🌸 Project Title: Iris Flower Classification using Machine Learning

Objective

The objective of this project was to build a machine learning model to classify iris flowers into three species—**Setosa**, **Versicolor**, and **Virginica**—based on their physical features. This classic classification problem was chosen for its simplicity and high educational value in understanding fundamental ML concepts.

Tools and Technologies Used

- **Programming Language:** Python
- **Libraries:** scikit-learn, pandas, NumPy, matplotlib, seaborn
- **Model Used:** Random Forest Classifier
- **IDE/Platform:** Google Colab / Jupyter Notebook
- **Deployment:** Streamlit (for web-based prediction UI)

Dataset

- The **Iris dataset** is a well-known multivariate dataset that includes:
    - Sepal length
    - Sepal width
    - Petal length
    - Petal width
    - Target: Flower species (Setosa, Versicolor, Virginica)
- **Data Exploration Included:**
    - Data visualization using seaborn pairplots and heatmaps
    - Checking class balance
    - Feature correlation

- Summary statistics (mean, std, etc.)

Model Development

- Chose the **Random Forest Classifier** for its accuracy and ability to handle feature importance.
- Steps involved:
  - Data preprocessing (cleaning and encoding)
  - Train-Test split (80%-20%)
  - Training the model
  - Evaluating accuracy and confusion matrix
  - Visualizing feature importance to see which attributes influence predictions most.

Deployment

- The trained model was saved and deployed using **Streamlit**, providing an interactive user interface.
- The app includes:
  - Sliders for users to input sepal and petal measurements.
  - Real-time prediction of the flower species.
  - Display of model confidence or probability scores.

Features

- Predicts iris flower species from 4 input measurements.
- Feature importance bar graph included.
- Deployed interface accessible via browser.
- Educational UI to explain classification logic.

Outcomes

- Gained hands-on experience with:
    - Classification algorithms
    - Model training & evaluation
    - Deploying ML models using Streamlit
- Understood the concept of **decision boundaries**, **confusion matrix**, and **overfitting** in small datasets.

Applications

- Educational use for ML learners and beginners.
- Demonstrates end-to-end ML project flow (from training to deployment).
- Can be extended to mobile apps or embedded devices for educational tools.

Conclusion

The Iris Flower Classification project served as a foundational introduction to supervised machine learning. It successfully demonstrates data preprocessing, model training, evaluation, and deployment using user-friendly tools. The simplicity of the problem makes it an excellent template for understanding the ML pipeline.