IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 5, May 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 5, May 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1005024|

Agrarian Crop & Fertilizers Proposal Utilizing Machine Learning Approach

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ABSTRACT: In India, farming is the biggest source of vocation. An endless division of the population of India considers farming as its essential occupation. The wealth of India perceptible depends on farming. Still, conventional ways of proposals are utilized for agriculture. Currently, agriculture is done based on different approximations of fertilizers amount and the crop to be developed or planted. Agribusiness significantly depends on the. Subsequently, it gets to be critical to forming progression in this field. The paper proposes the advancement of a Metaphysics based suggestion system for crop appropriateness and fertilizer proposal. It overcomes any issues among ranchers and innovation. It is a source of strength between farmers and innovation. This strategy gives progression like proposing a recommendation system using an optimization technique with weighted majority techniques using random tree, Decision Tree, and Naive Bayes, Support Vector Machine as learners to recommend suitable crop with high specific accuracy and efficiency. This technology helps farmers make sensible fertilization choices. The out-turn from the experiment illustrated that the system offers more accurate and appropriate Crop & Fertilizer proposals.

KEYWORDS: Agrarian, advancement of a Metaphysics, Recursive Feature Elimination, Random Forest, soil composition

I. INTRODUCTION

The agriculture sector plays a fundamental part in the development of the complete economy of a nation.The nature of the soil is expected to be kept up with for the development interaction. Intelligent technology for planning, analysis, and production control is crucial for improving organic soil productivity, plant nutrition, and irrigation quality.Farmers may make correct and beneficial decisions that positively influence their livelihoods if they have access to the relevant information at the right time.Various researchers are now a dayutilizing data mining[9], machine learning, and deep learning methodologies to optimize and enhance crop productivity and quality.Machine Learning facilitates machine execution by discriminating and depicting the consistency and pattern of drive information without requiring defined computer programming.In agriculture, machine learning leads to efficient and precise farming with reduced human wages and greater production. Machine learning algorithms learn from previous data as input and infer new output values to find the pattern for building themodel.This paper is comprising of a hypothetical andconceptual stage of the Proposal System through incorporated models of gathering ecological factors and Machine learning strategies, for example, Naive Bayes and Support Vector Machine (SVM), Unsupervised AI calculation, for example, Hierarchical Clustering[15]

The system's architecture will suggest the select the most suitable crop for a certain piece of land.Based on Analyze many relevant factors such as location, pH value to identify the soil, nutrients required for the crop, and nutrients already present in the soil.A three-level strategy is offered, consisting of soil categorization, crop forecast, and manure suggestion.In India, there are 15 agro-climatic areas that are classified according to the kind of land. Some crops can be grown in each agro-climatic area[3]. Based on this, we must advise the farmer as to which crop is the best among those grown in those climate zones. The project's ultimate goal is to produce the most crop with the fewest yield.

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To have a deeper knowledge of agricultural yield, we must analyze large amounts of data using a machine learning algorithm, which will provide an accurate yield for that crop and recommend a better crop to the farmer. Working on theamount of the harvest is the critical objective of accuracy farmingimplies getting a superior comprehension of the yield utilizing thedata innovation strategies.

The dataset is gathered from the site Kaggle,Pre-processing is performed to make data less complex.The data includes variables like NKP (nitrogen: phosphorus: potassium), soil PH, rainfall , humidity and temperature.Unsupervised learning creates a mathematical model from a set of data with only inputs andno ideal resultmarks.Unsupervised learning creates a mathematical model from a set of data with only inputs and no desired output labels. Semi-supervised learning techniques are used to expand mathematical models using sparse training data, as when a portion of the sample inputlacks labels.Experiments were carried out using a real-time agribusiness dataset, and performance was assessed in terms of accuracy, precision, recall, and F1 score.The exploratory outcomes showed that the proposed strategy gives more precise and appropriate Crop and Fertilizer proposals.

II.RELATED WORK

With the assistance of field data, a prescient model helps the ranchers by giving information about trimming designs, establishing time, crop yield, and natural fertilizer. A reap is assessed in numerous Indian states in light of field and impacting information that influences crop advancement in unambiguous places and picks the affecting elements utilizing the dataset of 25 states in India [3]. The dirt surface shifts relying on the areaThe harvest development is impacted by the component of soil. The harvest is anticipated proficiently by characterizing planning soil examples to edit information to come by improved results [4].Key topics in agriculture include soil nutrient forecasts, yield forecasts, and fertilizer recommendations.

