learning, Unsupervised learning, Predictive Modelling, K-Means Clustering, Logistic Regression.**

I. Introduction

Farming and farmers, play a significant part in the existence of each person. Since ancient times, agribusiness is viewed as one of the principal occupations and practices followed in India. In the past, people in India used to grow crops in their own land to fulfil their basic needs. Today, the agricultural sector remains a vital part of the country's economy, and advancements in innovation and technology have helped to strengthen it in response to the public's needs. With the growing population, these advancements are expected to play a crucial role in addressing the needs of every individual..

A. Problem Statement

The choice of a farmer in regards to which kind of crop he should cultivate and grow, by and large relies upon his instinct and numerous different factors, for example, creating immense gains inside a brief timeframe, absence of mindfulness about the interest and demand of the market and when he misjudges the potential and capability of soil to support the growth of a particular type of crop is an important factor in agricultural development. A wrong choice on the farmer's end could negatively effect the financial state of his family, bringing about serious misfortune. To avoid such situations, we can perceive how much stress and tension a farmer faces to decide which crop would be advisable for him to cultivate in his farm land.

B. Proposed Solution

So presently the main perspective is to plan a proposal framework system that can forecast the appropriate crop to cultivate in a particular area of land, thereby assisting farmers. Considering already stated point we own chosen to evolve a framework that analyses the soil characteristics for instance soil nutrients and acidity value along with thus anticipated reasonable crop perhaps be filled around there. The dataset as of now comprises NPK and PH indicators upsides pertaining to the soil and crop seed requirements of various plants that can be sown in the given soil. For our proposed frame- work, we use Machine learning algorithms are based on the concept of learning, which involves improving performance at a given task through experience and information gained from previous tasks. In this case, a program learns from data and information (referred to as 'E') about specific tasks ('T') and their performance ('P'). As the program learns from its experiences, it is able to automatically improve its performance at the given task. Thus, machine learning is a subset of artificial intelligence that enables machines to learn and improve without explicit programming. Programs are designed to take input and produce output in a way that facilitates learning and improvement.

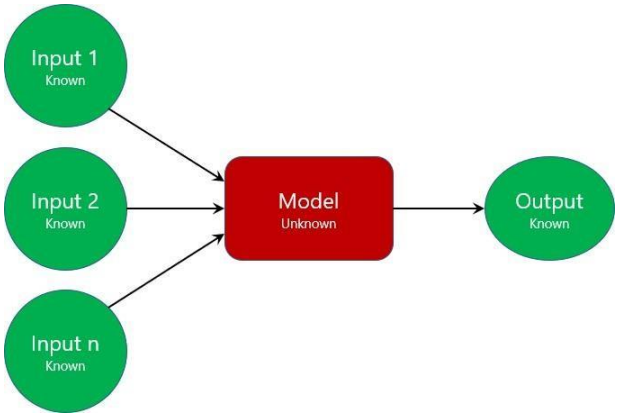


Fig. 1. Machine Learning

Two of the most common Machine Learning techniques which are widely used are: supervised learning and unsupervised learning. This undertaking utilizes the concept of unsupervised learning's clustering techniques to recommend the best possible crop to grow. In unsupervised learning, an AI framework will create clusters using the unsorted and unlabelled data as per similarities and contrasts.

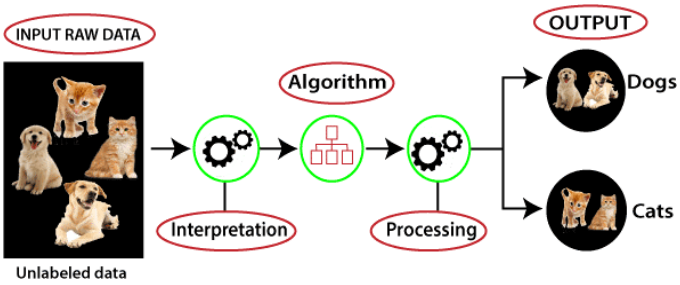


Fig. 2. Unsupervised Learning

Unsupervised learning algorithms can perform more complex computations when compared to supervised learning frameworks. The goal with unsupervised learning is to create and use algorithms which can help to identify patterns inside the given training dataset and categorize the input based on the recognized patterns by the framework. The algorithm analyzes the valuable underlying structure of the data and extracting valuable and informative features and highlights from them. In this manner, these calculations are relied upon to produce explicit results from the unstructured input data by searching for connections and relation between each input object.The agriculture sector could see a significant impact from the adoption of machine learning (ML), which has rapidly become a popular concept.

