Notebook

November 19, 2024

1 Import libraries

```
import os
import sys
import cv2
import math
import json
import joblib
import nbformat
import numpy as np
import pandas as pd
import seaborn as sns
from tqdm import tqdm
from sklearn.svm import SVC
from datetime import datetime
import matplotlib.pyplot as plt
from nbconvert.exporters import PDFExporter
from skimage.feature import hog as skimage_hog
from sklearn.preprocessing import LabelEncoder
from IPython.display import display, Javascript
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.metrics import classification_report, confusion_matrix
from scipy.spatial.distance import cityblock, cosine, correlation, sqeuclidean
```

2 Load data

```
project_dir = os.getcwd()
project_dir = os.path.dirname(project_dir)
```

```
width = 64
height = 64
```

```
data_dir = project_dir + "\\data"

train_path = os.path.join(data_dir, "train")
```

```
test_path = os.path.join(data_dir, "test")

train_images = []
test_images = []

train_labels = []
test_labels = []

for path in (train_path, test_path):
    if (path.split('\\')[-1] == "train"):
        for dir in os.listdir(path):
            label_path = os.path.join(path, dir)
            label = dir.split('\\')[-1]
            for image in os.listdir(label_path):
                image_path = os.path.join(label_path, image)
                image = cv2.imread(image_path)
                image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
                image = cv2.resize(image, (width, height))
                train_images.append(image)
                train_labels.append(label)
    else:
        for dir in os.listdir(path):
            label_path = os.path.join(path, dir)
            label = dir.split('\\')[-1]
            for image in os.listdir(label_path):
                image_path = os.path.join(label_path, image)
                image = cv2.imread(image_path)
                image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
                image = cv2.resize(image, (width, height))
                test_images.append(image)
                test_labels.append(label)
```

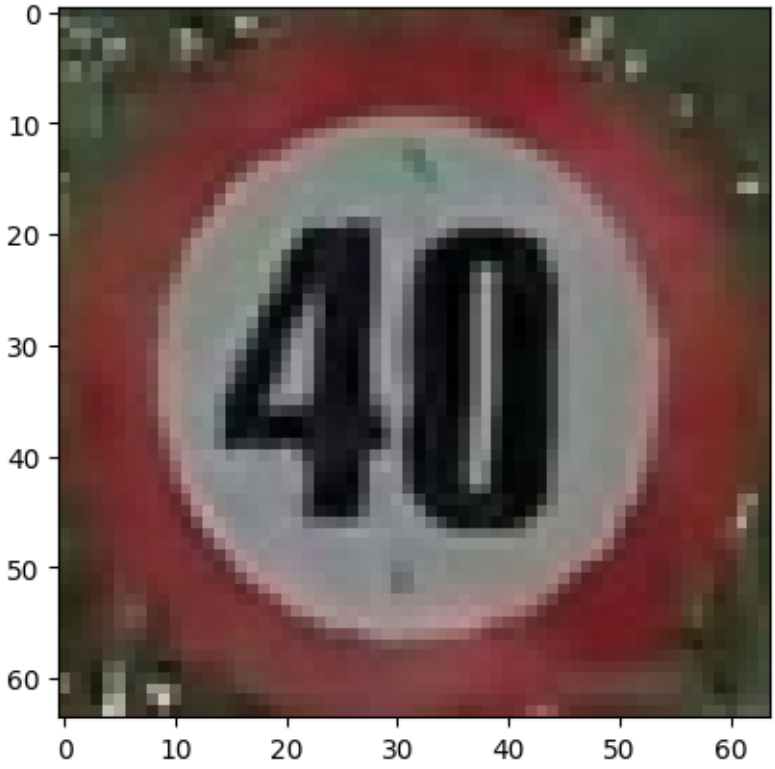
```
label_encoder = LabelEncoder()
train_labels_encoded = label_encoder.fit_transform(train_labels)
test_labels_encoded = label_encoder.transform(test_labels)
```

```
joblib.dump(train_labels_encoded, project_dir + '\joblib\\train_labels_encoded.
 ↪joblib')
joblib.dump(test_labels_encoded, project_dir + '\joblib\\test_labels_encoded.
 ↪joblib')
joblib.dump(label_encoder, project_dir + '\joblib\\label_encoder.joblib')
```

```
['d:\\ASUS\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\label_encoder.joblib']
```

```
plt.imshow(test_images[0])
```

```
<matplotlib.image.AxesImage at 0x22f4fb16910>
```




```
plt.imshow(train_images[1])
```

```
<matplotlib.image.AxesImage at 0x22f50de5a10>
```

3 Extract features

```
def blur_image(image):
    blurred_image = cv2.medianBlur(image, 5)
    return blurred_image
```

```
def color_histogram(image):
    # image = cv2.cvtColor(image, cv2.COLOR_RGB2LUV)
    row, column, channel = image.shape[:3]
    size = row * column
    feature = []
    for k in range(channel):
        histogram = np.squeeze(cv2.calcHist([image], [k], None, [32], [0, 256]))
        histogram = histogram / size
        feature.extend(histogram)
    return feature
```

```
def hog(image):
    # image = cv2.cvtColor(image, cv2.COLOR_RGB2LUV)
```

```
    hog_features = skimage_hog(image, orientations=9, pixels_per_cell=(8, 8),␣
 ↪cells_per_block=(2, 2), visualize=False, block_norm='L2-Hys',␣
 ↪transform_sqrt=True, channel_axis=2)
    return hog_features
```

```
def extract_features(images):
    blurred_images = [blur_image(image) for image in tqdm(images,␣
 ↪desc="Sharpening Images")]
    color_features = [color_histogram(image) for image in tqdm(blurred_images,␣
 ↪desc="Extracting Color Features")]
    hog_features = [hog(image) for image in tqdm(blurred_images,␣
 ↪desc="Extracting HOG Features")]
    combined_features = [np.concatenate((color_feature, hog_feature))
                         for color_feature, hog_feature in␣
 ↪tqdm(zip(color_features, hog_features), desc="Combining Features")]

    return combined_features
```

```
train_features = extract_features(train_images)
joblib.dump(train_features, project_dir + '\joblib\\train_features.joblib')
```

```
Sharpening Images: 100%|      | 1415/1415 [00:00<00:00, 1545.00it/s]
Extracting Color Features: 100%|      | 1415/1415 [00:00<00:00,
13039.70it/s]
Extracting HOG Features: 100%|      | 1415/1415 [00:05<00:00, 265.33it/s]
Combining Features: 1415it [00:00, 40434.26it/s]

['d:\\ASUS\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\train_features.joblib']
```

```
test_features = extract_features(test_images)
joblib.dump(test_features, project_dir + '\joblib\\test_features.joblib')
```

```
Sharpening Images: 100%|      | 150/150 [00:00<00:00, 2050.44it/s]
Extracting Color Features: 100%|      | 150/150 [00:00<00:00, 11529.36it/s]
Extracting HOG Features: 100%|      | 150/150 [00:00<00:00, 238.39it/s]
Combining Features: 150it [00:00, 34274.66it/s]

['d:\\ASUS\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\test_features.joblib']
```

```
X_train, X_val, y_train, y_val = train_test_split(train_features,␣
 ↪train_labels_encoded, test_size=0.2, random_state=42)
```

4 Distance metrics KNN

```
def chi_square_distance(x, y):
    return cv2.compareHist(np.array(x, dtype=np.float32), np.array(y, dtype=np.
 ↪float32), cv2.HISTCMP_CHISQR)

def bhattacharyya_distance(x, y):
    return cv2.compareHist(np.array(x, dtype=np.float32), np.array(y, dtype=np.
 ↪float32), cv2.HISTCMP_BHATTACHARYYA)

def intersection_distance(x, y):
    return 1 - cv2.compareHist(np.array(x, dtype=np.float32), np.array(y,␣
 ↪dtype=np.float32), cv2.HISTCMP_INTERSECT)
```

5 Gridsearch KNN

```
param_grid = {
    'n_neighbors': [3, 4, 5, 6, 7],
    'weights': ['uniform', 'distance'],
    'leaf_size': [10, 20, 30, 40, 50],
    'metric': [
        cityblock,
        cosine,
        correlation,
        sqeuclidean,
        chi_square_distance,
        bhattacharyya_distance,
        intersection_distance
    ]
}

knn_model = KNeighborsClassifier()
grid_search_knn = GridSearchCV(
    knn_model,
    param_grid,
    cv=3,
    scoring='f1_macro',
    verbose=3
)

grid_search_knn.fit(X_train, y_train)
```

```
Fitting 3 folds for each of 350 candidates, totalling 1050 fits
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
```

```
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.1s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.7s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.5s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.6s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.5s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.7s
```

```
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.5s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   8.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   8.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.3s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.4s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   8.6s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   9.0s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   9.0s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.5s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.6s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.6s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.5s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   8.7s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   8.4s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   9.3s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.6s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.5s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   8.5s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.6s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   8.4s
```

```
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.7s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.8s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.6s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.5s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   8.6s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.4s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   9.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.6s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  18.9s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  18.4s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  19.2s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  18.2s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  18.1s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.1s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  18.9s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.3s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  18.4s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  19.0s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.6s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  18.6s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  18.4s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  19.1s
```

```
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  18.2s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  17.8s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  18.5s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  18.4s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  18.5s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  18.3s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  19.1s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  18.4s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  18.2s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  18.2s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  18.7s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  18.0s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  18.1s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  19.3s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  18.5s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.6s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.7s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.2s
```

```
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.6s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.6s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.1s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.717 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
```

```
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.701 total time=
3.9s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.693 total time=
3.8s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.0s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.6s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.6s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.2s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.761 total time=
4.2s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
```

