Machine Learning for Crop Yield Prediction — Supporting SDG 2 (Zero Hunger)

Introduction

Achieving Zero Hunger (UN Sustainable Development Goal 2) is critical for global well-being and sustainable development. Food security depends heavily on accurate predictions of crop yields to optimize farming practices, allocate resources effectively, and reduce hunger risks.

Problem Statement

Unpredictable crop yields caused by varying weather, soil conditions, and pesticide use challenge farmers and policymakers alike. Without reliable forecasts, planning becomes difficult, risking food shortages and economic losses.

Solution: Machine Learning Crop Yield Prediction

This project uses supervised machine learning regression models to predict crop yields based on environmental and agricultural factors such as rainfall, temperature, pesticide use, crop type, and region.

The dataset was sourced from Kaggle, containing historical crop production data from India.

Approach

- Data preprocessing included cleaning, handling missing values, and encoding categorical variables for crop type and region.
- Two regression models were trained and compared:
  - Linear Regression — a simple baseline model.
  - Random Forest Regressor — an ensemble model capable of capturing complex relationships.
- The data was split into training and testing sets to evaluate performance.

Results

The Random Forest model outperformed Linear Regression, achieving a lower mean absolute error (MAE) and higher R^2 score, indicating more accurate predictions of crop yields.

Visualizations of actual vs predicted yields and residual errors further confirmed the model's effectiveness.

Ethical Considerations

- The data used is publicly available and anonymized, ensuring privacy.
- Bias may exist due to uneven data coverage across regions and crop types, potentially

impacting prediction fairness.
- This tool is designed to support, not replace, expert agricultural decision-making.

Conclusion

By leveraging machine learning to forecast crop yields, this project contributes to better food security and resource planning aligned with SDG 2: Zero Hunger. Future work could involve real-time data integration and deployment as a farmer-friendly web application.