II. Literature Review

Ashwani Kumar Kushwaha [1] explains crop yield forecasting Suggest methods and suitable crops so that it can be improved Profit for farmer and quality of agricultural sector.In this paper is widely used for crop yield forecasting Using the data is known as big data (soil and weather data). Hadoop Platform and Agro Algorithm. Hence repository based The data will predict suitability crops for a particular condition and improve crop quality.

Girish L [2] explain the forecasting of crop yield and rainfall Using machine learning method. In this paper they went Through a different machine learning approach for Forecast and also mention the rainfall and crop yield Performance of discrete machine learning algorithms such as Liner Regression, SVM, KNN method and decision tree. In it Algorithms They conclude that SVM has the highest efficiency For rain forecast.

Rahul Kataria [3] describes various machine learning Methods used to boost crop yield. In this paper they Went through various artificial intelligence techniques viz As a machine learning algorithm, big data analysis for precision Agriculture He explains about crop recommendation system Using KNN, ensemble-based models, neural networks, ... etc

A. Based on the Literature Survey

Approximately 60purposes to meet the demands of its 1.3 billion population, which continues to increase daily. Therefore, modernizing agriculture is imperative to ensure the profitability of farmers and address their numerous challenges. Current frameworks lack a strong connection between farmers and any agriculture-based technology. Traditionally, farmers have relied on a "trial and error" method, experimenting with various crops on their cultivation land until they achieve the desired yield. There are some past frameworks which help in selection of crop but their accuracy is questionable and can be greatly improved. Several older frameworks rely on diverse techniques for predicting and suggesting crops based on weather-related input parameters. However, crop growth is influenced by various other factors beyond climatic and weather conditions. There are multiple framework proposals on crop prediction that have stated different approaches using various machine learning algorithms are available for prediction purposes and recommendation. But no such framework has been able to be implemented at a large scale as of today. So, there is a big need to implement such a framework so that farmers can gain benefits.

III. DESIGN OF PROPOSED SYSTEM

The framework we propose aims to forecast the optimal crop to cultivate in a given land region by taking into account soil nutrient levels, temperature, humidity, pH value, and rainfall.

A. Technologies Used

1. Machine Learning 2. K Means Clustering 3. Unsupervised Learning

IV. Tools Used

1. Python: Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation through the off-side rule. Python is dynamically typed and garbage collected.

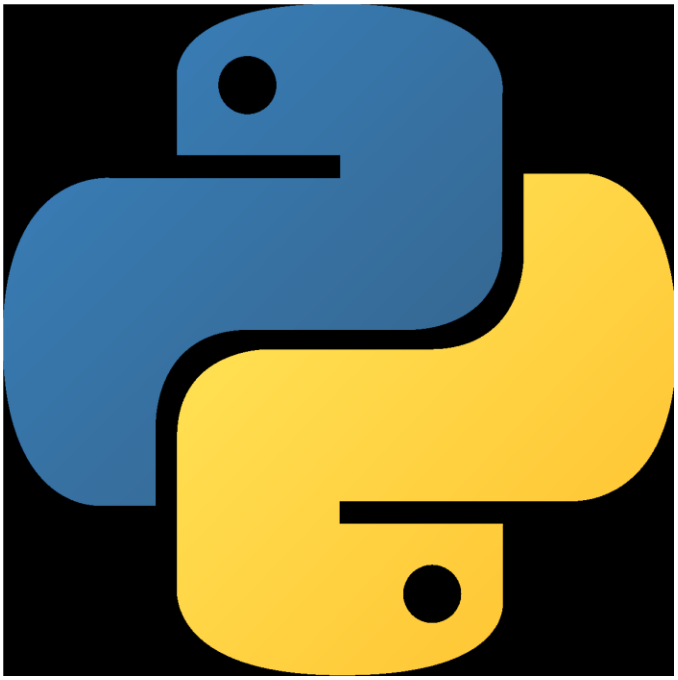


Fig. 3. Python.

A. Pandas:

Pandas is a software library present in the Python programming language for data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series.