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0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.729 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.0s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.702 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.0s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.1s
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0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.5s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.732 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.717 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.794 total time=
3.6s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.803 total time=
3.6s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.797 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
```

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0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.832 total time=
3.7s
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[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.7s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.763 total time=
3.6s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.5s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.8s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.6s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.811 total time=
3.6s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.8s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.783 total time=
3.5s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.9s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.6s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.6s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.774 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.8s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.7s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.8s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.8s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.7s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.8s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.8s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.8s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
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3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.8s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.785 total time=
3.9s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
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3.2s
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3.5s
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4.0s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
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0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.4s
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3.4s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.4s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.5s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=uniform;, score=0.683 total time=
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[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.5s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
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3.3s
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0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.5s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
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3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
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3.4s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
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3.3s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
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0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
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3.4s
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0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=uniform;, score=0.701 total time=
3.4s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.2s
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3.3s
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3.2s
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3.1s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
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3.2s
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n_neighbors=3, weights=uniform;, score=0.841 total time=   3.2s
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n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.6s
```

```
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.5s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.5s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.6s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.9s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   8.7s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   9.0s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.8s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.2s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   8.2s
```

```
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   8.3s
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n_neighbors=4, weights=uniform;, score=0.816 total time=   8.4s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.8s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.9s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.4s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.3s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   8.4s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   8.5s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   8.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   9.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.6s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.6s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   8.4s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   9.0s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   8.8s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.7s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.8s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   9.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.7s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.7s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.9s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   8.8s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.5s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   8.5s
```

```
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   9.2s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  18.0s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  18.1s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  18.1s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  19.3s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  18.4s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.9s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  19.2s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.2s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  17.9s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  18.0s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.7s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  18.2s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  19.2s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  19.6s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  19.1s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  19.1s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  19.2s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  19.8s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  18.2s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  18.1s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  18.7s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  18.0s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  18.2s
```

```
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  19.1s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  19.8s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  18.6s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  17.8s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  18.9s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  17.9s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.5s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.5s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.6s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
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[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
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[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.6s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.5s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.5s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.5s
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[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.6s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.8s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   4.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.7s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   4.1s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.5s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.5s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.3s
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[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
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4.1s
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0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.662 total time=
3.9s
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[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
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[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
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4.0s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.0s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.689 total time=
3.9s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.702 total time=
4.0s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
```

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0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.2s
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4.2s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.2s
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0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.4s
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0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.6s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.732 total time=
4.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.717 total time=
4.1s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.794 total time=
3.9s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.9s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.8s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.8s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.8s
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3.8s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.8s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.8s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.9s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.8s
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3.6s
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3.6s
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3.6s
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3.9s
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3.7s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.7s
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3.5s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.6s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.6s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.5s
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3.7s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.6s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.5s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.6s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.7s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.5s
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[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.6s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.6s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
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3.6s
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3.6s
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3.4s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
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3.3s
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3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
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3.5s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
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0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.5s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
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3.4s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
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3.4s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
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3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
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3.6s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.9s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
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3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.4s
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3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
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3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
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3.5s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
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```
0x0000022F50DFB7E0>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
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3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.5s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.5s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.7s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.6s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.4s
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n_neighbors=5, weights=uniform;, score=0.838 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.3s
```

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[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.1s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.5s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.6s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   8.6s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   8.8s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.7s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.8s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   8.9s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   8.7s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   9.5s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.8s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.5s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.3s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.4s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   8.3s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   8.9s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   8.5s
```

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[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.9s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.5s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.4s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   8.6s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.5s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   8.8s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.9s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
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[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.8s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.7s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.8s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   9.0s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   9.0s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.7s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   9.4s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.9s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  19.1s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  18.3s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  18.5s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  18.4s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  18.1s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.2s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  19.9s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  19.0s
```

```
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  18.8s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  18.5s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.2s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  18.2s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  18.1s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  19.0s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  19.0s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  18.9s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  19.5s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  19.3s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  19.0s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  18.7s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  19.1s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  18.0s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  17.9s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  18.6s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  18.8s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  19.1s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  19.3s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  19.8s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  17.9s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.1s
```

```
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.6s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.1s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.5s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.5s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.9s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.7s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.5s
```

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[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.5s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.717 total time=
4.2s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.4s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.2s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.693 total time=
4.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.2s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.4s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
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4.5s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
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0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.761 total time=
4.2s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.729 total time=
3.9s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.0s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.0s
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0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.702 total time=
4.0s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.707 total time=
3.9s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.0s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.3s
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0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.0s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.732 total time=
3.9s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
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0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.717 total time=
3.9s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.794 total time=
3.8s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.803 total time=
3.8s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.797 total time=
3.7s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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3.7s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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3.8s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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3.8s
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0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.763 total time=
3.7s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.8s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.8s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.812 total time=
3.8s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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4.2s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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3.9s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.7s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
```

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0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.795 total time=
3.8s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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4.0s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.786 total time=
3.7s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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3.8s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.8s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
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3.9s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.821 total time=
3.7s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.6s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.6s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.6s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.764 total time=
3.7s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.809 total time=
3.5s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.6s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.785 total time=
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[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.2s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
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0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.3s
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0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.3s
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0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
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3.4s
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3.3s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
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0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
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3.7s
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3.5s
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3.3s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
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3.4s
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3.3s
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3.5s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
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3.4s
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n_neighbors=3, weights=uniform;, score=0.841 total time=   3.4s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.4s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.5s
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n_neighbors=4, weights=uniform;, score=0.842 total time=   3.4s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   4.0s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.6s
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n_neighbors=4, weights=distance;, score=0.872 total time=   3.3s
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n_neighbors=4, weights=distance;, score=0.872 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.4s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.4s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.4s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.4s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.4s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.4s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.4s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.7s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.2s
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```
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x0000022F4C42F1A0>,
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[CV 1/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   8.4s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   8.3s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.4s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.3s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   8.3s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   8.8s
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n_neighbors=4, weights=uniform;, score=0.816 total time=   9.4s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.8s
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n_neighbors=4, weights=uniform;, score=0.803 total time=   8.7s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.7s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.7s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
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[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   9.2s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.4s
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n_neighbors=5, weights=distance;, score=0.834 total time=   8.4s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   8.2s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.3s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   8.3s
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[CV 1/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.8s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
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```

```
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.9s
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[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.8s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   8.8s
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[CV 2/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
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[CV 3/3] END leaf_size=40, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.7s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  19.2s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
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n_neighbors=3, weights=uniform;, score=0.870 total time=  20.0s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  18.8s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  17.9s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.2s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  18.8s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.5s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  18.3s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  19.7s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.7s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  18.2s
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n_neighbors=5, weights=uniform;, score=0.851 total time=  18.0s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  18.9s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  17.9s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  18.4s
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n_neighbors=5, weights=distance;, score=0.855 total time=  19.8s
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[CV 3/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
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n_neighbors=6, weights=uniform;, score=0.822 total time=  19.1s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  19.3s
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n_neighbors=6, weights=distance;, score=0.862 total time=  19.1s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
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[CV 3/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
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[CV 1/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
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n_neighbors=7, weights=uniform;, score=0.825 total time=  18.9s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  19.5s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  19.2s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x0000022F4C42EDE0>,
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n_neighbors=3, weights=uniform;, score=0.826 total time=   3.4s
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n_neighbors=3, weights=uniform;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.6s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
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[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.2s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
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[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.2s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.3s
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[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
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n_neighbors=5, weights=uniform;, score=0.810 total time=   3.2s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.4s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.1s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.1s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.4s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.1s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.6s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.3s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.5s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.4s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.3s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.5s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.717 total time=
4.2s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.1s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
```

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0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.2s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.3s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.693 total time=
4.2s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.1s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.8s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.4s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.1s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.1s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.2s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.761 total time=
4.2s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.1s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.729 total time=
4.3s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.2s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
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```
0x0000022F50DFB920>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.4s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
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4.1s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.6s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
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4.5s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
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4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.1s
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4.0s
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0x0000022F50DFB920>, n_neighbors=7, weights=distance;, score=0.732 total time=
3.9s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
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4.0s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.794 total time=
3.6s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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3.6s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.832 total time=
3.6s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.822 total time=
3.6s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.6s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.763 total time=
3.5s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.6s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.5s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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4.0s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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3.8s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.780 total time=
3.6s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.783 total time=
3.6s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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3.8s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.795 total time=
3.7s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.6s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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3.7s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.774 total time=
3.8s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.8s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.769 total time=
3.9s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.821 total time=
3.8s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.9s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.8s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.9s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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3.8s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.809 total time=
4.3s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.8s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
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[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.4s
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0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.4s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.4s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.4s
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3.3s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.2s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=uniform;, score=0.638 total time=
3.3s
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0x0000022F50DFB7E0>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.2s
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3.2s
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0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.2s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.2s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
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3.2s
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3.1s
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0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.7s
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0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
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3.2s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=uniform;, score=0.721 total time=
3.2s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.2s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.1s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
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```
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.1s
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0x0000022F50DFB7E0>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.3s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=uniform;, score=0.684 total time=
3.2s
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3.3s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
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3.4s
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n_neighbors=3, weights=uniform;, score=0.841 total time=   3.5s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.5s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.9s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.7s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.3s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.4s
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```
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.4s
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n_neighbors=5, weights=distance;, score=0.865 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.7s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.8s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x0000022F4C42F1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   8.9s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   8.9s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.7s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.5s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   8.6s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   8.9s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.3s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.5s
```

