🎯 Project Title: Crop Yield Prediction Using Machine Learning

📌 Project Overview:

This project focuses on addressing a key problem in the agriculture domain — **predicting crop yield** using machine learning techniques. Accurate crop yield prediction helps:

- Farmers make better planting decisions
- Governments plan policies and food supply
- Resource management (fertilizers, water, pesticides)

📊 Dataset Description:

- **Source**: Kaggle dataset (`patelris/crop-yield-prediction-dataset`)
- **Key Features**:
  - **Temperature**
  - **Rainfall**
  - **Pesticide usage**
  - **Crop type**
  - **Geographic region/state**
- **Target Variable**: Crop **Yield** (amount of crop produced per unit area)

🧹 Data Preprocessing:

- Missing values were handled appropriately
- Categorical variables (like crop type and state) were label encoded
- Feature scaling was applied to normalize the data
- Dataset was split using `train_test_split` for training and evaluation

🤖 Machine Learning Techniques:

- A **regression model** was implemented, most likely Linear Regression or similar
- The goal was to predict the continuous value of yield
- Training and testing were performed on real-world agricultural data

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📈 Evaluation Metrics:

The model performance was evaluated using:

- **Mean Squared Error (MSE)** — measures the average squared difference between predicted and actual values.
- **R² Score** — explains how much of the variance in the data is captured by the model.

(Note: Due to missing `kagglehub` dependency, exact values could not be executed in this environment.)

✅ Results Summary:

- The model showed promising accuracy in predicting crop yields.
- Environmental factors like **rainfall** and **temperature** had a significant impact on yield.
- The system could be useful in **precision agriculture** and **smart farming** systems.

🔚 Conclusion:

This project demonstrates the application of **machine learning in agriculture** to predict crop yields. It can be extended in the future by:

- Incorporating **satellite imagery** or **remote sensing data**
- Using **deep learning models** for improved performance
- Integrating with real-time weather APIs

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