B. Numpy:

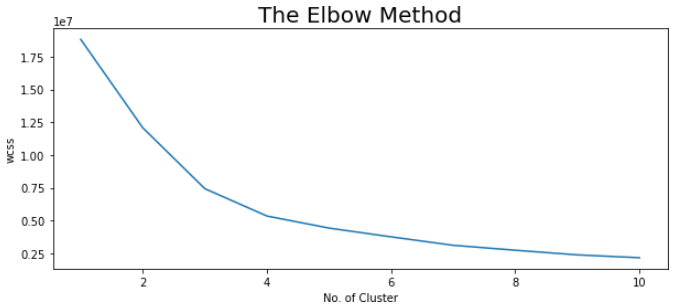
NumPy is a widely used Python library that is primarily used for array manipulation. In addition to its array capabilities, NumPy also provides functions for working with linear algebra, matrices, and Fourier transforms.

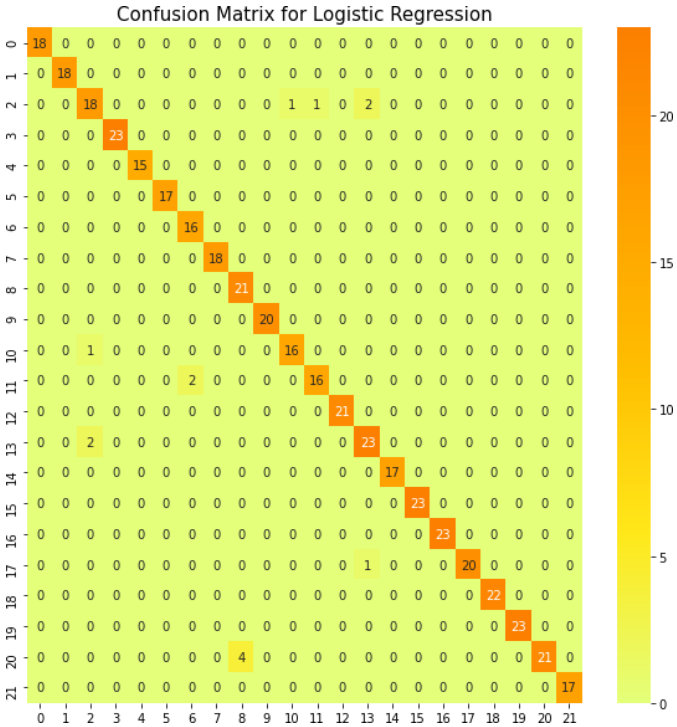
C. ipywidgets:

ipywidgets, also known as Jupyterwidgets or widgets, are HTML widgets that support interactivity and can be used in conjunction with Jupyter notebooks and the IPython kernel. By leveraging these widgets, notebooks become more dynamic and userfriendly, enabling users to have greater control over their data and visualize real-time changes with ease

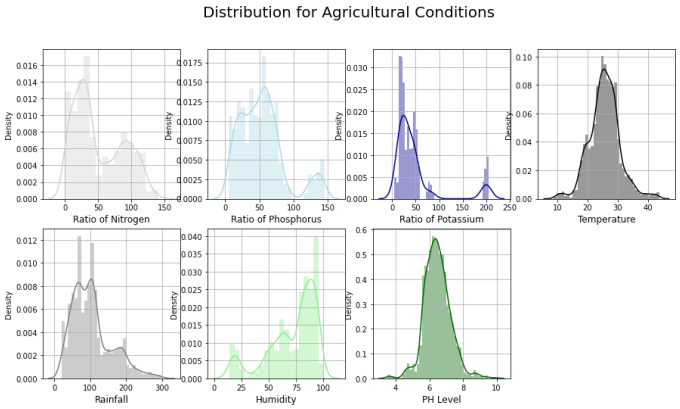
V. Result

In the return part the system shows the best crop. Our project is focused on offering crop recommendations that are appropriate even when soil conditions are altered due to natural disasters like floods and soil erosion. The recommendation system relies on the K-Means Clustering algorithm, which considers soil characteristics such as Nitrogen, Phosphorus, Potassium, pH value, among other factors, as inputs. The algorithm searches for the crop that has a value closest to the input values, resulting in a list of crops that are the most suitable based on comparable values. We chose this algorithm due to its simplicity and higher convergence rate compared to other alternatives. Soil characteristics, such as Nitrogen, Phosphorus, Potassium, as well as climatic conditions such as rainfall and humidity, are the inputs to the algorithm. V.