```
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.6s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.4s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.6s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   8.5s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   9.5s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   8.9s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   9.0s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.8s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.9s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   9.0s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.7s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   8.8s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.6s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.3s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.3s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.5s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.4s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.6s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   8.7s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   9.3s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   8.4s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x0000022F4C42EE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.8s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  18.7s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  18.6s
```

```
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  19.8s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  19.1s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  19.5s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  19.9s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  18.1s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.1s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  18.0s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  18.7s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.2s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  19.0s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  19.8s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  18.7s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  18.2s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  18.0s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  18.7s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  18.3s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  18.3s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  19.5s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  18.6s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  19.0s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  19.1s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  19.9s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  19.1s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  18.2s
```

```
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  18.7s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  18.1s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  18.0s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x0000022F4C42EDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.4s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.7s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   4.0s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.3s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.4s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.6s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.3s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.1s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.3s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.7s
```

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[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.2s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.2s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.4s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.2s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.3s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.3s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.1s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.3s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x0000022F4C42ED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.2s
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[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
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[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
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[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
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3.9s
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0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.0s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=3, weights=distance;, score=0.693 total time=
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[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.1s
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0x0000022F50DFB920>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.2s
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```
0x0000022F50DFB920>, n_neighbors=4, weights=distance;, score=0.748 total time=
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[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
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4.2s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.3s
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0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.761 total time=
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0x0000022F50DFB920>, n_neighbors=5, weights=distance;, score=0.729 total time=
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[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
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[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
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4.2s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
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[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.4s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.3s
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0x0000022F50DFB920>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.3s
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4.1s
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[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
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3.8s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=uniform;, score=0.797 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.832 total time=
3.9s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.822 total time=
3.8s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.763 total time=
3.8s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.9s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=uniform;, score=0.771 total time=
4.3s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.6s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.811 total time=
3.6s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
```

```
0x0000022F50DFB9C0>, n_neighbors=4, weights=distance;, score=0.812 total time=
3.6s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.780 total time=
3.7s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.7s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.795 total time=
3.5s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.7s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=5, weights=distance;, score=0.786 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.774 total time=
3.6s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.6s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=uniform;, score=0.769 total time=
3.7s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.821 total time=
3.5s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.6s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.5s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.791 total time=
4.1s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=uniform;, score=0.764 total time=
4.1s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
```

```
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.809 total time=
3.8s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.8s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x0000022F50DFB9C0>, n_neighbors=7, weights=distance;, score=0.785 total time=
3.9s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.4s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.3s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.4s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=uniform;, score=0.638 total time=
3.4s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.3s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.5s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.2s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.4s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
```

```
0x0000022F50DFB7E0>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.6s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=uniform;, score=0.715 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=uniform;, score=0.694 total time=
3.1s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=uniform;, score=0.721 total time=
3.4s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.1s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.2s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.1s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=uniform;, score=0.701 total time=
3.2s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.2s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=uniform;, score=0.684 total time=
3.3s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x0000022F50DFB7E0>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.1s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
```

```
0x0000022F50DFB7E0>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.2s

GridSearchCV(cv=3, estimator=KNeighborsClassifier(),
             param_grid={'leaf_size': [10, 20, 30, 40, 50],
                         'metric': [<function cityblock at 0x0000022F4C42F1A0>,
                                    <function cosine at 0x0000022F4C42EE80>,
                                    <function correlation at
0x0000022F4C42EDE0>,
                                    <function sqeuclidean at
0x0000022F4C42ED40>,
                                    <function chi_square_distance at
0x0000022F50DFB920>,
                                    <function bhattacharyya_distance at
0x0000022F50DFB9C0>,
                                    <function intersection_distance at
0x0000022F50DFB7E0>],
                         'n_neighbors': [3, 4, 5, 6, 7],
                         'weights': ['uniform', 'distance']},
             scoring='f1_macro', verbose=3)
```

```
best_knn = grid_search_knn.best_estimator_
print(f"Best Params: {grid_search_knn.best_params_}")

best_knn.fit(train_features, train_labels_encoded)

y_pred_knn = best_knn.predict(test_features)

joblib.dump(best_knn, project_dir + '\joblib\\best_knn_model.joblib')
```

```
Best Params: {'leaf_size': 10, 'metric': <function cityblock at
0x0000022F4C42F1A0>, 'n_neighbors': 3, 'weights': 'distance'}

['d:\\ASUS\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\best_knn_model.joblib']
```

