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# Import necessary libraries

from sklearn import datasets

from sklearn.model_selection import train_test_split

from sklearn.svm import SVC

from sklearn.metrics import f1_score

import pandas as pd


# Load the dataset

digits = datasets.load_digits()

X, y = digits.data, digits.target


# 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)


# Define kernel types and C (learning_rate) values

kernels = ['linear', 'poly', 'rbf']

C_values = [0.1, 0.3, 0.5]

results = []


# Train and evaluate the model for each kernel and C value

for kernel in kernels:

    for C in C_values:

        svm = SVC(kernel=kernel, C=C)

        svm.fit(X_train, y_train)


        # Predict and evaluate the model

        y_pred = svm.predict(X_test)

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


        # Append results

        results.append({'Nature': kernel, 'Learning_rate': C, 'F1_score': f1})
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# Create a DataFrame to display results in tabular format
results_df = pd.DataFrame(results)
print(results_df)
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