ISSN No:-2456-2165

Eco-Fertilization using Ml Technique

Mohd.Anwar Ali[1], Anakala Harini[2], Vattamwar Akshya[3], Gandrath Manish[4], A. Dharmesh Sai Suraj[5]
Department of InformationTechnology MLR Institute of Technology Hyderabad, India

Abstract:- Expert guidance on best practices for fertilizer usage can help farmers achieve higher yields and reduce fertilizer losses, even though they generally have limited control over their fertilizer use. Additionally, rainfall volume and timing play a crucial role in nutrient loss, with moderate rainfall at the right moment aiding nutrient infiltration and dissolution, while excessive rainfall can lead to nutrient runoff and loss, including vital nutrients like nitrogen, phosphorus, and potassium.

To tackle these challenges, a nutrient recommendation system is proposed in this paper. The system utilizes an updated version of the Random Forest algorithm based on time-series data to determine the optimal nutrient amounts required by different crops, taking into account rainfall patterns and crop fertility. By using this system, farmers can enhance soil fertility, minimize the risk of leaching and runoff, and create optimal conditions for crop growth.

I. INTRODUCTION

The agriculture sector occupies a significant position in the agriculture sector and occupies a significant position in the national economy as it contributes approximately 17-18% to India's gross domestic product (GDP). India also ranks second in the world in terms of agricultural production, highlighting the vital role of agriculture in the country's economic growth. Crop fertilization and rainfall are closely related because rainfall affects the effectiveness of fertilizers in promoting crop growth.

Sufficient rainfall after fertilization can facilitate the infiltration of nutrients into the soil and their absorption by plant roots, ultimately leading to improved crop productivity. Lack of rainfall can cause fertilizers to remain on the soil surface, causing them to evaporate or be blown away by the wind. Excessive rainfall can cause fertilizer runoff, which can result in nutrient loss and reduced crop productivity. Rainfall timing is also key to fertilizing crops, as rainfall shortly after fertilization helps dissolve fertilizers and move them into the soil. Excessive rainfall can lead to leaching, where nutrients are carried away from the root zone and lost from the soil. Different crops have different fertilizer requirements and sensitivities to rainfall, and farmers must take these factors into account when fertilizing their crops. Taken together, fertilization and rainfall are interdependent factors that affect crop growth and productivity, and farmers must manage them carefully to maximize their agricultural production.

Nitrogen (N), phosphorus (P) and potassium (K) are the three most important macronutrients that plants need for their growth and development. These nutrients play a vital role in various physiological processes in the plant, and their availability in the soil can have a significant effect on crop yield and quality. Nitrogen is essential for the formation of chlorophyll, the green pigment in plants that is responsible for photosynthesis. Phosphorus is involved in energy transfer in the plant and is also important for root development and water uptake. Potassium is important for regulating the water balance in the plant. It also helps plants resist stress and disease and can improve the quality of fruits and vegetables.

Predictive analytics is a data analysis technique that involves the use of machine learning algorithms and statistical methods to analyze historical and current data to predict future events or trends. The objective of utilizing predictive analytics is to discover patterns and connections within data that enable informed decision- making regarding upcoming results. Random forest is a popular machine learning and predictive analysis algorithm that belongs to the category of ensemble methods. The algorithm is based on decision trees, where multiple decision trees are trained on different subsets of data and their outputs are combined to produce a final prediction. To use the random forest algorithm in this project, we trained the model using historical data on crop nutrient requirements and rainfall. The model was then used to predict the amount of nutrients the crop needed based on the amount of rainfall.

II. LITERATURE SURVEY

A. Gap Analysis

Traditionally, farmers have used a fixed amount of fertilizers for a specific type of crop, which can result in excessive use of fertilizers and water pollution. Although there are existing models related to soil fertility for certain types of crops or specific regions, their accuracy may be limited. However, by utilizing the Random Forest algorithm, we can potentially improve the accuracy of these models. Our project aims to cover a wide range of crops present in India, unlike existing models which only focus on specific crops or regions.

B. Existing Methodolgy

In the past, farmers used knowledge and assumptions to determine the right fertilizer to apply to their crops, but now there are machine learning models that can predict the amount of nutrients needed for a specific type of crop or location. More. Deep learning models using Elm Machine Learning Extreme algorithms to predict nutrient requirements based on climate conditions of previous systems had limited accuracy and all the existing models only focused on a single type of crop, and some projects did not account for weather conditions.