6 Gridsearch SVM

```
param_grid = {
    'C': [0.1, 1, 10, 100],
    'kernel': ['rbf', 'linear', 'poly', 'sigmoid'],
    'gamma': ['scale', 'auto', 0.1, 0.01, 0.001],
    'degree': [2, 3, 4],
}

svm_model = SVC(random_state=42)
```

```
grid_search_svm = GridSearchCV(
    estimator=svm_model,
    param_grid=param_grid,
    cv=3,
    scoring='f1_macro',
    verbose=3,
)

grid_search_svm.fit(X_train, y_train)
```

```
Fitting 3 folds for each of 240 candidates, totalling 720 fits
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.471 total time=
1.3s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.481 total time=
1.0s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.476 total time=
1.0s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.736 total time=
0.6s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.690 total time=
0.7s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.701 total time=
0.6s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.494 total
time=   0.9s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.485 total
time=   0.8s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.500 total
time=   1.0s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.3s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
0.9s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.249 total time=
1.2s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.226 total time=
1.3s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.224 total time=
1.2s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.842 total time=
0.4s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.838 total time=
0.4s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.850 total time=
0.4s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.858 total time=
0.5s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.6s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.888 total time=
0.7s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.208 total
time=   1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.264 total
time=   1.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.246 total
time=   1.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.459 total time=
1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.460 total time=
1.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.454 total time=
1.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.398 total time=
```

```
1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.386 total time=
0.9s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.389 total time=
1.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.443 total
time=   0.8s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.451 total
time=   0.9s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.449 total
time=   0.9s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.3s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.471 total time=
1.1s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.481 total time=
1.1s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.476 total time=
1.0s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.774 total time=
```

```
0.7s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.782 total time=
0.7s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.758 total time=
0.7s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.494 total
time=   0.9s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.485 total
time=   0.8s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.500 total
time=   0.8s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.3s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.249 total time=
1.2s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.226 total time=
1.3s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.224 total time=
1.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.842 total time=
0.4s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.838 total time=
0.4s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.850 total time=
0.5s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
```

```
0.7s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
0.7s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.208 total
time=   1.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.264 total
time=   1.0s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.246 total
time=   0.9s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.459 total time=
1.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.460 total time=
1.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.454 total time=
1.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.443 total
time=   0.9s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.451 total
time=   0.9s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.449 total
time=   0.8s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
0.9s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.471 total time=
1.0s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.481 total time=
1.0s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.476 total time=
1.1s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.792 total time=
0.7s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.819 total time=
0.7s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.811 total time=
0.7s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.494 total
time=   0.8s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.485 total
time=   0.9s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.500 total
time=   0.8s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
0.9s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.249 total time=
1.2s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.226 total time=
1.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.224 total time=
1.2s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.842 total time=
0.4s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.838 total time=
0.4s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.850 total time=
0.5s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
0.9s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
0.9s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.208 total
time=   1.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.264 total
time=   1.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.246 total
time=   1.0s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.459 total time=
1.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.460 total time=
1.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.454 total time=
1.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
```

```
0.9s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.9s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.443 total
time=   0.9s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.451 total
time=   0.9s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.449 total
time=   0.9s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.838 total
time=   0.4s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 1/3] END C=1, degree=2, gamma=scale, kernel=rbf;, score=0.833 total time=
0.8s
[CV 2/3] END C=1, degree=2, gamma=scale, kernel=rbf;, score=0.837 total time=
0.9s
[CV 3/3] END C=1, degree=2, gamma=scale, kernel=rbf;, score=0.864 total time=
0.8s
[CV 1/3] END C=1, degree=2, gamma=scale, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=2, gamma=scale, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=2, gamma=scale, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=1, degree=2, gamma=scale, kernel=poly;, score=0.861 total time=
```

```
0.6s
[CV 2/3] END C=1, degree=2, gamma=scale, kernel=poly;, score=0.885 total time=
0.6s
[CV 3/3] END C=1, degree=2, gamma=scale, kernel=poly;, score=0.888 total time=
0.6s
[CV 1/3] END C=1, degree=2, gamma=scale, kernel=sigmoid;, score=0.748 total
time=   0.5s
[CV 2/3] END C=1, degree=2, gamma=scale, kernel=sigmoid;, score=0.727 total
time=   0.5s
[CV 3/3] END C=1, degree=2, gamma=scale, kernel=sigmoid;, score=0.735 total
time=   0.6s
[CV 1/3] END C=1, degree=2, gamma=auto, kernel=rbf;, score=0.450 total time=
1.1s
[CV 2/3] END C=1, degree=2, gamma=auto, kernel=rbf;, score=0.453 total time=
1.1s
[CV 3/3] END C=1, degree=2, gamma=auto, kernel=rbf;, score=0.452 total time=
1.0s
[CV 1/3] END C=1, degree=2, gamma=auto, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=2, gamma=auto, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=2, gamma=auto, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 2/3] END C=1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 1/3] END C=1, degree=2, gamma=auto, kernel=sigmoid;, score=0.400 total time=
0.9s
[CV 2/3] END C=1, degree=2, gamma=auto, kernel=sigmoid;, score=0.396 total time=
1.0s
[CV 3/3] END C=1, degree=2, gamma=auto, kernel=sigmoid;, score=0.403 total time=
0.9s
[CV 1/3] END C=1, degree=2, gamma=0.1, kernel=rbf;, score=0.806 total time=
1.3s
[CV 2/3] END C=1, degree=2, gamma=0.1, kernel=rbf;, score=0.781 total time=
1.2s
[CV 3/3] END C=1, degree=2, gamma=0.1, kernel=rbf;, score=0.809 total time=
1.1s
[CV 1/3] END C=1, degree=2, gamma=0.1, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=2, gamma=0.1, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=2, gamma=0.1, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=1, degree=2, gamma=0.1, kernel=poly;, score=0.851 total time=
```

```
0.6s
[CV 2/3] END C=1, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.7s
[CV 3/3] END C=1, degree=2, gamma=0.1, kernel=poly;, score=0.897 total time=
0.6s
[CV 1/3] END C=1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.505 total time=
0.7s
