AgriFusion

Unified Intelligence for Crops, Fertilizers, and Soil Health

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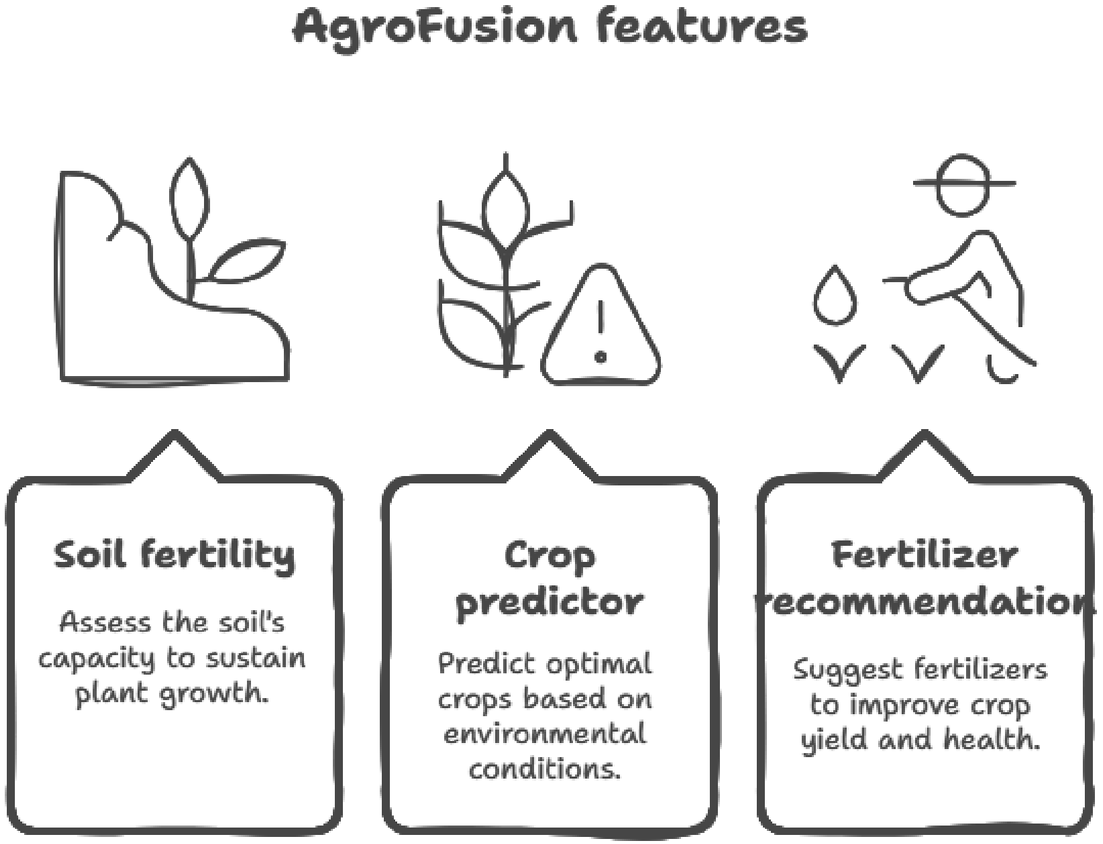
From Soil Signals to Crop Success

Problem Statement:

Sustainable agriculture is critical to feeding a growing global population while preserving natural resources. However, farmers often lack accurate guidance on soil health, suitable crops, and fertilizer application, leading to overuse of chemicals, soil degradation, and reduced biodiversity. Traditional methods fail to support precision and long-term soil care. There is a pressing need for an AI-driven solution that promotes sustainable farming by analyzing soil parameters to recommend optimal crops and eco-friendly fertilizer use, thereby enhancing productivity while protecting the environment.



Learning Objectives

Goal 2

Zero Hunger

Boosts agricultural productivity through smart crop and fertilizer prediction

Goal 12

Responsible Consumption and Production

Prevents overuse of fertilizers and supports soil health

Goal 13

Climate Action

Reduces harmful environmental impacts from misuse of agri-inputs

Goal 15

Life on Land

Promotes sustainable land and soil use

Solution:

In the project, a comprehensive machine learning-based system is developed to support sustainable farming practices.

The solution includes three integrated modules:

- **Soil Fertility:** Based on soil nutrient values (N, P, K), moisture, and environmental factors, the system evaluates soil health.
- **Crop Prediction:** Using supervised learning models, it recommends the most suitable crop for a given soil condition and environment.
- **Fertilizer Recommendation:** The system suggests the optimal fertilizer required for the selected crop and soil condition to avoid overuse and ensure maximum yield.