ML strategies are utilized to conquer these difficulties. Sensors are utilized to gauge the supplements present in the dirt dampness. The characterization of soil is finished with the assistance of information mining calculations, for example, Naive Bayes, Decision Tree and K-closest neighbor [5].By considering soil nutrients, the suitability of plants to soil is accurate. Predict yields using a random forest algorithm using soil nutrients and harvest data [7]. Nearest neighbor algorithms are used to predict and predict harvest and fertilization recommendations [8]. Machine learning makes decisions based on what you learn, but neural networks don't just learn and make your own decisions intelligently.Among all of the soil vitamins, N and P are the first-class combos to are expecting the fertilizer [9]. A neural community calls for extra records to make selections and spends extra time in computation.

Analyze the many relevant factors such as location, pH value to assess the soil, nutrients needed for the crop, and nutrients existing in the soil. Soil categorization, crop forecast, and Manure Recommendation are among the three stages. The data is gained from the Kaggle website. Pre - processing is done to lessen the complexity of the data. It uses a random forest algorithm to categorize the soil, a support vector machine to forecast crop viability, and hierarchical clustering to provide the most appropriate organic manure. The experimental results demonstrate that the proposed method gives more accurate and realistic crop and fertilizer recommendations.

III. PRELIMINARIES

A. Dataset Description

The dataset is accumulated from the site Kaggle[1].The dataset includes three macronutrients (nitrogen, potassium, phosphorus, and so on), as well as 23 crops (such as Jute, Rice, maize, etc.).The highlights are recorded within the table I

B. Data preprocessing

Pre-processing of data is principally to really look at the data quality.The quality can be inspected with regard to Accuracy, Completeness, consistency, practicality, authenticity, and interpretability.The gathered dataset is crude in nature.Prior to playing out the ML method,the dataset ought to be in an organized course of action.The preeminent advance of Data pre-processing is information cleaning.Amending information mistakes and erasing awful records can be a tedious, tedious activity, which can't be overlooked.

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Figure 3.1 represent correlation Graph for the Current data set Feature

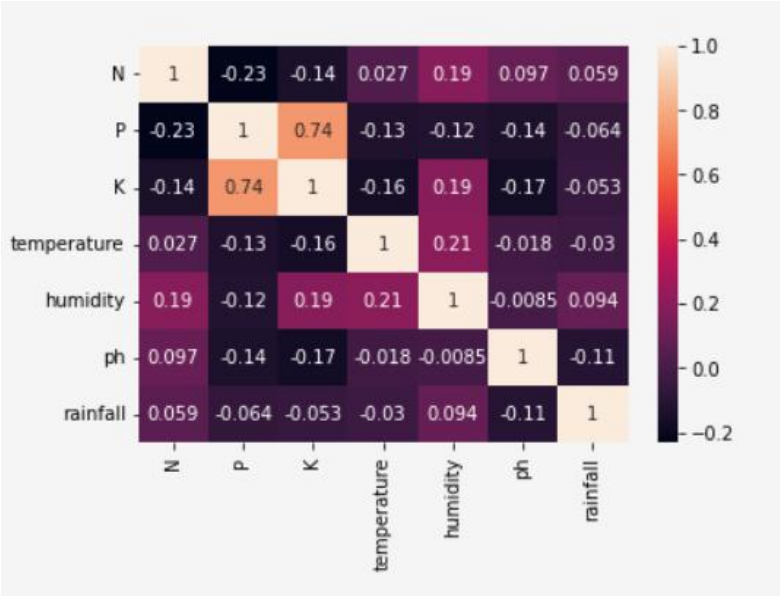

Figure 3.1Correlation Graph

C. Feature Selection

The highlight choice strategy is utilized to distinguish the most excellent set of traits by dispensing with unimportant properties. It'll increment precision, and diminish preparing time and overfitting.The highlight determination is of three sorts to be specific filters, wrapper and implanted method. Figure 3.2 Shows Original vs Feature Extracted data of current dataset

S.No	Original Features	S.No	Extracted Feature
1.	Sample No	1.	PH
2	PH	4.	N(Nitrogen)
3.	Crop	5.	K(Potassium)
4.	N(Nitrogen)	6.	P(Phosphorus)
5.	P(Phosphorus)	7.	Rainfall
6.	K(Potassium)	8.	Humidity
7.	Rainfall	9.	Temperature
8.	Humidity		
9.	Temperature		

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IV. PROBLEM STATEMENT

The work donecurrently just focused on crop forecasts utilizing different soil properties and Data Mining Techniques[16].The fertilizer Proposal isn't taken into thought.Thus, it is important to foster a harvest yield forecast and Fertilizer suggestion system which predicts crop yield inview of soil supplements crop yield information and suggest Fertilizer for chosen crop in light of various datasets like Fertilizer information, area information, and yield information

V. PROPOSED METHODOLOGY AND DISCUSSION

A. Soil Identification

Agricultural land soil is classified based on soil texture. Sandy, loam sand, sandy loam, loam, silty loam, silt, sandy clay loam, loam clay, silty loam clay, sandy clay, silty clay and clay are the main categories of soil texture.From the Attributes such as PH, N(Nitrogen), P(Phosphorous), and K were taken from the Kaggle dataset (Potassium).