III. PROPOSED METHODOLOGY

The system being proposed employs the random forest algorithm to analyze user-provided information and generate precise predictions. If nutrients are used excessively or inadequately, it may result in reduced crop yields. This study aims to supply the appropriate amounts of nutrients, such as N, P, and K, based on the weather patterns of a designated

location for 7 days.

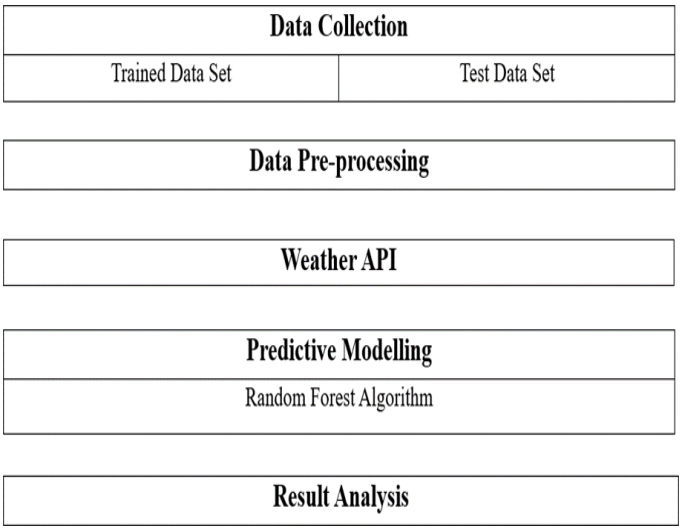

Fig. 1: System Architecture of proposed system

IV. IMPLEMENTATION

A. Data Preprocessing

To prepare the data for our system, we perform data pre-processing by selecting and extracting only the pertinent information from the acquired dataset. This typically involves identifying and including data on the crop type, the required N, P, K values for that crop, and relevant weather conditions like temperature and rainfall. Any extraneous data is excluded, resulting in a streamlined and useful dataset that can be effectively utilized by our system.

➢ *Weather Forecast*

In order to put the proposed system into operation, it is necessary to obtain the latest weather forecast for the designated area. To do this, we will establish a connection between our system and the weather API and get only the key information such as temperature, precipitation and humidity.

B. Train and Test data

To train the model, we need to apply the random forest algorithm on the training dataset, specifying the number of decision trees to be used. After training, we can evaluate the performance of the model by testing it on the test dataset.

C. Random Forest Algorithm

The Random Forest algorithm is a powerful machine learning algorithm that can process large amounts of data and is capable of making accurate predictions. It has several advantages over other algorithms. One of the main advantages of the Random Forest algorithm is its ability to handle large data sets with a large number of input variables. It creates a large number of decision trees and combines their outputs to generate predictions. Each decision tree is developed using a random subset of the data and training functions.

This process reduces the risk of overfitting and improves the ability of the model to generalize to new data.

In this context, the algorithm calculates the average of the predictions of all decision trees. This method of combining multiple models improves the robustness and accuracy of the models.

When constructing a decision tree, we first select an element to partition the data set according to its impurity, choosing the element with the lowest impurity or Gini index as the root node.

$$Gini\ Index = 1 - \sum_{i=1}^{n} (P_i)^2$$

$$= 1 - [(P_+)^2 + (P_-)^2]$$

For training our random forest regression model, we will be utilizing the sklearn module, specifically the RandomForestRegressor function. This function has several important parameters that need to be considered, such as:

- **n_estimators:** specifies the number of decision trees that will be used in the model.