- Machine learning models such as **Random Forest, XGBoost, and SVM** were trained and evaluated for accuracy.
- **Streamlit** was used to create an interactive web interface for real-time predictions.
- **Power BI** dashboards were integrated for visualizing data insights and feature importance for better decision-making.

Methodology

Data Collection

Soil nutrient, temperature, crop & fertilizer dataset

Data Preprocessing

Label Encoding, handling missing values

Visualization

Feature importance and model insights

Model Training

Using Random Forest, XGBoost

Model Evaluation

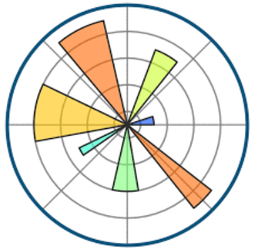
Accuracy, confusion matrix, and correlation between models

Prediction

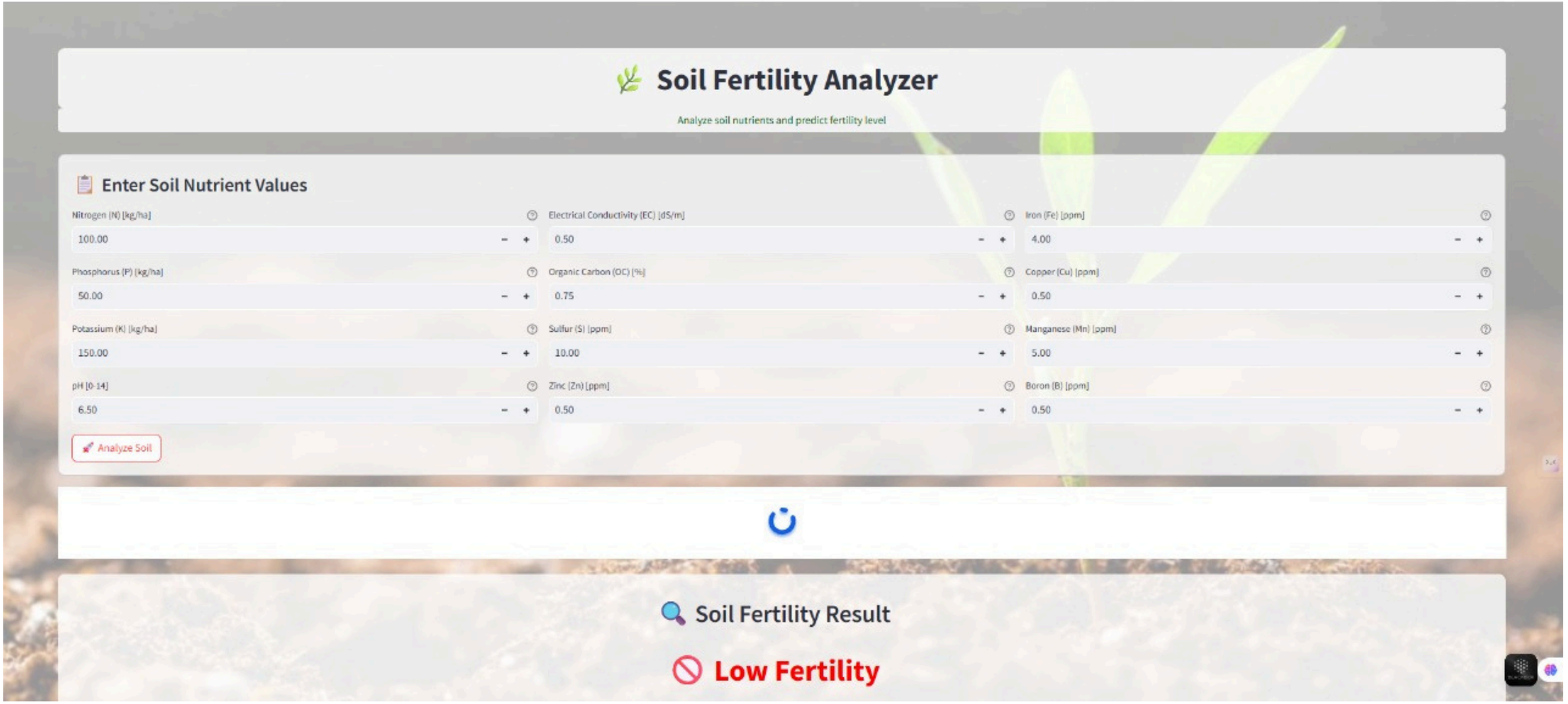
Based on nutrient inputs and crop type

Tools and Technology used

- Languages: Python
- Libraries: pandas, numpy, matplotlib, seaborn, scikit-learn
- ML Models:
    a) Random Forest Classifier
    b) XGBoost Classifier
- Model Deployment and UI : Streamlit, Jupyter Notebook, Google Colab
- Model Export: Pickle (.pkl)
- Visualization Tools: Matplotlib, Seaborn, Power BI



