

Crop and Fertilizer Recommendation System Using Machine Learning

GAUTAM SHIVAJI PATIL, REHAN RAFIQ KHAN, RAJ SANTOSH BHAGWAT

AI&DS & SSGB COET, BHUSAWAL

AI&DS & SSGB COET, BHUSAWAL

AI&DS & SSGB COET, BHUSAWAL

Abstract - Agriculture plays a crucial role in the economy of many countries. Farmers often face difficulties in selecting crops and fertilizers due to changing soil conditions and lack of technical knowledge. This paper proposes a machine learning-based recommendation system using soil parameters like NPK, temperature, humidity, pH, and rainfall. The system predicts suitable crops and fertilizers using algorithms such as Decision Tree and Random Forest. The model is deployed using Streamlit to support smart farming and improve productivity.

Key Words: Crop Recommendation, Fertilizer Prediction, Machine Learning, Smart Farming

1. INTRODUCTION

Agriculture is one of the most important sectors. Machine learning helps farmers make data-driven decisions using soil and climate data. Agriculture sector act as backbone of India by providing food security and playing major role in Indian economy. Due to drastically changes in climatic condition it is affecting farmers due to poor yield, which also affect them economically. Due to it prediction of crop is getting difficult for farmers.

2. Body of Paper

2.1 System Overview

The system takes input parameters such as:

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)
- Temperature
- Humidity
- pH level
- Rainfall

It processes this data using trained machine learning models to predict suitable crops and fertilizers.

2.2 Machine Learning Models Used

The following algorithms are applied:

- Decision Tree Classifier
- Random Forest Classifier
- Logistic Regression

Among these, Random Forest gives higher accuracy due to ensemble learning.

2.3 Dataset Description

The dataset includes agricultural records with soil properties and corresponding crop labels. It is collected from open-source agricultural datasets available on Kaggle and government agriculture portals.

2.4 System Architecture

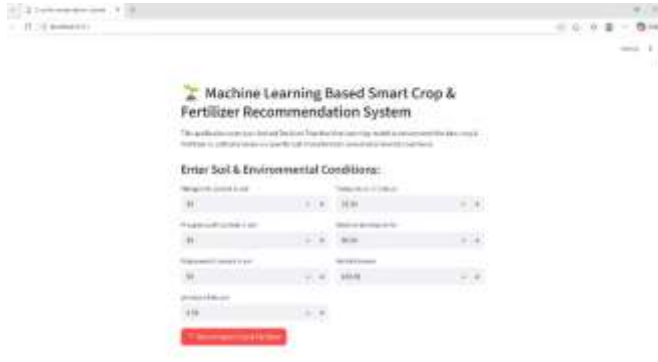
The system consists of:

1. Data Collection
2. Data Preprocessing
3. Model Training
4. Prediction Module
5. Web Interface (Streamlit)

Agriculture plays a crucial role in global food security, yet farmers often rely on traditional experience-based methods to choose crops and fertilizers. These methods are prone to uncertainty due to changing weather, soil degradation, and increasing climate variability. Machine Learning (ML) has emerged as a powerful tool to analyze complex agricultural data and provide accurate, data-driven recommendations.

Many studies focus on using ML algorithms to predict suitable crops and fertilizers based on soil characteristics and environmental conditions.

Table -1: Sample format



Several studies have proposed ML-based crop recommendation systems that use soil and environmental parameters such as Nitrogen (N), Phosphorus (P), Potassium (K), pH level, temperature, humidity, and rainfall. These datasets are commonly used to train classification algorithms.

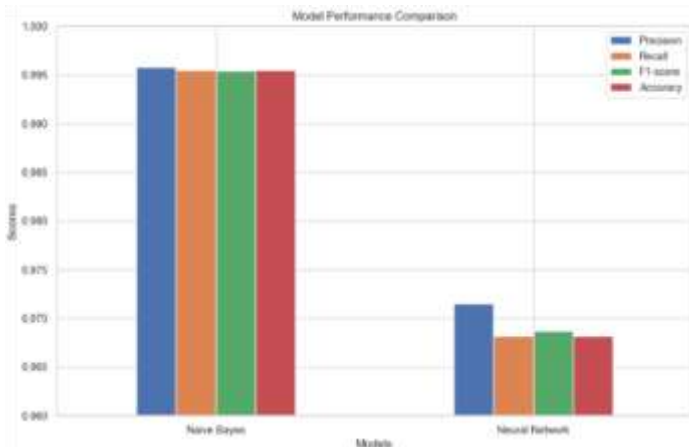


Fig -1: Result for error calculations in crop recommendation

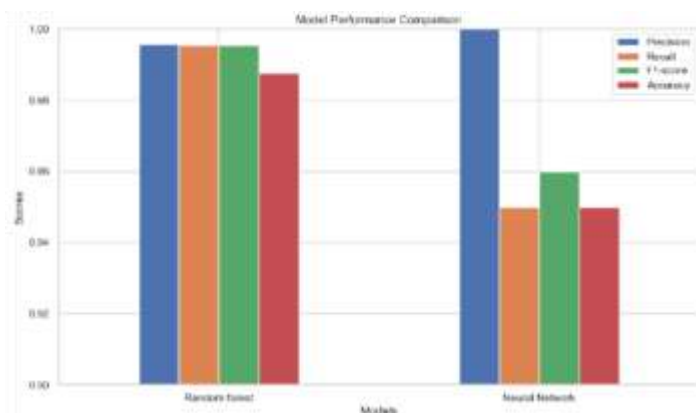
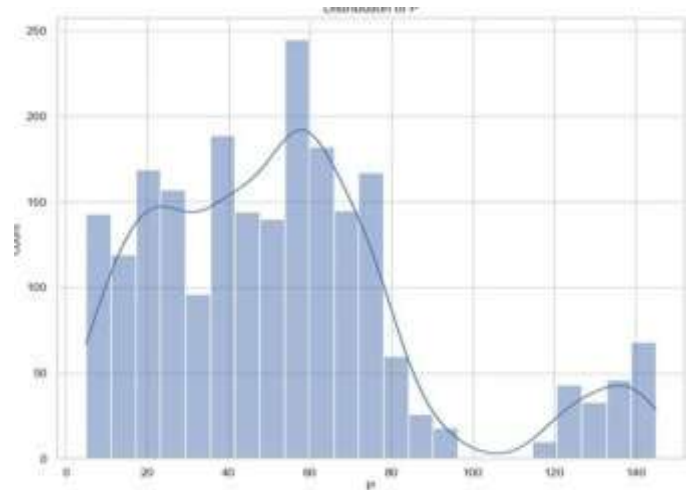


Fig-2: Result for error calculations in fertilizer recommendation



3. CONCLUSIONS

The proposed Crop and Fertilizer Recommendation System effectively assists farmers in selecting suitable crops and fertilizers using machine learning techniques. The system improves agricultural productivity by providing accurate and data-driven recommendations. It reduces dependency on traditional methods and helps in efficient resource utilization. Future enhancements may include integration, real-time weather forecasting systems.

ACKNOWLEDGEMENT

The authors would like to thank their faculty members and institution for their support and guidance in completing this project successfully. We also acknowledge open-source datasets and machine learning libraries that helped in building this system.

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