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l... from sklearn.ensemble import AdaBoostClassifier
    from sklearn.tree import DecisionTreeClassifier
    from sklearn.model_selection import train_test_split
    from sklearn.metrics import accuracy_score
    import pandas as pd

# 1. 讀取葡萄酒數據集
df_wine =
pd.read_csv('https://archive.ics.uci.edu/ml/machine-
learning-databases/wine/wine.data', header=None)
df_wine.columns = ['Class label', 'Alcohol', 'Malic acid',
'Ash', 'Alcalinity of ash', 'Magnesium',
                    'Total phenols', 'Flavanoids',
'Nonflavanoid phenols', 'Proanthocyanins',
                    'Color intensity', 'Hue', 'OD280/OD315
of diluted wines', 'Proline']

# 過濾數據，只使用類別 2 和 3
df_wine = df_wine[df_wine['Class label'] != 1]
y = df_wine['Class label'].values
X = df_wine[['Alcohol', 'OD280/OD315 of diluted
wines']].values

# 2. 劃分訓練集和測試集
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=1, stratify=y)

# 3. 定義參數組合
learning_rates = [0.01, 0.05, 0.1, 0.3, 0.5]
n_estimators_list = [100, 500, 1000]

# 儲存結果
results = []

# 4. 測試不同參數組合
for lr in learning_rates:
    for n_estimators in n_estimators_list:
        ada = AdaBoostClassifier(

base_estimator=DecisionTreeClassifier(max_depth=1),
        n_estimators=n_estimators,
        learning_rate=lr,

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        random_state=1
    )
    ada.fit(X_train, y_train)

    # 計算正確率
    train_acc = accuracy_score(y_train,
ada.predict(X_train))
    test_acc = accuracy_score(y_test,
ada.predict(X_test))

    # 儲存結果
    results.append([lr, n_estimators, train_acc,
test_acc])

# 5. 輸出結果為 DataFrame
columns = ['learning_rate', 'n_estimators',
'train_accuracy', 'test_accuracy']
results_df = pd.DataFrame(results, columns=columns)

# 6. 將結果轉為所需的表格格式
pivot_table = results_df.pivot(index='learning_rate',
columns='n_estimators',
                                values=['train_accuracy',
'test_accuracy'])

# 調整列寬與數字格式
pd.set_option("display.max_columns", None) # 顯示所有列
pd.set_option("display.width", 1000) # 調整寬度
pd.set_option("display.float_format", lambda x: f"{x:.4f}")
# 格式化數字至小數點後 4 位
print(pivot_table)
pivot_table.to_csv("adaboost_results.csv") # 儲存成 CSV 文件

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	train_accuracy			test_accuracy	
n_estimators	100	500	1000	100	500
learning_rate					
0.0100	0.9368	0.9579	0.9579	0.9167	0.9167
0.9167					
0.0500	0.9579	0.9895	1.0000	0.9167	0.9167
0.9167					
0.1000	0.9789	1.0000	1.0000	0.9167	0.9167
0.9167					
0.3000	1.0000	1.0000	1.0000	0.9167	0.9167

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0.9167
0.5000      1.0000 1.0000 1.0000      0.9167 0.9167
0.9167
In []:
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