Iris Classification

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Project Overview:-

This project focuses on classifying Iris flower species based on petal and sepal dimensions using machine learning. The model is trained, evaluated, and deployed via a Flask web application. Visualization and exploratory analysis help in understanding feature importance and patterns.

1. Problem Statement:-

- Objective: To classify iris flowers into Setosa, Versicolor, or Virginica species.
- Deliverables:
  - Trained classification model using KNN
  - Visualizations for EDA
  - Flask-based interactive web app for classification

2. Dataset Details:-

- Source: UCI Machine Learning Repository
- Format: CSV
- Features:
  - SepalLengthCm, SepalWidthCm
  - PetalLengthCm, PetalWidthCm
  - Species (Target)

3. Data Preprocessing & Feature Engineering:-

- Label encoded species column to convert it into numeric.
- Used StandardScaler to normalize the feature space.
- Split dataset into 80% train and 20% test sets.

4. Exploratory Data Analysis:-

- Pairplots were used to visualize class separation.
- Boxplots showed feature distribution across species.
- Correlation heatmaps were used to find important features.

5. Machine Learning Model:-

- Model Used: K-Nearest Neighbors (KNN)
- Hyperparameters tuned using GridSearchCV
- Final model: KNeighborsClassifier(n_neighbors=9)

6. Model Evaluation:-

- Accuracy achieved: ~100.0%
- Evaluation Metrics: Confusion matrix and accuracy score

7. Web Application (Flask):-

- Inputs: Sepal length, Sepal width, Petal length, Petal width
- Outputs:
  - Predicted species
  - Data visualization plots (pairplot, boxplot, heatmap)
- Backend: Flask
- Frontend: HTML form + Matplotlib image rendering

8. Key Insights & Takeaways:-

- Petal measurements are the most important features.
- KNN performs well for this classification task with high accuracy.
- Web deployment makes the solution user-friendly and interactive.

File Structure:-

```
project/
├── app.py
├── Iris.csv
├── templates/
│   └── index.html
├── static/
│   ├── boxplot_petal_length.png
│   ├── boxplot_petal_width.png
│   ├── boxplot_petal_width.png
│   ├── boxplot_sepal_length.png
│   ├── boxplot_sepal_width.png
│   ├── confusion_matrix.png
│   ├── correlation_heatmap.png
│   ├── pairplot.png
│   ├── knn_model.pkl
│   ├── label_encoder.pkl
│   └── scaler.pkl
│
```