ISSN No:-2456-2165

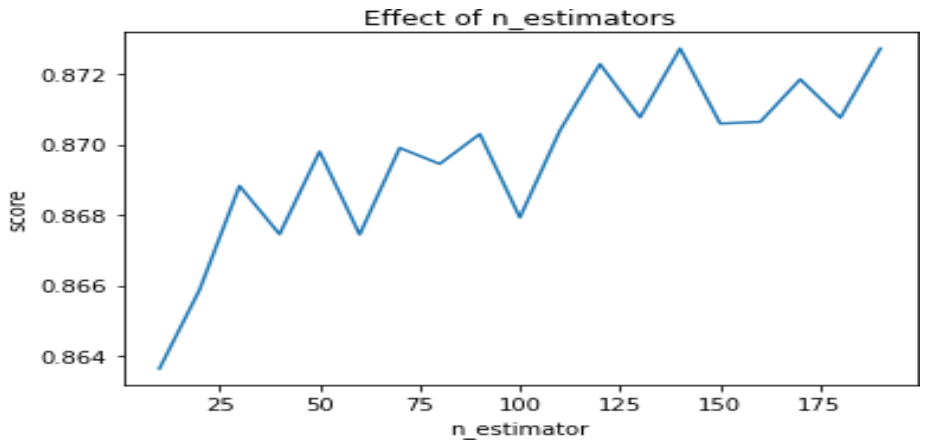

Fig. 2: Graph

- **criterion:** allows us to choose a loss function that the model will use to determine its results. We mainly use the mean squared error (MSE) as the loss function. Our goal is to minimize MSE as much as possible.

V. RESULTS AND DISCUSSIONS

To get the required information the user has to enter the relevant information such as the type of crop the name of the state and the name of the city once the page is submitted the system will process the information and display the results the results will include the optimum amount of nutrients required for the specified crop based on the temperature and rainfall of the location in addition a weather report for the next seven days will be provided with 90 accuracy the system will display the results in the following format.

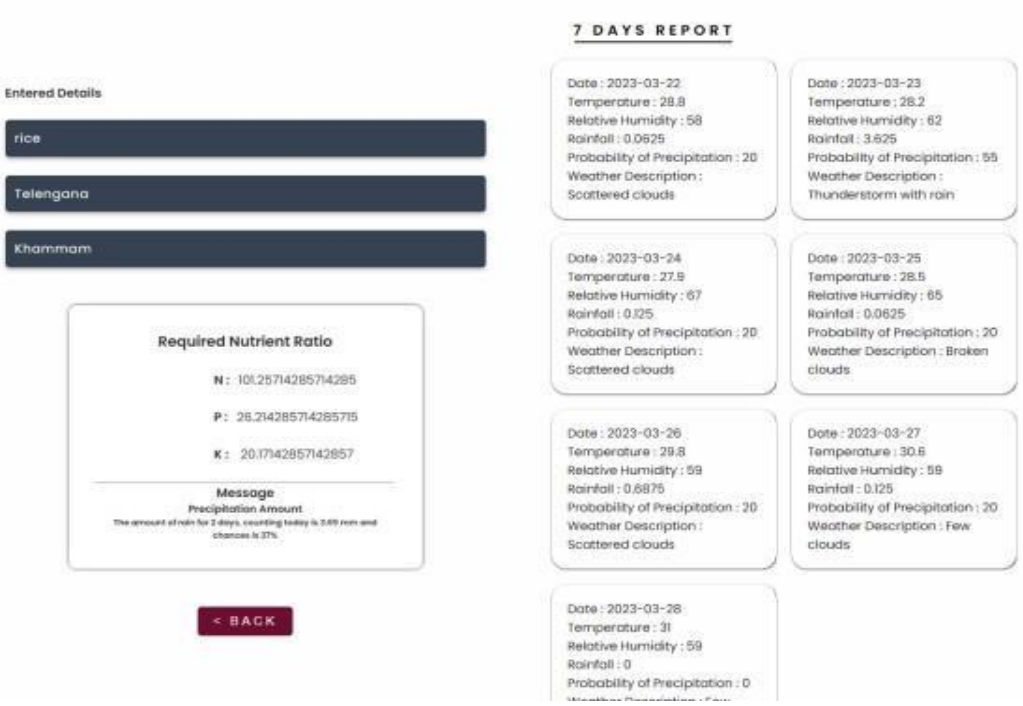

Fig. 3: Output

VI. CONCLUSION AND FUTURE SCOPE

By using the Random Forest algorithm, this study demonstrates the ability to predict optimal nutrient levels necessary for crop growth and yield improvement. Such progress is invaluable to our farming community. This research takes into account current weather conditions and crop type to provide more accurate nutrient recommendations. Improvements to this system include creating a native language user interface to make it easier for non- English speaking individuals to use the system. Additionally, speech recognition features can be integrated to accommodate illiterate users. Utilizing IOT technology, data related to soil composition can be directly extracted, which further helps in fertilizer predictions.

