Comparative Analysis of Crop Recommendation System

by

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Guide
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Introduction

Crop aims to create an advanced agricultural bot that leverages existing soil and crop yield data to optimize crop management for small-scale farmers.Using the **Gaussian Naïve Bayes** algorithm, the system predicts soil health and provides tailored recommendations for irrigation, fertilization, and crop selection.Farmers can access these insights through a user-friendly interface, making advanced agricultural tools easily accessible and actionable

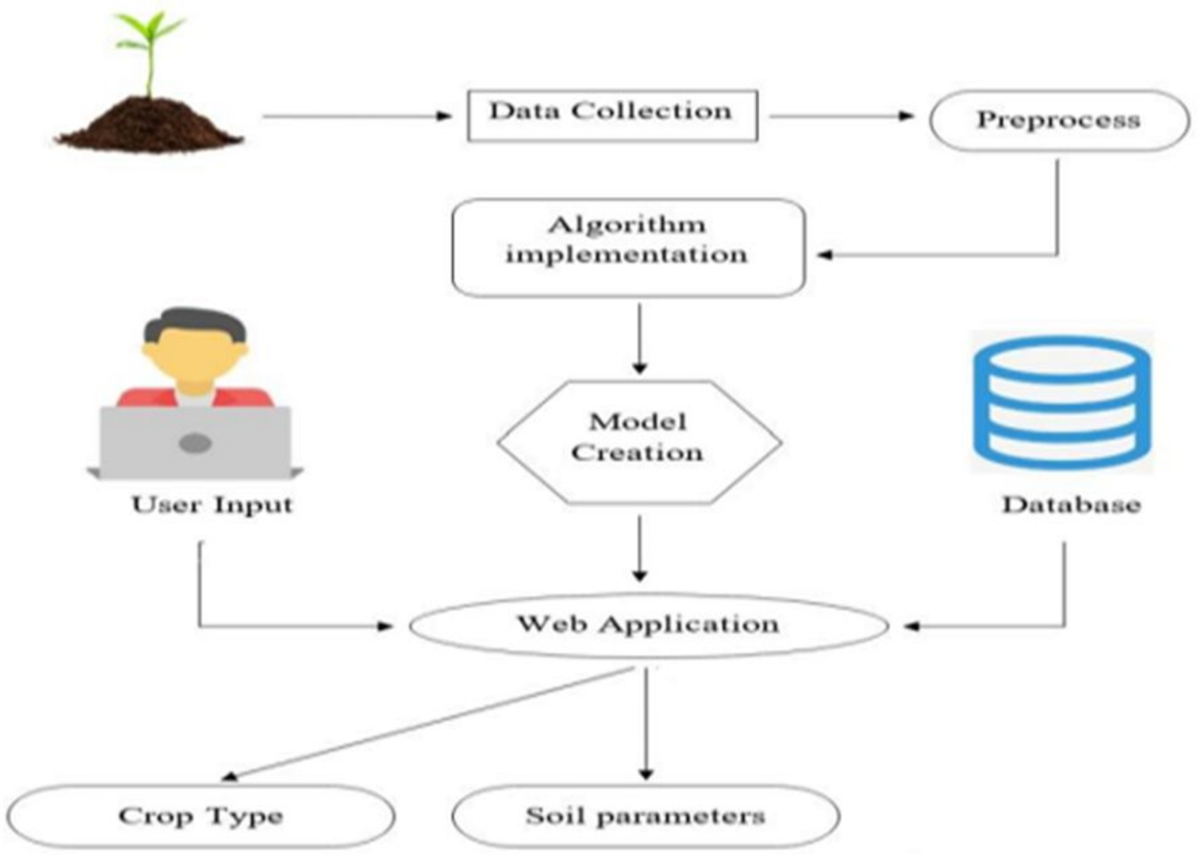
Literature Survey

- **C. Bhuvaneswari,H.S. Pokhariya et al. -** Implementing AI-Powered Chatbots in Agriculture for Optimization and Efficiency
- **Ajay Agarwal, Sartaj Ahmad -** Machine learning-based crop recommendations using soil properties by XGBoost algorithm
- **Gaurav Chauhan and Alka Chaudhary -** Predict the most suitable crops for various soil types based on several factors by Random Forest & Decision Tree Algorithm.
- **Neelam Chandolikar and Chirag Dale -** A chatbot with expert agricultural advice and predictive insights by using Gaussian Naïve Bayes Algorithm