B. Crop Suitability

Crop productivity is anticipated by mapping the nutrients required by the crop and the nutrient level in the soil. The soil macronutrient and crop nutrient datasets are being used to forecast crop production. Maize, mothbeans, blackgram, coconut, mungbean, cotton, jute rice, and other crops are included in the dataset. The chemical composition of the soil (i.e. PH, EC(salinity+), N(Nitrogen), P(Phosphorous), K(Potassium), environmental conditions (i.e. Rainfall, Humidity, Temperature), and soil type were all examined from the Kaggle dataset. Crop suitability is estimated using a random forest algorithm.

RandomForest :It's a bagging method-based ensemble learning algorithm. The bagging approach incorporates decision trees and merges them to get more precise and accurate results. To address classification and regression concerns, a random forest technique is utilised. Random forest has the virtue of automatically leveling the dataset, avoiding biased diagnosis, and not impacting algorithm if a new record is introduced. If there are more trees in the forest, it does not suffer from overfitting [16]. The random forest's operational flow is as follows:

1. A decision tree is generated via randomising k data points from the dataset (i.e. k is a subset of the dataset).
2. Accurately predict the number of decision trees to be erected (n).
3. Repeat steps 1 and 2 until the dataset has been adequately processed.
4. For each new data point, each decision tree will guess the outcomes, with the ultimate conclusion determined by the decision trees' referendum.

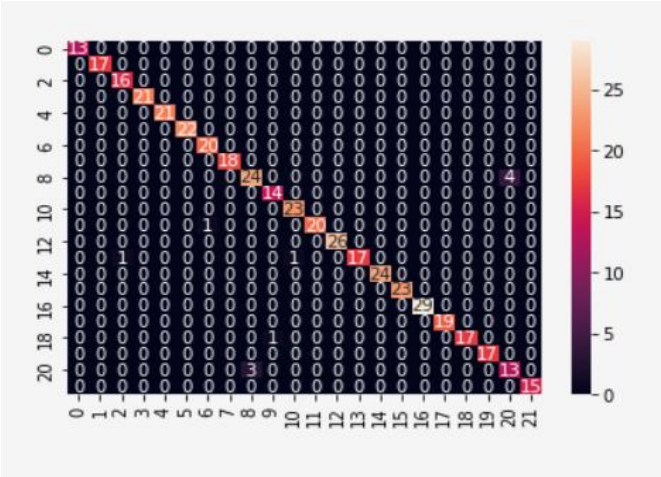

Figure 5.1Confusion Matrix of Soil identification (RF)

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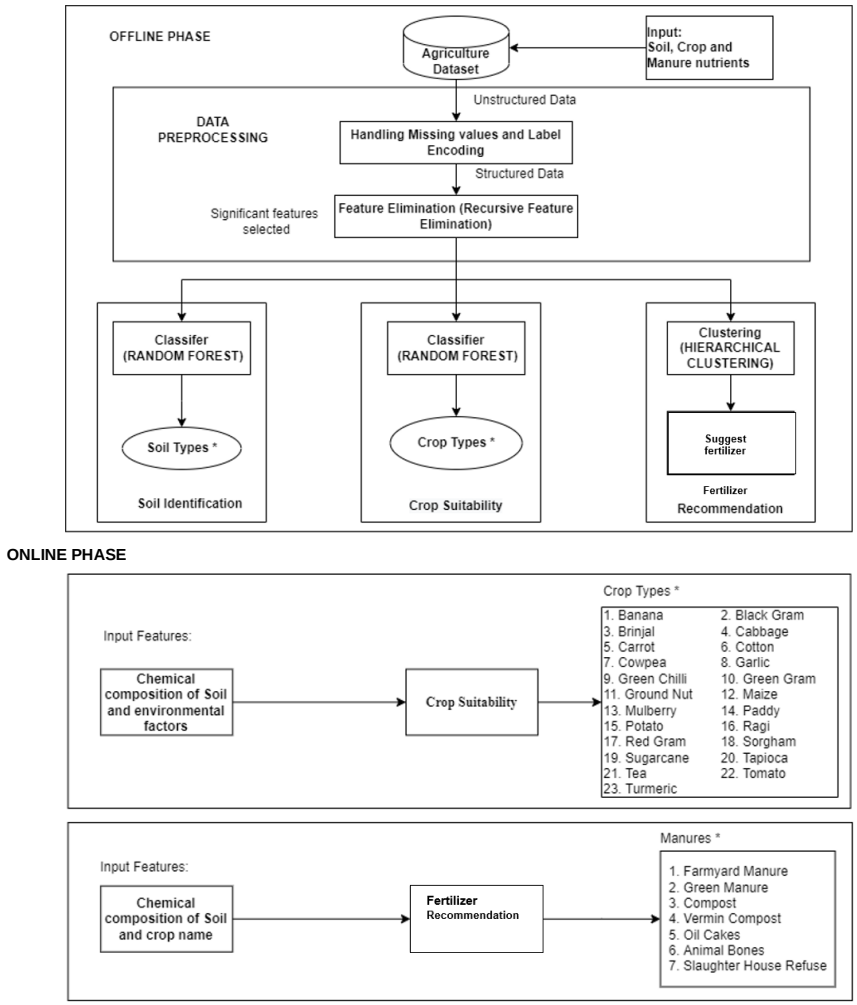
C. Fertilizer Recommendation