Here we have taken a sample input providing all the required parameters and the suggested crop that we get is: ‘RICE’ as can be seen in the given output:




```
In [20]: prediction = model.predict((np.array([[90,
                                                40,
                                                40,
                                                20,
                                                80,
                                                7,
                                                200]])))
         print("The suggested Crop for Given Climatic condition is :", prediction)

         The suggested Crop for Given Climatic condition is : ['rice']
```

VI. Conclusion

At right now, our farmers are not taking help of machine and analysis at a larger scale, so they face many risks affecting their income and livelihood. To reduce those type of loses, we have proposed a farmer friendly framework, that will recommend which would be the best and most suitable crop for a particular land area also providing information about required nutrients to add up, required seeds for cultivation. So, this will help the farmers to take decisions based after anlayzing in depth and as a result, selecting the best crop for cultivation. The proposed framework can work wonders if it can be recognized in the agricultural domain.

VII. Future Scope

We can implement the proposed framework by integrating it on a website or an Android/IOS application as giving this framework a great and easy to use User Interface could really help in delivering it to a large section of the farmer community. We can also add the GPS locations feature so that we can increase the land data of various regions in the system. We can also apply for a legal tender to take access of the Rain forecasting system by the government. In the future, this framework can also be integrated to other emergingtechnologies like Internet of things (IOT).

References

[1] Ashwani kumar Kushwaha, Swetabhattachrya "crop yield prediction using agro algorithm in hatoop"

[2] Girish L, Gangadhar S, Bharath T R, Balaji K S, Abhishek K T "Crop Yield and Rainfall Prediction in Tumakuru District using Machine Learning".

[3] Rahul Katarya, Ashutosh Raturi, Abhinav Mehndiratta, Abhinav Thapper "Impact of Machine Learning Techniques in Precision Agriculture".

[4]] Pijush Samui, Venkata Ravibabu Mandla, Arun Krishna and Tarun Teja "Prediction of Rainfall Using Support Vector Machine and Relevance Vector Machine".

[5] Himani Sharma, Sunil Kumar "A Survey on Decision Tree Algorithms of Classification in Data Mining".

[6] Pavan Patil, Virendra Panpatil, Prof. Shrikant Kokate "Crop Prediction System using Machine Learning Algorithms".

[7] Prof. D.S. Zingade ,Omkar Buchade ,Nilesh Mehta ,Shubham Ghodekar ,Chandan Mehta "Crop Prediction System using Machine Learning"

[8] Kevin Tom Thomas , Varsha S , Merin Mary Saji , Lisha Varghese , Er. Jinu Thomas "Crop Prediction using Machine Learning".

[9] Nischitha K, Dhanush Vishwakarma, Mahendra N, Manjuraju M.R, Ashwini "Crop Prediction using Machine Learning Approaches"

[10] "CROP YIELD PREDICTION USING K-MEANS CLUSTERING" Capstone Design Spring 2020 Amine Bouighoulouden Dr. Ilham Kissani.

[11] "Crop prediction based on soil and environmental characteristics using feature selection techniques" by A. Suruliandi,G. Mariammal S.P. Raj

[12] "Crop Yield Prediction Using Supervised Machine Learning Algorithm" Hardik Joshi, Monika Gawade, Manasvi Ganu, Prof. Priya Porwal

[13] P. Johri, J. N. Singh, A. Sharma and D. Rastogi, quot;Sustainability of Coexistence of Humans and Machines: An Evolution of In- dustry 5.0 from Industry 4.0,quot; 2021 10th International Con- ference on System Modeling amp; Advancement in Research Trends (SMART), MORADABAD, India, 2021, pp.410-414, doi: 10.1109/SMART52563.2021.9676275.

[14] Johri, P., Singh, J.N., Khatri, S.K., Bagchi, A., Rajesh, E. (2022). Role of Satellites in Agriculture. In: Moh, M., Sharma, K.P., Agrawal, R., Garcia Diaz, V. (eds) Smart IoT for Research and Industry. EAI/Springer Innovations in Communication and Computing. Springer, Cham. https://doi.org/10.1007/978-3-030-71485-7$_6$