Objectives

- Enhance soil health and crop yield predictions using data-driven insights from the Gaussian Naïve Bayes Algorithm.
- Provide actionable farming recommendations through a user-friendly app to help small-scale farmers make informed decisions.
- Develop a scalable and adaptable system that improves with new data and feedback, suitable for diverse farming conditions.

System Architecture



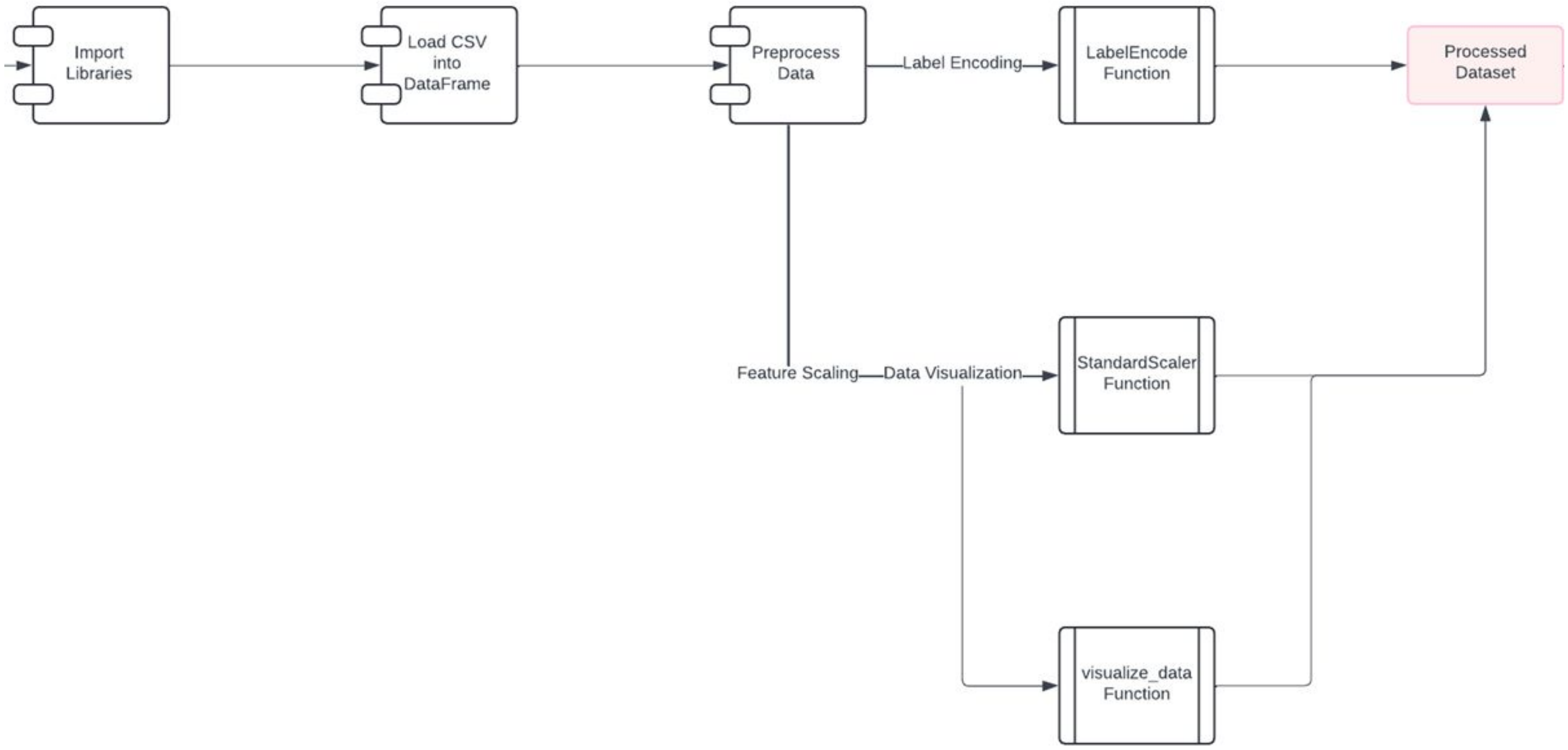
Methodology

- Data Collection and Preprocessing Module
- Model Building & Evaluation Module
- Model Performance
- Prediction and Recommendation Module
- Data visualization
- User Interface Module

