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import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import make_classification
from sklearn.model_selection import train_test_split
from sklearn.ensemble import BaggingClassifier, AdaBoostClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score, confusion_matrix

# Generate some synthetic data for classification
X, y = make_classification(n_samples=1000, n_features=2, n_classes=2, n_clusters_per_class=1, n_redundant=0, random_state=42)

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)

# Create a Decision Tree classifier as the base estimator
base_classifier = DecisionTreeClassifier(random_state=42)

# Bagging (Bootstrap Aggregating)
bagging_classifier = BaggingClassifier(base_estimator=base_classifier, n_estimators=100, random_state=42)
bagging_classifier.fit(X_train, y_train)

# Boosting (AdaBoost)
boosting_classifier = AdaBoostClassifier(base_estimator=base_classifier, n_estimators=100, random_state=42)
boosting_classifier.fit(X_train, y_train)

# Make predictions on the test data
bagging_pred = bagging_classifier.predict(X_test)
boosting_pred = boosting_classifier.predict(X_test)

# Calculate accuracy of the classifiers
bagging_accuracy = accuracy_score(y_test, bagging_pred)
boosting_accuracy = accuracy_score(y_test, boosting_pred)

print("Bagging Accuracy: {:.2f}%".format(bagging_accuracy * 100))
print("Boosting Accuracy: {:.2f}%".format(boosting_accuracy * 100))

# Create a confusion matrix for bagging and boosting
bagging_conf_matrix = confusion_matrix(y_test, bagging_pred)
boosting_conf_matrix = confusion_matrix(y_test, boosting_pred)

print("Bagging Confusion Matrix:")
print(bagging_conf_matrix)

print("Boosting Confusion Matrix:")
print(boosting_conf_matrix)

Bagging Accuracy: 94.00%
Boosting Accuracy: 93.67%
Bagging Confusion Matrix:
[[141  6]
 [ 12 141]]
Boosting Confusion Matrix:
[[139  8]
 [ 11 142]]
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_base.py:166: FutureWarning: `base_estimator` was renamed to `estimator` i
warnings.warn(
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