[CV 2/3] END C=1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.460 total time=
0.8s
[CV 3/3] END C=1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.460 total time=
0.8s
[CV 1/3] END C=1, degree=2, gamma=0.01, kernel=rbf;, score=0.779 total time=
0.7s
[CV 2/3] END C=1, degree=2, gamma=0.01, kernel=rbf;, score=0.781 total time=
0.7s
[CV 3/3] END C=1, degree=2, gamma=0.01, kernel=rbf;, score=0.773 total time=
0.8s
[CV 1/3] END C=1, degree=2, gamma=0.01, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=1, degree=2, gamma=0.01, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=1, degree=2, gamma=0.01, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=1, degree=2, gamma=0.01, kernel=poly;, score=0.732 total time=
0.6s
[CV 2/3] END C=1, degree=2, gamma=0.01, kernel=poly;, score=0.682 total time=
0.7s
[CV 3/3] END C=1, degree=2, gamma=0.01, kernel=poly;, score=0.691 total time=
0.7s
[CV 1/3] END C=1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.758 total time=
0.6s
[CV 2/3] END C=1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.720 total time=
0.7s
[CV 3/3] END C=1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.728 total time=
0.6s
[CV 1/3] END C=1, degree=2, gamma=0.001, kernel=rbf;, score=0.511 total time=
1.0s
[CV 2/3] END C=1, degree=2, gamma=0.001, kernel=rbf;, score=0.516 total time=
1.1s
[CV 3/3] END C=1, degree=2, gamma=0.001, kernel=rbf;, score=0.513 total time=
1.0s
[CV 1/3] END C=1, degree=2, gamma=0.001, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=2, gamma=0.001, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=2, gamma=0.001, kernel=linear;, score=0.845 total time=
0.6s
[CV 1/3] END C=1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
0.9s
[CV 2/3] END C=1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 1/3] END C=1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.448 total
time=   0.9s
[CV 2/3] END C=1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.453 total
time=   0.9s
[CV 3/3] END C=1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.452 total
time=   0.9s
[CV 1/3] END C=1, degree=3, gamma=scale, kernel=rbf;, score=0.833 total time=
0.9s
[CV 2/3] END C=1, degree=3, gamma=scale, kernel=rbf;, score=0.837 total time=
0.8s
[CV 3/3] END C=1, degree=3, gamma=scale, kernel=rbf;, score=0.864 total time=
0.8s
[CV 1/3] END C=1, degree=3, gamma=scale, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=3, gamma=scale, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=3, gamma=scale, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=1, degree=3, gamma=scale, kernel=poly;, score=0.851 total time=
0.7s
[CV 2/3] END C=1, degree=3, gamma=scale, kernel=poly;, score=0.901 total time=
0.7s
[CV 3/3] END C=1, degree=3, gamma=scale, kernel=poly;, score=0.897 total time=
0.6s
[CV 1/3] END C=1, degree=3, gamma=scale, kernel=sigmoid;, score=0.748 total
time=   0.5s
[CV 2/3] END C=1, degree=3, gamma=scale, kernel=sigmoid;, score=0.727 total
time=   0.5s
[CV 3/3] END C=1, degree=3, gamma=scale, kernel=sigmoid;, score=0.735 total
time=   0.5s
[CV 1/3] END C=1, degree=3, gamma=auto, kernel=rbf;, score=0.450 total time=
1.0s
[CV 2/3] END C=1, degree=3, gamma=auto, kernel=rbf;, score=0.453 total time=
1.1s
[CV 3/3] END C=1, degree=3, gamma=auto, kernel=rbf;, score=0.452 total time=
1.0s
[CV 1/3] END C=1, degree=3, gamma=auto, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=1, degree=3, gamma=auto, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=1, degree=3, gamma=auto, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
0.9s
[CV 2/3] END C=1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=1, degree=3, gamma=auto, kernel=sigmoid;, score=0.400 total time=
1.0s
[CV 2/3] END C=1, degree=3, gamma=auto, kernel=sigmoid;, score=0.396 total time=
0.9s
[CV 3/3] END C=1, degree=3, gamma=auto, kernel=sigmoid;, score=0.403 total time=
0.9s
[CV 1/3] END C=1, degree=3, gamma=0.1, kernel=rbf;, score=0.806 total time=
1.3s
[CV 2/3] END C=1, degree=3, gamma=0.1, kernel=rbf;, score=0.781 total time=
1.3s
[CV 3/3] END C=1, degree=3, gamma=0.1, kernel=rbf;, score=0.809 total time=
1.2s
[CV 1/3] END C=1, degree=3, gamma=0.1, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=1, degree=3, gamma=0.1, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=3, gamma=0.1, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=1, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
0.7s
[CV 2/3] END C=1, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
0.7s
[CV 3/3] END C=1, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
0.7s
[CV 1/3] END C=1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.505 total time=
0.8s
[CV 2/3] END C=1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.460 total time=
0.8s
[CV 3/3] END C=1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.460 total time=
0.8s
[CV 1/3] END C=1, degree=3, gamma=0.01, kernel=rbf;, score=0.779 total time=
0.7s
[CV 2/3] END C=1, degree=3, gamma=0.01, kernel=rbf;, score=0.781 total time=
0.7s
[CV 3/3] END C=1, degree=3, gamma=0.01, kernel=rbf;, score=0.773 total time=
0.8s
[CV 1/3] END C=1, degree=3, gamma=0.01, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=1, degree=3, gamma=0.01, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=1, degree=3, gamma=0.01, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=1, degree=3, gamma=0.01, kernel=poly;, score=0.554 total time=
```

```
0.7s
[CV 2/3] END C=1, degree=3, gamma=0.01, kernel=poly;, score=0.529 total time=
0.8s
[CV 3/3] END C=1, degree=3, gamma=0.01, kernel=poly;, score=0.535 total time=
0.8s
[CV 1/3] END C=1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.758 total time=
0.6s
[CV 2/3] END C=1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.720 total time=
0.6s
[CV 3/3] END C=1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.728 total time=
0.6s
[CV 1/3] END C=1, degree=3, gamma=0.001, kernel=rbf;, score=0.511 total time=
1.0s
[CV 2/3] END C=1, degree=3, gamma=0.001, kernel=rbf;, score=0.516 total time=
1.0s
[CV 3/3] END C=1, degree=3, gamma=0.001, kernel=rbf;, score=0.513 total time=
1.0s
[CV 1/3] END C=1, degree=3, gamma=0.001, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=3, gamma=0.001, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=3, gamma=0.001, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 1/3] END C=1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.448 total
time=   0.9s
[CV 2/3] END C=1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.453 total
time=   1.0s
[CV 3/3] END C=1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.452 total
time=   0.9s
[CV 1/3] END C=1, degree=4, gamma=scale, kernel=rbf;, score=0.833 total time=
0.9s
[CV 2/3] END C=1, degree=4, gamma=scale, kernel=rbf;, score=0.837 total time=
1.0s
[CV 3/3] END C=1, degree=4, gamma=scale, kernel=rbf;, score=0.864 total time=
1.0s
[CV 1/3] END C=1, degree=4, gamma=scale, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=1, degree=4, gamma=scale, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=4, gamma=scale, kernel=linear;, score=0.845 total time=
0.7s
[CV 1/3] END C=1, degree=4, gamma=scale, kernel=poly;, score=0.847 total time=
```

```
1.0s
[CV 2/3] END C=1, degree=4, gamma=scale, kernel=poly;, score=0.884 total time=
0.9s
[CV 3/3] END C=1, degree=4, gamma=scale, kernel=poly;, score=0.897 total time=
0.9s
[CV 1/3] END C=1, degree=4, gamma=scale, kernel=sigmoid;, score=0.748 total
time=   0.8s
[CV 2/3] END C=1, degree=4, gamma=scale, kernel=sigmoid;, score=0.727 total
time=   0.6s
[CV 3/3] END C=1, degree=4, gamma=scale, kernel=sigmoid;, score=0.735 total
time=   0.9s
[CV 1/3] END C=1, degree=4, gamma=auto, kernel=rbf;, score=0.450 total time=
1.6s
[CV 2/3] END C=1, degree=4, gamma=auto, kernel=rbf;, score=0.453 total time=
1.4s
[CV 3/3] END C=1, degree=4, gamma=auto, kernel=rbf;, score=0.452 total time=
1.5s
[CV 1/3] END C=1, degree=4, gamma=auto, kernel=linear;, score=0.822 total time=
0.6s
[CV 2/3] END C=1, degree=4, gamma=auto, kernel=linear;, score=0.817 total time=
0.8s
[CV 3/3] END C=1, degree=4, gamma=auto, kernel=linear;, score=0.845 total time=
0.6s
[CV 1/3] END C=1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=1, degree=4, gamma=auto, kernel=sigmoid;, score=0.400 total time=
1.0s
[CV 2/3] END C=1, degree=4, gamma=auto, kernel=sigmoid;, score=0.396 total time=
1.5s
[CV 3/3] END C=1, degree=4, gamma=auto, kernel=sigmoid;, score=0.403 total time=
1.1s
[CV 1/3] END C=1, degree=4, gamma=0.1, kernel=rbf;, score=0.806 total time=
1.2s
[CV 2/3] END C=1, degree=4, gamma=0.1, kernel=rbf;, score=0.781 total time=
1.3s
[CV 3/3] END C=1, degree=4, gamma=0.1, kernel=rbf;, score=0.809 total time=
1.2s
[CV 1/3] END C=1, degree=4, gamma=0.1, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=4, gamma=0.1, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=4, gamma=0.1, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=1, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
```

```
0.8s
[CV 2/3] END C=1, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
0.8s
[CV 3/3] END C=1, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.505 total time=
0.9s
[CV 2/3] END C=1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.460 total time=
0.8s
[CV 3/3] END C=1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.460 total time=
0.8s
[CV 1/3] END C=1, degree=4, gamma=0.01, kernel=rbf;, score=0.779 total time=
0.8s
[CV 2/3] END C=1, degree=4, gamma=0.01, kernel=rbf;, score=0.781 total time=
0.8s
[CV 3/3] END C=1, degree=4, gamma=0.01, kernel=rbf;, score=0.773 total time=
0.8s
[CV 1/3] END C=1, degree=4, gamma=0.01, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=1, degree=4, gamma=0.01, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=1, degree=4, gamma=0.01, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=1, degree=4, gamma=0.01, kernel=poly;, score=0.432 total time=
