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from sklearn.datasets import load_wine

from sklearn.ensemble import RandomForestClassifier

from sklearn.model_selection import train_test_split

from sklearn.metrics import accuracy_score, f1_score

import matplotlib.pyplot as plt

# Load dataset

data = load_wine()

X = data.data

y = data.target

# Split the dataset

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=1)

# Try different numbers of trees

tree_counts = [1, 5, 10, 20, 50, 100, 200]

accuracies = []

f1_scores = []

for n in tree_counts:

    model = RandomForestClassifier(n_estimators=n, random_state=1)

    model.fit(X_train, y_train)

    y_pred = model.predict(X_test)

    acc = accuracy_score(y_test, y_pred)

    f1 = f1_score(y_test, y_pred, average='macro')

    accuracies.append(acc)

    f1_scores.append(f1)

    print(f"Trees: {n:<3} | Accuracy: {acc:.4f} | F1 Score: {f1:.4f}")

# Plot Accuracy

plt.figure(figsize=(10, 5))

plt.plot(tree_counts, accuracies, label='Accuracy', marker='o')

plt.xlabel('Number of Trees')

plt.ylabel('Score')

plt.title('Random Forest Accuracy vs Number of Trees')

plt.legend()

plt.grid(True)

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# Plot F1 Score

plt.figure(figsize=(10, 5))

plt.plot(tree_counts, f1_scores, label='F1 Score', marker='s', color='orange')

plt.xlabel('Number of Trees')

plt.ylabel('Score')

plt.title('Random Forest F1 Score vs Number of Trees')

plt.legend()

plt.grid(True)

plt.show()
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