REFERENCES

[1.] Krutika Hampannavar, Vijay Bhajantri, Shashikumar G,[25 April 2019] Prediction of Crop Fertilizer Consumption,IEEE,
[2.] DOI: 10.1109/ICCUBEA.2018.8697827
[3.] G. Prabakarana, D. Vaithiyanathanb, Madhavi Ganesanc, [2018]"Fuzzy decision support system for improving the crop productivity and efficient use of fertilizers," Computers and Electronics in Agriculture Volume 150, July 2018
[4.] Usman Ahmed , Jerry Chun-weilin,Gautam Srivastava,Youcef Djenouri,[2021] "A nutrient recommendation system for soil fertilization based on evolutionary computation," https://doi.org/10.1016/j.compag.2021.106407
[5.] Zonlehoua Coulibali1, Athyna Nancy Cambouris ,Serge- Étienne Parent, [2020 Aug 7] "Site-specific machine learning predictive fertilization models for potato crops in Eastern Canada," doi: 10.1371/journal.pone.0230888
[6.] Umm E Farwaa, Ahsan Ur Rehmanb, Saad Qasim Khanc, Muhammad Khurramd, [April 2020]" Prediction of Soil Macronutrients Using Machine Learning Algorithm," International Journal of Computer (IJC), 38(1), 1–14. Retrieved from
[7.] https://ijcjournal.org/index.php/InternationalJournalO fCompu ter/article/view/1527.
[8.] LIUJianab*ZUOQiangc*ZHAILi-meiaLUOChun-yanaLIUHong-binaWANGHong-yuanaLIUShenaZOUGuo- yuancRENTian-zhi,[2016] " Phosphorus losses via surface runoff in rice-wheat cropping systems as impacted by rainfall regimes and fertilizer applications,", IEEE, https://doi.org/10.1016/S2095-3119(15)61087-5.
[9.] Nusrat Jahan, Rezvi Shahariar., [DEC 20220]"Predicting fertilizer treatment of maize using decision tree algorithm," DOI: http://doi.org/10.11591/ijeecs.v20.i3.pp1427-1434.
[10.] T. Blesslin Sheeba,1L. D. Vijay Anand,2Gunaselvi Manohar,3Saravana Selvan,4C. Bazil Wilfred,5K. Muthukumar,6S. Padmavathy,7P. Ramesh Kumar,8and Belete Tessema Asfaw, [19 Apr 2022] "Machine Learning Algorithm for Soil Analysis and Classification of Micronutrients in IoT- Enabled Automated Farms,"
[11.] U. Naseem, I. Razzak, and P. W. Eklund, "A survey of preprocessing techniques to improve short-text quality: A case study on hate speech detection on Twitter," in Multimedia Tools and Applications. Springer, Nov. 2020, pp. 1–28. [Online].Available: https://link. springer.com/article/10.1007/s11042-020-10082-6
[12.] Kaggle, " https://www.kaggle.com/datasets/atharvaingle/crop-recommendation-dataset ".
[13.] Z Senthil Kumar Swami Durai, Mary Divya Shamili, "Smart farming using Machine Learning and Deep Learning techniques," Decision Analytics Journal, vol-2, 2022, PP.1-30.
[14.] Akash Manish Lad, K. Mani Bharathi, B. Akash Saravanan, R. Karthik, "Factors affecting agriculture and estimation of crop yield using supervised learning algorithms," https://doi.org/10.1016/j.matpr.2022.03.080.
[15.] Potnuru Sai Nishant,Pinapa Sai Venkat,Bollu Lakshmi Avinash,B. Jabber, "Crop Yield Prediction Based on Indian Agriculture using Machine Learning," 2020 International Conference for Emerging Technology (INCET), 2020, PP. 1- 4.
[16.] Yulong Yin, Hao Ying, Huifang Zhen, Q ingsong Zhang, Y anfang Xue, Zhenling I, "Estimation of NPK requirements for rice production in diverse Chinese environments under optimal fertilization rate," Agricultural and Forest Meteorology, vol- 279, 2019, PP. 1-6.
[17.] Laura J.T. Hess, Eve-Lyn S. Hinckley, G. Philip Robertson, Pamela A. Matson, "Rainfallintensification increases nitrate leaching from tilled but not no-till cropping systems in the U.S.Midwest," Agriculture, Ecosystems & Environment, vol- 290, 2020, PP. 1-10.