0.9s
[CV 2/3] END C=1, degree=4, gamma=0.01, kernel=poly;, score=0.444 total time=
0.9s
[CV 3/3] END C=1, degree=4, gamma=0.01, kernel=poly;, score=0.451 total time=
0.9s
[CV 1/3] END C=1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.758 total time=
0.6s
[CV 2/3] END C=1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.720 total time=
0.7s
[CV 3/3] END C=1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.728 total time=
0.7s
[CV 1/3] END C=1, degree=4, gamma=0.001, kernel=rbf;, score=0.511 total time=
1.0s
[CV 2/3] END C=1, degree=4, gamma=0.001, kernel=rbf;, score=0.516 total time=
1.1s
[CV 3/3] END C=1, degree=4, gamma=0.001, kernel=rbf;, score=0.513 total time=
0.9s
[CV 1/3] END C=1, degree=4, gamma=0.001, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=1, degree=4, gamma=0.001, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=1, degree=4, gamma=0.001, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
0.9s
[CV 2/3] END C=1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.448 total
time=   0.9s
[CV 2/3] END C=1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.453 total
time=   0.9s
[CV 3/3] END C=1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.452 total
time=   1.0s
[CV 1/3] END C=10, degree=2, gamma=scale, kernel=rbf;, score=0.851 total time=
0.9s
[CV 2/3] END C=10, degree=2, gamma=scale, kernel=rbf;, score=0.891 total time=
1.0s
[CV 3/3] END C=10, degree=2, gamma=scale, kernel=rbf;, score=0.894 total time=
0.9s
[CV 1/3] END C=10, degree=2, gamma=scale, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=10, degree=2, gamma=scale, kernel=linear;, score=0.817 total
time=   0.5s
[CV 3/3] END C=10, degree=2, gamma=scale, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=10, degree=2, gamma=scale, kernel=poly;, score=0.851 total time=
0.6s
[CV 2/3] END C=10, degree=2, gamma=scale, kernel=poly;, score=0.877 total time=
0.6s
[CV 3/3] END C=10, degree=2, gamma=scale, kernel=poly;, score=0.897 total time=
0.6s
[CV 1/3] END C=10, degree=2, gamma=scale, kernel=sigmoid;, score=0.728 total
time=   0.4s
[CV 2/3] END C=10, degree=2, gamma=scale, kernel=sigmoid;, score=0.731 total
time=   0.3s
[CV 3/3] END C=10, degree=2, gamma=scale, kernel=sigmoid;, score=0.725 total
time=   0.3s
[CV 1/3] END C=10, degree=2, gamma=auto, kernel=rbf;, score=0.765 total time=
0.8s
[CV 2/3] END C=10, degree=2, gamma=auto, kernel=rbf;, score=0.739 total time=
0.9s
[CV 3/3] END C=10, degree=2, gamma=auto, kernel=rbf;, score=0.744 total time=
0.8s
[CV 1/3] END C=10, degree=2, gamma=auto, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=10, degree=2, gamma=auto, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=10, degree=2, gamma=auto, kernel=linear;, score=0.845 total time=
0.6s
[CV 1/3] END C=10, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
1.0s
[CV 2/3] END C=10, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=10, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 1/3] END C=10, degree=2, gamma=auto, kernel=sigmoid;, score=0.694 total
time=   0.7s
[CV 2/3] END C=10, degree=2, gamma=auto, kernel=sigmoid;, score=0.622 total
time=   0.6s
[CV 3/3] END C=10, degree=2, gamma=auto, kernel=sigmoid;, score=0.657 total
time=   0.6s
[CV 1/3] END C=10, degree=2, gamma=0.1, kernel=rbf;, score=0.810 total time=
1.2s
[CV 2/3] END C=10, degree=2, gamma=0.1, kernel=rbf;, score=0.805 total time=
1.2s
[CV 3/3] END C=10, degree=2, gamma=0.1, kernel=rbf;, score=0.835 total time=
1.2s
[CV 1/3] END C=10, degree=2, gamma=0.1, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=10, degree=2, gamma=0.1, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=10, degree=2, gamma=0.1, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=10, degree=2, gamma=0.1, kernel=poly;, score=0.851 total time=
0.6s
[CV 2/3] END C=10, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.6s
[CV 3/3] END C=10, degree=2, gamma=0.1, kernel=poly;, score=0.897 total time=
0.5s
[CV 1/3] END C=10, degree=2, gamma=0.1, kernel=sigmoid;, score=0.521 total time=
0.5s
[CV 2/3] END C=10, degree=2, gamma=0.1, kernel=sigmoid;, score=0.502 total time=
0.4s
[CV 3/3] END C=10, degree=2, gamma=0.1, kernel=sigmoid;, score=0.435 total time=
0.5s
[CV 1/3] END C=10, degree=2, gamma=0.01, kernel=rbf;, score=0.844 total time=
0.7s
[CV 2/3] END C=10, degree=2, gamma=0.01, kernel=rbf;, score=0.868 total time=
0.8s
[CV 3/3] END C=10, degree=2, gamma=0.01, kernel=rbf;, score=0.881 total time=
0.7s
[CV 1/3] END C=10, degree=2, gamma=0.01, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=10, degree=2, gamma=0.01, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=10, degree=2, gamma=0.01, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=10, degree=2, gamma=0.01, kernel=poly;, score=0.858 total time=
```

```
0.6s
[CV 2/3] END C=10, degree=2, gamma=0.01, kernel=poly;, score=0.877 total time=
0.6s
[CV 3/3] END C=10, degree=2, gamma=0.01, kernel=poly;, score=0.888 total time=
0.6s
[CV 1/3] END C=10, degree=2, gamma=0.01, kernel=sigmoid;, score=0.827 total
time=   0.4s
[CV 2/3] END C=10, degree=2, gamma=0.01, kernel=sigmoid;, score=0.841 total
time=   0.4s
[CV 3/3] END C=10, degree=2, gamma=0.01, kernel=sigmoid;, score=0.850 total
time=   0.4s
[CV 1/3] END C=10, degree=2, gamma=0.001, kernel=rbf;, score=0.805 total time=
0.7s
[CV 2/3] END C=10, degree=2, gamma=0.001, kernel=rbf;, score=0.795 total time=
0.7s
[CV 3/3] END C=10, degree=2, gamma=0.001, kernel=rbf;, score=0.806 total time=
0.7s
[CV 1/3] END C=10, degree=2, gamma=0.001, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=10, degree=2, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.5s
[CV 3/3] END C=10, degree=2, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=10, degree=2, gamma=0.001, kernel=poly;, score=0.398 total time=
0.9s
[CV 2/3] END C=10, degree=2, gamma=0.001, kernel=poly;, score=0.386 total time=
1.0s
[CV 3/3] END C=10, degree=2, gamma=0.001, kernel=poly;, score=0.389 total time=
1.0s
[CV 1/3] END C=10, degree=2, gamma=0.001, kernel=sigmoid;, score=0.761 total
time=   0.6s
[CV 2/3] END C=10, degree=2, gamma=0.001, kernel=sigmoid;, score=0.732 total
time=   0.6s
[CV 3/3] END C=10, degree=2, gamma=0.001, kernel=sigmoid;, score=0.738 total
time=   0.6s
[CV 1/3] END C=10, degree=3, gamma=scale, kernel=rbf;, score=0.851 total time=
0.9s
[CV 2/3] END C=10, degree=3, gamma=scale, kernel=rbf;, score=0.891 total time=
0.9s
[CV 3/3] END C=10, degree=3, gamma=scale, kernel=rbf;, score=0.894 total time=
0.9s
[CV 1/3] END C=10, degree=3, gamma=scale, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=10, degree=3, gamma=scale, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=10, degree=3, gamma=scale, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=10, degree=3, gamma=scale, kernel=poly;, score=0.851 total time=
```

```
0.7s
[CV 2/3] END C=10, degree=3, gamma=scale, kernel=poly;, score=0.901 total time=
0.8s
[CV 3/3] END C=10, degree=3, gamma=scale, kernel=poly;, score=0.897 total time=
0.7s
[CV 1/3] END C=10, degree=3, gamma=scale, kernel=sigmoid;, score=0.728 total
time=   0.3s
[CV 2/3] END C=10, degree=3, gamma=scale, kernel=sigmoid;, score=0.731 total
time=   0.3s
[CV 3/3] END C=10, degree=3, gamma=scale, kernel=sigmoid;, score=0.725 total
time=   0.4s
[CV 1/3] END C=10, degree=3, gamma=auto, kernel=rbf;, score=0.765 total time=
0.8s
[CV 2/3] END C=10, degree=3, gamma=auto, kernel=rbf;, score=0.739 total time=
0.7s
[CV 3/3] END C=10, degree=3, gamma=auto, kernel=rbf;, score=0.744 total time=
0.8s
[CV 1/3] END C=10, degree=3, gamma=auto, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=10, degree=3, gamma=auto, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=10, degree=3, gamma=auto, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=10, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=10, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=10, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=10, degree=3, gamma=auto, kernel=sigmoid;, score=0.694 total
time=   0.8s
[CV 2/3] END C=10, degree=3, gamma=auto, kernel=sigmoid;, score=0.622 total
time=   0.7s
[CV 3/3] END C=10, degree=3, gamma=auto, kernel=sigmoid;, score=0.657 total
time=   0.9s
[CV 1/3] END C=10, degree=3, gamma=0.1, kernel=rbf;, score=0.810 total time=
1.5s
[CV 2/3] END C=10, degree=3, gamma=0.1, kernel=rbf;, score=0.805 total time=
1.4s
[CV 3/3] END C=10, degree=3, gamma=0.1, kernel=rbf;, score=0.835 total time=
1.3s
[CV 1/3] END C=10, degree=3, gamma=0.1, kernel=linear;, score=0.822 total time=
0.5s
[CV 2/3] END C=10, degree=3, gamma=0.1, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=10, degree=3, gamma=0.1, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=10, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
```

```
0.8s
[CV 2/3] END C=10, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
0.7s
[CV 3/3] END C=10, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
0.7s
[CV 1/3] END C=10, degree=3, gamma=0.1, kernel=sigmoid;, score=0.521 total time=
0.5s
[CV 2/3] END C=10, degree=3, gamma=0.1, kernel=sigmoid;, score=0.502 total time=
0.4s
[CV 3/3] END C=10, degree=3, gamma=0.1, kernel=sigmoid;, score=0.435 total time=
0.6s
[CV 1/3] END C=10, degree=3, gamma=0.01, kernel=rbf;, score=0.844 total time=
1.0s
[CV 2/3] END C=10, degree=3, gamma=0.01, kernel=rbf;, score=0.868 total time=
1.0s
[CV 3/3] END C=10, degree=3, gamma=0.01, kernel=rbf;, score=0.881 total time=
0.9s
[CV 1/3] END C=10, degree=3, gamma=0.01, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=10, degree=3, gamma=0.01, kernel=linear;, score=0.817 total time=
0.6s