Methodology

- Check for missing values in the dataset using .isnull().sum().
- Separate features (X) and target (y) by dropping the 'label' column.
- Apply MinMaxScaler to scale the features to a range between 0 and 1 for normalization.
- Save the scalar object using pickle for consistency in future predictions.
- Convert the scaled features back into a DataFrame to retain column name
- Split the data into training and testing sets and train the model.

Implementation



Implementation - Model Training

Algorithms Used:

1.Logistic Regression:

- ❑ Simple and Effective for Classification Tasks
- ❑ Probabilistic linear for binary Outcome based on Input Features

2.DecisionTreeClassifier

- ❑ Tree-like structures to classify the instances
- ❑ Uses input objects to classify the instances

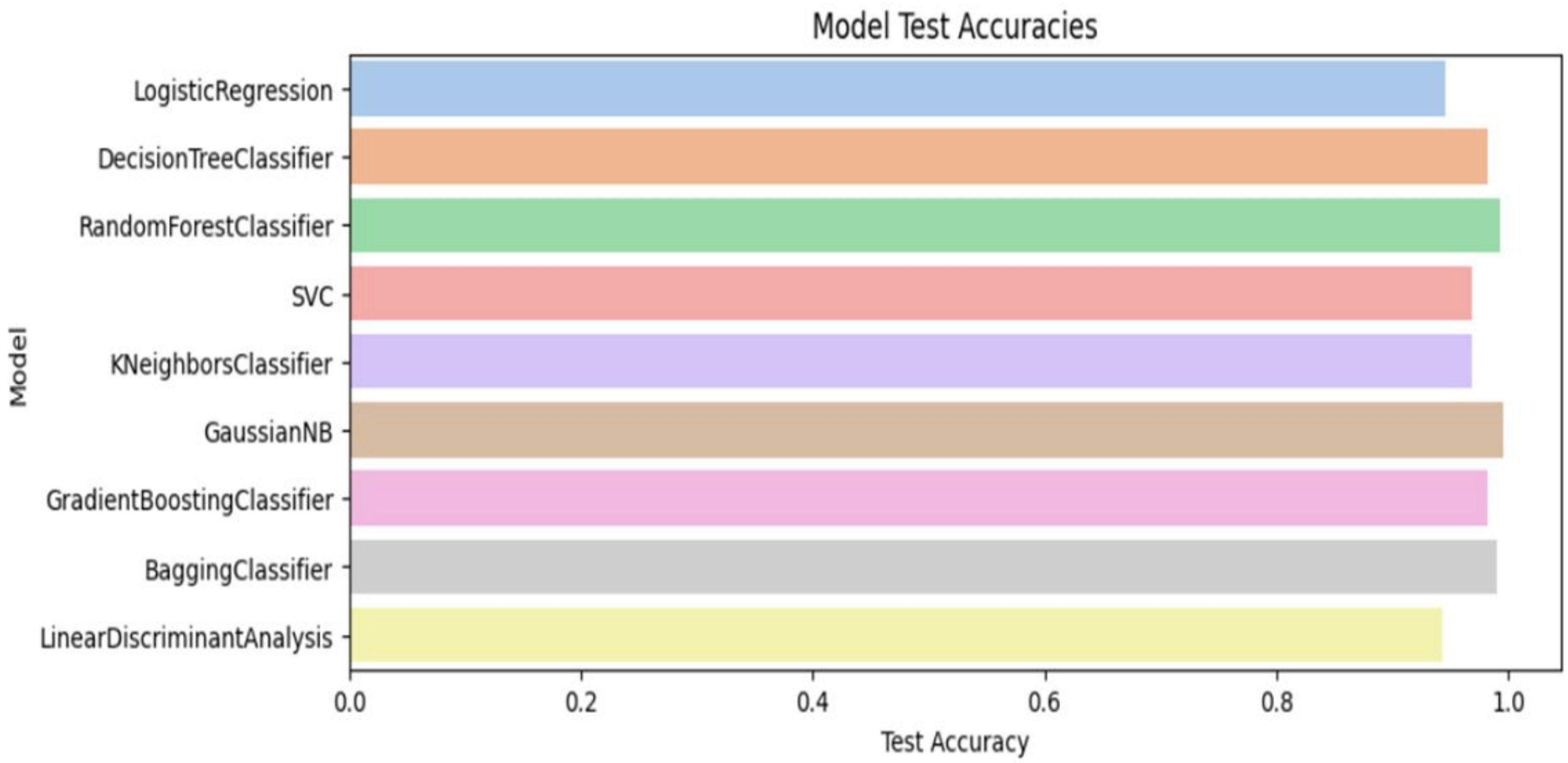
3.Random Forest Classifier

- ❑ Can be an Ensemble for Classification Techniques
- ❑ Handles feature transformations and reduces overfitting

Implementation - Model Evaluation & Selection

- ***Logistic Regression***
  - Accuracy : 94.55%
  - Fast and Simple
  - Better overall performance
- ***Random Forest Classifier***
  - Accuracy : 99.32%
  - Captured complex patterns
  - Calculates lowest misclassification
- ***Decision Tree Classifier***
  - Accuracy : 98.18%
  - Consistent and Robust
  - Better overall accuracy
- ***Gaussian Naive Bayes Classifier***
  - Accuracy : 99.55%
    Fast and Simple
  - Performed Best in all classes
  - Chosen for Deployment
  - Ensure Consistency and robustness

Results - Comparative Analysis

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The model with the highest accuracy is: GaussianNB with an accuracy of 99.55%
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Comparison with existing work

- Traditional methods involve periodic soil sampling and laboratory analysis, which are time-consuming and lack real-time data.