To escalate the crop yield with the aid of using reading the soil nutrients, predicting the crop, and suggesting the natural manure. The taken into consideration attributes are chemical composition of the soil (i.e. PH, N(Nitrogen), P(Phosphorous), K(Potassium). and crop name. The hierarchical clustering algorithmic rule is employed to advocatethe natural manure and its composition.

1. Each data point is first established as a distinct cluster
2. Join two closed clusters together to form a single cluster
3. Repeat Step 2 until there is only one cluster left.
4. Once you've reached the last cluster, draw a dendrogram to split it.

Figure 5.2 Shows the design of the Proposed Architecture



VI. RESULTS AND DISSCUSSION

The exactness of categorization calculations is delineated graphically in Figure 6.1. When compared to Nave Bayes, Support Vector Machine, and decision tree, Random Forest and Calculated Relapse convey predominant precision within the general extent of the dataset. So, in arrange to urge more exactness, Random Forest isutilized for soil categorization.

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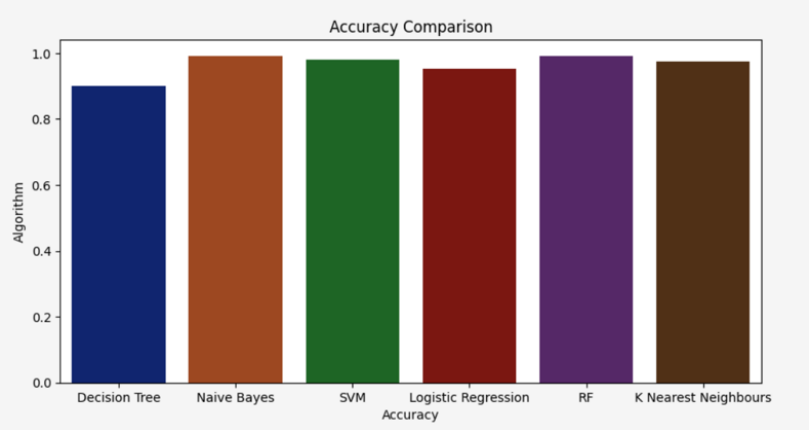

Figure 6.1. Accuracy of soil identification compared with different algorithms.

```
Decision Tree --> 0.9
Naive Bayes --> 0.990909090909091
SVM --> 0.9795454545454545
Logistic Regression --> 0.9522727272727273
RF --> 0.990909090909091
K Nearest Neighbours --> 0.975
```

The proposed system recommends the best suitable crop& fertilizer forparticular land by considering parameters as annual rainfall,temperature, humidity and soil pH. Among these parametersannual rainfall is predicted by system itself by using previousyear data with RF algorithm and other parameters are haveto be entered by the user.

IV.CONCLUSION& FUTURE WORK

The vital approach of this project is to predict the Crop & Fertilizer based on the soil nutrient content and the location To help crofter to choose the right crop for their land and to give the suitable amount of fertilizer to produce the maximum yield. It is tested for 23 crops (such as Paddy, wheat, maize, etc.) with 8 attributes such as pH, N, P, K, etc. and Crop & Fertilizer is recommended.

Because our farmers are now not successfully utilizing technology and analysis, there is a risk of incorrect crop selection for cultivation, which will diminish their revenue. To reduce these types of losses, we have developed a farmer-friendly system with a graphical user interface that will predict which crop would be the best fit for a specific plot of land. This system will also provide information on required nutrients to add, required seeds for cultivation, expected yield, and market price. As a result, farmers are more likely to make sound crop selection decisions, and the agricultural industry will benefit from creative ideas.

The proposed method is tested only for a small set of crops and Fertilizer. In future, the suggested method needs to be tested for more variety of Crops and Fertilizer . The feature ofdataset is low, so more Feature like other macronutrients (C,Zn etc) need to be added to dataset to get the ideal accuracy. An android application is designed to help the young farmers by just stuffing the field details into the interface and getting useful and accurate results in a fraction of time.

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