[CV 3/3] END C=10, degree=3, gamma=0.01, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=10, degree=3, gamma=0.01, kernel=poly;, score=0.848 total time=
0.8s
[CV 2/3] END C=10, degree=3, gamma=0.01, kernel=poly;, score=0.875 total time=
0.8s
[CV 3/3] END C=10, degree=3, gamma=0.01, kernel=poly;, score=0.876 total time=
0.7s
[CV 1/3] END C=10, degree=3, gamma=0.01, kernel=sigmoid;, score=0.827 total
time=   0.4s
[CV 2/3] END C=10, degree=3, gamma=0.01, kernel=sigmoid;, score=0.841 total
time=   0.5s
[CV 3/3] END C=10, degree=3, gamma=0.01, kernel=sigmoid;, score=0.850 total
time=   0.5s
[CV 1/3] END C=10, degree=3, gamma=0.001, kernel=rbf;, score=0.805 total time=
1.0s
[CV 2/3] END C=10, degree=3, gamma=0.001, kernel=rbf;, score=0.795 total time=
0.8s
[CV 3/3] END C=10, degree=3, gamma=0.001, kernel=rbf;, score=0.806 total time=
0.7s
[CV 1/3] END C=10, degree=3, gamma=0.001, kernel=linear;, score=0.822 total
time=   0.5s
[CV 2/3] END C=10, degree=3, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=10, degree=3, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=10, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.0s
[CV 2/3] END C=10, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.2s
[CV 3/3] END C=10, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=10, degree=3, gamma=0.001, kernel=sigmoid;, score=0.761 total
time=   0.6s
[CV 2/3] END C=10, degree=3, gamma=0.001, kernel=sigmoid;, score=0.732 total
time=   0.7s
[CV 3/3] END C=10, degree=3, gamma=0.001, kernel=sigmoid;, score=0.738 total
time=   0.6s
[CV 1/3] END C=10, degree=4, gamma=scale, kernel=rbf;, score=0.851 total time=
0.9s
[CV 2/3] END C=10, degree=4, gamma=scale, kernel=rbf;, score=0.891 total time=
1.2s
[CV 3/3] END C=10, degree=4, gamma=scale, kernel=rbf;, score=0.894 total time=
1.0s
[CV 1/3] END C=10, degree=4, gamma=scale, kernel=linear;, score=0.822 total
time=   0.5s
[CV 2/3] END C=10, degree=4, gamma=scale, kernel=linear;, score=0.817 total
time=   0.5s
[CV 3/3] END C=10, degree=4, gamma=scale, kernel=linear;, score=0.845 total
time=   0.6s
[CV 1/3] END C=10, degree=4, gamma=scale, kernel=poly;, score=0.847 total time=
1.0s
[CV 2/3] END C=10, degree=4, gamma=scale, kernel=poly;, score=0.884 total time=
0.9s
[CV 3/3] END C=10, degree=4, gamma=scale, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=10, degree=4, gamma=scale, kernel=sigmoid;, score=0.728 total
time=   0.3s
[CV 2/3] END C=10, degree=4, gamma=scale, kernel=sigmoid;, score=0.731 total
time=   0.3s
[CV 3/3] END C=10, degree=4, gamma=scale, kernel=sigmoid;, score=0.725 total
time=   0.3s
[CV 1/3] END C=10, degree=4, gamma=auto, kernel=rbf;, score=0.765 total time=
0.6s
[CV 2/3] END C=10, degree=4, gamma=auto, kernel=rbf;, score=0.739 total time=
0.6s
[CV 3/3] END C=10, degree=4, gamma=auto, kernel=rbf;, score=0.744 total time=
0.6s
[CV 1/3] END C=10, degree=4, gamma=auto, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=10, degree=4, gamma=auto, kernel=linear;, score=0.817 total time=
0.3s
[CV 3/3] END C=10, degree=4, gamma=auto, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=10, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
0.7s
[CV 2/3] END C=10, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.7s
[CV 3/3] END C=10, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.7s
[CV 1/3] END C=10, degree=4, gamma=auto, kernel=sigmoid;, score=0.694 total
time=   0.5s
[CV 2/3] END C=10, degree=4, gamma=auto, kernel=sigmoid;, score=0.622 total
time=   0.5s
[CV 3/3] END C=10, degree=4, gamma=auto, kernel=sigmoid;, score=0.657 total
time=   0.5s
[CV 1/3] END C=10, degree=4, gamma=0.1, kernel=rbf;, score=0.810 total time=
1.1s
[CV 2/3] END C=10, degree=4, gamma=0.1, kernel=rbf;, score=0.805 total time=
1.1s
[CV 3/3] END C=10, degree=4, gamma=0.1, kernel=rbf;, score=0.835 total time=
1.0s
[CV 1/3] END C=10, degree=4, gamma=0.1, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=10, degree=4, gamma=0.1, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=10, degree=4, gamma=0.1, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=10, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
0.6s
[CV 2/3] END C=10, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
0.6s
[CV 3/3] END C=10, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
0.6s
[CV 1/3] END C=10, degree=4, gamma=0.1, kernel=sigmoid;, score=0.521 total time=
0.4s
[CV 2/3] END C=10, degree=4, gamma=0.1, kernel=sigmoid;, score=0.502 total time=
0.3s
[CV 3/3] END C=10, degree=4, gamma=0.1, kernel=sigmoid;, score=0.435 total time=
0.4s
[CV 1/3] END C=10, degree=4, gamma=0.01, kernel=rbf;, score=0.844 total time=
0.7s
[CV 2/3] END C=10, degree=4, gamma=0.01, kernel=rbf;, score=0.868 total time=
0.6s
[CV 3/3] END C=10, degree=4, gamma=0.01, kernel=rbf;, score=0.881 total time=
0.6s
[CV 1/3] END C=10, degree=4, gamma=0.01, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=10, degree=4, gamma=0.01, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=10, degree=4, gamma=0.01, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=10, degree=4, gamma=0.01, kernel=poly;, score=0.789 total time=
```

```
0.5s
[CV 2/3] END C=10, degree=4, gamma=0.01, kernel=poly;, score=0.812 total time=
0.5s
[CV 3/3] END C=10, degree=4, gamma=0.01, kernel=poly;, score=0.805 total time=
0.6s
[CV 1/3] END C=10, degree=4, gamma=0.01, kernel=sigmoid;, score=0.827 total
time=   0.3s
[CV 2/3] END C=10, degree=4, gamma=0.01, kernel=sigmoid;, score=0.841 total
time=   0.4s
[CV 3/3] END C=10, degree=4, gamma=0.01, kernel=sigmoid;, score=0.850 total
time=   0.3s
[CV 1/3] END C=10, degree=4, gamma=0.001, kernel=rbf;, score=0.805 total time=
0.6s
[CV 2/3] END C=10, degree=4, gamma=0.001, kernel=rbf;, score=0.795 total time=
0.6s
[CV 3/3] END C=10, degree=4, gamma=0.001, kernel=rbf;, score=0.806 total time=
0.6s
[CV 1/3] END C=10, degree=4, gamma=0.001, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=10, degree=4, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=10, degree=4, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=10, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.7s
[CV 2/3] END C=10, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.7s
[CV 3/3] END C=10, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.8s
[CV 1/3] END C=10, degree=4, gamma=0.001, kernel=sigmoid;, score=0.761 total
time=   0.4s
[CV 2/3] END C=10, degree=4, gamma=0.001, kernel=sigmoid;, score=0.732 total
time=   0.4s
[CV 3/3] END C=10, degree=4, gamma=0.001, kernel=sigmoid;, score=0.738 total
time=   0.4s
[CV 1/3] END C=100, degree=2, gamma=scale, kernel=rbf;, score=0.851 total time=
0.7s
[CV 2/3] END C=100, degree=2, gamma=scale, kernel=rbf;, score=0.891 total time=
0.8s
[CV 3/3] END C=100, degree=2, gamma=scale, kernel=rbf;, score=0.894 total time=
0.8s
[CV 1/3] END C=100, degree=2, gamma=scale, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=100, degree=2, gamma=scale, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=2, gamma=scale, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=100, degree=2, gamma=scale, kernel=poly;, score=0.851 total time=
```

```
0.5s
[CV 2/3] END C=100, degree=2, gamma=scale, kernel=poly;, score=0.877 total time=
0.5s
[CV 3/3] END C=100, degree=2, gamma=scale, kernel=poly;, score=0.897 total time=
0.4s
[CV 1/3] END C=100, degree=2, gamma=scale, kernel=sigmoid;, score=0.712 total
time=   0.2s
[CV 2/3] END C=100, degree=2, gamma=scale, kernel=sigmoid;, score=0.624 total
time=   0.2s
[CV 3/3] END C=100, degree=2, gamma=scale, kernel=sigmoid;, score=0.699 total
time=   0.2s
[CV 1/3] END C=100, degree=2, gamma=auto, kernel=rbf;, score=0.834 total time=
0.5s
[CV 2/3] END C=100, degree=2, gamma=auto, kernel=rbf;, score=0.841 total time=
0.6s
[CV 3/3] END C=100, degree=2, gamma=auto, kernel=rbf;, score=0.850 total time=
0.5s
[CV 1/3] END C=100, degree=2, gamma=auto, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=100, degree=2, gamma=auto, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=2, gamma=auto, kernel=linear;, score=0.845 total
time=   0.3s
[CV 1/3] END C=100, degree=2, gamma=auto, kernel=poly;, score=0.477 total time=
0.7s
[CV 2/3] END C=100, degree=2, gamma=auto, kernel=poly;, score=0.490 total time=
0.7s
[CV 3/3] END C=100, degree=2, gamma=auto, kernel=poly;, score=0.487 total time=
0.6s
[CV 1/3] END C=100, degree=2, gamma=auto, kernel=sigmoid;, score=0.835 total
time=   0.3s
[CV 2/3] END C=100, degree=2, gamma=auto, kernel=sigmoid;, score=0.839 total
time=   0.3s
[CV 3/3] END C=100, degree=2, gamma=auto, kernel=sigmoid;, score=0.844 total
time=   0.3s
[CV 1/3] END C=100, degree=2, gamma=0.1, kernel=rbf;, score=0.810 total time=
1.0s
[CV 2/3] END C=100, degree=2, gamma=0.1, kernel=rbf;, score=0.805 total time=
1.1s
[CV 3/3] END C=100, degree=2, gamma=0.1, kernel=rbf;, score=0.835 total time=
1.0s
[CV 1/3] END C=100, degree=2, gamma=0.1, kernel=linear;, score=0.822 total time=
0.3s
[CV 2/3] END C=100, degree=2, gamma=0.1, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=100, degree=2, gamma=0.1, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=100, degree=2, gamma=0.1, kernel=poly;, score=0.851 total time=
```

```
0.4s
[CV 2/3] END C=100, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.5s
[CV 3/3] END C=100, degree=2, gamma=0.1, kernel=poly;, score=0.897 total time=
0.4s
[CV 1/3] END C=100, degree=2, gamma=0.1, kernel=sigmoid;, score=0.493 total
time=   0.3s
[CV 2/3] END C=100, degree=2, gamma=0.1, kernel=sigmoid;, score=0.544 total
time=   0.2s
[CV 3/3] END C=100, degree=2, gamma=0.1, kernel=sigmoid;, score=0.428 total
time=   0.3s
[CV 1/3] END C=100, degree=2, gamma=0.01, kernel=rbf;, score=0.849 total time=
0.7s
[CV 2/3] END C=100, degree=2, gamma=0.01, kernel=rbf;, score=0.866 total time=
0.7s