- Farmers use limited or outdated tools for decision-making, relying on general recommendations rather than real-time, data-driven insights.
- Data is often collected manually and in an unstructured manner, making it difficult to analyze and integrate for comprehensive crop management.
- Current systems lack integration between different agricultural processes, leading to inefficiencies and suboptimal resource utilization.

Conclusion and Future Work

Efficient Predictions: Uses existing data to train a model, predicting soil health and best practices without real-time sensors.

Flexible and Scalable: Adaptable to different regions, farming conditions, and evolving needs, making it ideal for small-scale farmers.

Easy-to-Use: Farmers can access these insights through a simple website, ensuring the system is both efficient and user-friendly, even for those with limited technical skills.

Efficiency: By leveraging the most suitable algorithm, the system maximizes efficiency in processing and analyzing data, leading to faster and more reliable insights for farmers.

Reference

"Implementing AI-Powered Chatbots in Agriculture for Optimization and Efficiency" by C. Bhuvaneswari, Hemant Singh Pokhariya, Pallavi Yarde, Vipul Vekariya, and Harshal Patil, Natrayan L, IEEE Xplore, 2024.

"Crop Recommendation Based on Soil Properties: A Comprehensive Analysis" by Ajay Agarwal, Sartaj Ahmad and Adesh Pandey, IEEE Xplore, 2023.

"Crop Recommendation System using Machine Learning Algorithms" by Gaurav Chauhan and Alka Chaudhary, IEEE Xplore, 2023.

"Integrated Fertilizer Recommendation and Crop Management System for Farmers" by Shanmugapriya M, Saikrishnan S, Arun Depak K, Adithyaa Jagannathan Sudhakar, IEEE Xplore, 2023.

"Agriculture Assistant Chatbot Using Artificial Neural Network" by Neelam Chandolikar and Chirag Dale, IEEE Xplore, 2022.

THANK YOU