Screenshot of Output:



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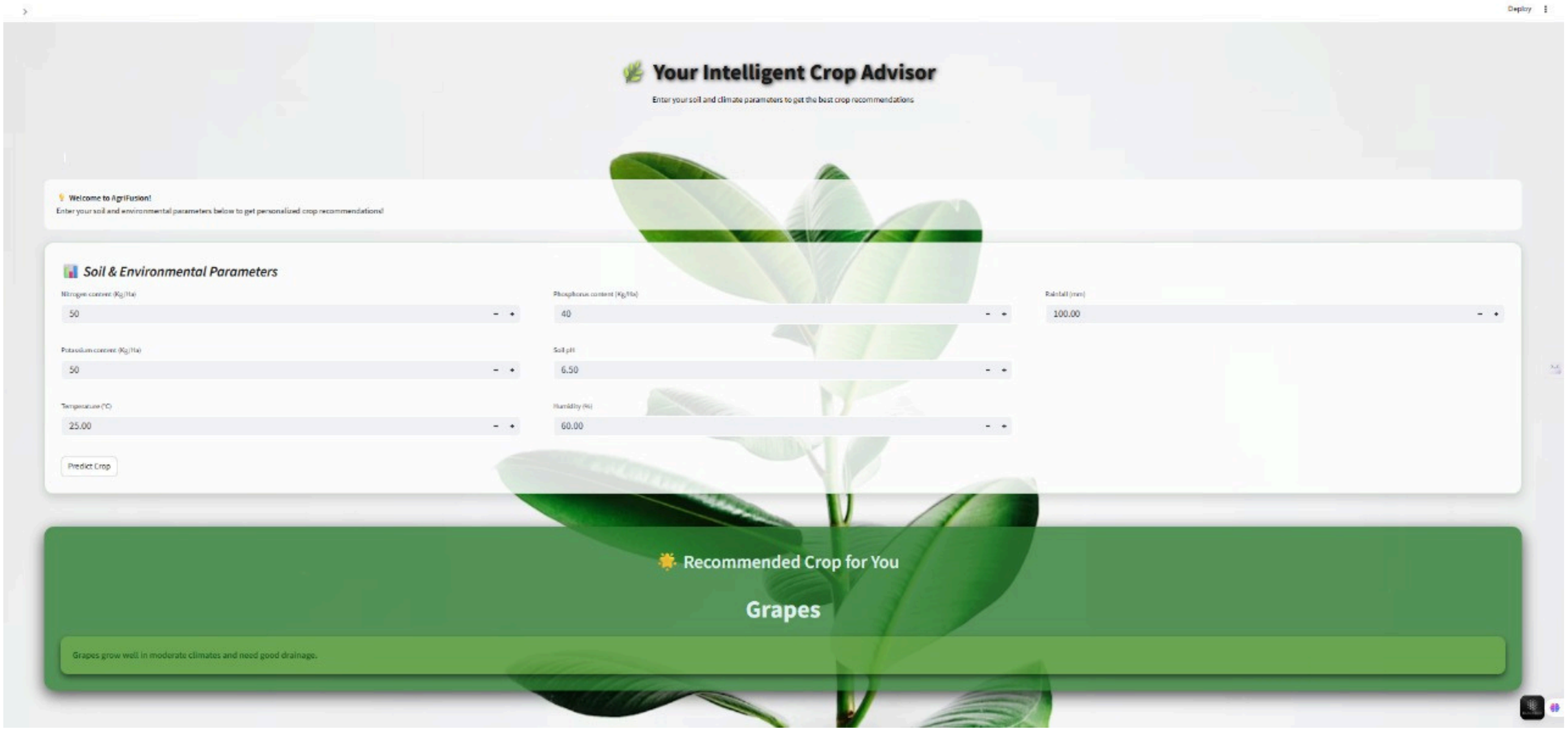

Conclusion:

- This project uses machine learning to solve major agricultural challenges.
- It analyzes soil fertility, predicts the most suitable crop, and recommends the right fertilizer.
- Models like Random Forest, XGBoost, and SVM provide accurate and reliable predictions.
- Streamlit offers a user-friendly interface for real-time recommendations.
- Power BI visualizes data and model insights clearly.
- The system promotes sustainable agriculture by reducing fertilizer misuse and improving crop productivity.
- It supports farmers with smart, AI-based decisions aligned with SDG goals.