[CV 3/3] END C=100, degree=2, gamma=0.01, kernel=rbf;, score=0.881 total time=
0.6s
[CV 1/3] END C=100, degree=2, gamma=0.01, kernel=linear;, score=0.822 total
time=   0.3s
[CV 2/3] END C=100, degree=2, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=2, gamma=0.01, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=100, degree=2, gamma=0.01, kernel=poly;, score=0.851 total time=
0.4s
[CV 2/3] END C=100, degree=2, gamma=0.01, kernel=poly;, score=0.877 total time=
0.4s
[CV 3/3] END C=100, degree=2, gamma=0.01, kernel=poly;, score=0.897 total time=
0.5s
[CV 1/3] END C=100, degree=2, gamma=0.01, kernel=sigmoid;, score=0.807 total
time=   0.3s
[CV 2/3] END C=100, degree=2, gamma=0.01, kernel=sigmoid;, score=0.810 total
time=   0.3s
[CV 3/3] END C=100, degree=2, gamma=0.01, kernel=sigmoid;, score=0.832 total
time=   0.4s
[CV 1/3] END C=100, degree=2, gamma=0.001, kernel=rbf;, score=0.835 total time=
0.5s
[CV 2/3] END C=100, degree=2, gamma=0.001, kernel=rbf;, score=0.831 total time=
0.5s
[CV 3/3] END C=100, degree=2, gamma=0.001, kernel=rbf;, score=0.845 total time=
0.5s
[CV 1/3] END C=100, degree=2, gamma=0.001, kernel=linear;, score=0.822 total
time=   0.3s
[CV 2/3] END C=100, degree=2, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=2, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=100, degree=2, gamma=0.001, kernel=poly;, score=0.732 total time=
```

```
0.5s
[CV 2/3] END C=100, degree=2, gamma=0.001, kernel=poly;, score=0.682 total time=
0.5s
[CV 3/3] END C=100, degree=2, gamma=0.001, kernel=poly;, score=0.691 total time=
0.5s
[CV 1/3] END C=100, degree=2, gamma=0.001, kernel=sigmoid;, score=0.842 total
time=   0.3s
[CV 2/3] END C=100, degree=2, gamma=0.001, kernel=sigmoid;, score=0.838 total
time=   0.4s
[CV 3/3] END C=100, degree=2, gamma=0.001, kernel=sigmoid;, score=0.850 total
time=   0.4s
[CV 1/3] END C=100, degree=3, gamma=scale, kernel=rbf;, score=0.851 total time=
0.8s
[CV 2/3] END C=100, degree=3, gamma=scale, kernel=rbf;, score=0.891 total time=
0.8s
[CV 3/3] END C=100, degree=3, gamma=scale, kernel=rbf;, score=0.894 total time=
0.8s
[CV 1/3] END C=100, degree=3, gamma=scale, kernel=linear;, score=0.822 total
time=   0.3s
[CV 2/3] END C=100, degree=3, gamma=scale, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=3, gamma=scale, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=100, degree=3, gamma=scale, kernel=poly;, score=0.851 total time=
0.5s
[CV 2/3] END C=100, degree=3, gamma=scale, kernel=poly;, score=0.901 total time=
0.6s
[CV 3/3] END C=100, degree=3, gamma=scale, kernel=poly;, score=0.897 total time=
0.5s
[CV 1/3] END C=100, degree=3, gamma=scale, kernel=sigmoid;, score=0.712 total
time=   0.2s
[CV 2/3] END C=100, degree=3, gamma=scale, kernel=sigmoid;, score=0.624 total
time=   0.2s
[CV 3/3] END C=100, degree=3, gamma=scale, kernel=sigmoid;, score=0.699 total
time=   0.2s
[CV 1/3] END C=100, degree=3, gamma=auto, kernel=rbf;, score=0.834 total time=
0.5s
[CV 2/3] END C=100, degree=3, gamma=auto, kernel=rbf;, score=0.841 total time=
0.5s
[CV 3/3] END C=100, degree=3, gamma=auto, kernel=rbf;, score=0.850 total time=
0.5s
[CV 1/3] END C=100, degree=3, gamma=auto, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=100, degree=3, gamma=auto, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=3, gamma=auto, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=100, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
0.7s
[CV 2/3] END C=100, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.7s
[CV 3/3] END C=100, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.7s
[CV 1/3] END C=100, degree=3, gamma=auto, kernel=sigmoid;, score=0.835 total
time=   0.4s
[CV 2/3] END C=100, degree=3, gamma=auto, kernel=sigmoid;, score=0.839 total
time=   0.4s
[CV 3/3] END C=100, degree=3, gamma=auto, kernel=sigmoid;, score=0.844 total
time=   0.3s
[CV 1/3] END C=100, degree=3, gamma=0.1, kernel=rbf;, score=0.810 total time=
1.0s
[CV 2/3] END C=100, degree=3, gamma=0.1, kernel=rbf;, score=0.805 total time=
1.0s
[CV 3/3] END C=100, degree=3, gamma=0.1, kernel=rbf;, score=0.835 total time=
1.0s
[CV 1/3] END C=100, degree=3, gamma=0.1, kernel=linear;, score=0.822 total time=
0.4s
[CV 2/3] END C=100, degree=3, gamma=0.1, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=100, degree=3, gamma=0.1, kernel=linear;, score=0.845 total time=
0.4s
[CV 1/3] END C=100, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
0.5s
[CV 2/3] END C=100, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
0.6s
[CV 3/3] END C=100, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
0.5s
[CV 1/3] END C=100, degree=3, gamma=0.1, kernel=sigmoid;, score=0.493 total
time=   0.3s
[CV 2/3] END C=100, degree=3, gamma=0.1, kernel=sigmoid;, score=0.544 total
time=   0.2s
[CV 3/3] END C=100, degree=3, gamma=0.1, kernel=sigmoid;, score=0.428 total
time=   0.3s
[CV 1/3] END C=100, degree=3, gamma=0.01, kernel=rbf;, score=0.849 total time=
0.7s
[CV 2/3] END C=100, degree=3, gamma=0.01, kernel=rbf;, score=0.866 total time=
0.6s
[CV 3/3] END C=100, degree=3, gamma=0.01, kernel=rbf;, score=0.881 total time=
0.6s
[CV 1/3] END C=100, degree=3, gamma=0.01, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=100, degree=3, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=3, gamma=0.01, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=100, degree=3, gamma=0.01, kernel=poly;, score=0.851 total time=
```

```
0.5s
[CV 2/3] END C=100, degree=3, gamma=0.01, kernel=poly;, score=0.901 total time=
0.5s
[CV 3/3] END C=100, degree=3, gamma=0.01, kernel=poly;, score=0.897 total time=
0.5s
[CV 1/3] END C=100, degree=3, gamma=0.01, kernel=sigmoid;, score=0.807 total
time=   0.3s
[CV 2/3] END C=100, degree=3, gamma=0.01, kernel=sigmoid;, score=0.810 total
time=   0.4s
[CV 3/3] END C=100, degree=3, gamma=0.01, kernel=sigmoid;, score=0.832 total
time=   0.3s
[CV 1/3] END C=100, degree=3, gamma=0.001, kernel=rbf;, score=0.835 total time=
0.5s
[CV 2/3] END C=100, degree=3, gamma=0.001, kernel=rbf;, score=0.831 total time=
0.6s
[CV 3/3] END C=100, degree=3, gamma=0.001, kernel=rbf;, score=0.845 total time=
0.5s
[CV 1/3] END C=100, degree=3, gamma=0.001, kernel=linear;, score=0.822 total
time=   0.3s
[CV 2/3] END C=100, degree=3, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=3, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.3s
[CV 1/3] END C=100, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.7s
[CV 2/3] END C=100, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.7s
[CV 3/3] END C=100, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.8s
[CV 1/3] END C=100, degree=3, gamma=0.001, kernel=sigmoid;, score=0.842 total
time=   0.3s
[CV 2/3] END C=100, degree=3, gamma=0.001, kernel=sigmoid;, score=0.838 total
time=   0.3s
[CV 3/3] END C=100, degree=3, gamma=0.001, kernel=sigmoid;, score=0.850 total
time=   0.3s
[CV 1/3] END C=100, degree=4, gamma=scale, kernel=rbf;, score=0.851 total time=
0.8s
[CV 2/3] END C=100, degree=4, gamma=scale, kernel=rbf;, score=0.891 total time=
0.9s
[CV 3/3] END C=100, degree=4, gamma=scale, kernel=rbf;, score=0.894 total time=
0.8s
[CV 1/3] END C=100, degree=4, gamma=scale, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=100, degree=4, gamma=scale, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=4, gamma=scale, kernel=linear;, score=0.845 total
time=   0.4s
[CV 1/3] END C=100, degree=4, gamma=scale, kernel=poly;, score=0.847 total time=
```

```
0.8s
[CV 2/3] END C=100, degree=4, gamma=scale, kernel=poly;, score=0.884 total time=
0.7s
[CV 3/3] END C=100, degree=4, gamma=scale, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=100, degree=4, gamma=scale, kernel=sigmoid;, score=0.712 total
time=   0.2s
[CV 2/3] END C=100, degree=4, gamma=scale, kernel=sigmoid;, score=0.624 total
time=   0.2s
[CV 3/3] END C=100, degree=4, gamma=scale, kernel=sigmoid;, score=0.699 total
time=   0.2s
[CV 1/3] END C=100, degree=4, gamma=auto, kernel=rbf;, score=0.834 total time=
0.6s
[CV 2/3] END C=100, degree=4, gamma=auto, kernel=rbf;, score=0.841 total time=
0.5s
[CV 3/3] END C=100, degree=4, gamma=auto, kernel=rbf;, score=0.850 total time=
0.5s
[CV 1/3] END C=100, degree=4, gamma=auto, kernel=linear;, score=0.822 total
time=   0.3s
[CV 2/3] END C=100, degree=4, gamma=auto, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=4, gamma=auto, kernel=linear;, score=0.845 total
time=   0.3s
[CV 1/3] END C=100, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.7s
[CV 2/3] END C=100, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.8s
[CV 3/3] END C=100, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.7s
[CV 1/3] END C=100, degree=4, gamma=auto, kernel=sigmoid;, score=0.835 total
time=   0.4s
[CV 2/3] END C=100, degree=4, gamma=auto, kernel=sigmoid;, score=0.839 total
time=   0.3s
[CV 3/3] END C=100, degree=4, gamma=auto, kernel=sigmoid;, score=0.844 total
time=   0.3s
[CV 1/3] END C=100, degree=4, gamma=0.1, kernel=rbf;, score=0.810 total time=
1.0s
[CV 2/3] END C=100, degree=4, gamma=0.1, kernel=rbf;, score=0.805 total time=
1.1s
[CV 3/3] END C=100, degree=4, gamma=0.1, kernel=rbf;, score=0.835 total time=
1.1s
[CV 1/3] END C=100, degree=4, gamma=0.1, kernel=linear;, score=0.822 total time=
0.3s
[CV 2/3] END C=100, degree=4, gamma=0.1, kernel=linear;, score=0.817 total time=
0.4s
[CV 3/3] END C=100, degree=4, gamma=0.1, kernel=linear;, score=0.845 total time=
0.3s
[CV 1/3] END C=100, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
```

```
0.7s
[CV 2/3] END C=100, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
0.6s
[CV 3/3] END C=100, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
0.6s
[CV 1/3] END C=100, degree=4, gamma=0.1, kernel=sigmoid;, score=0.493 total
time=   0.3s
[CV 2/3] END C=100, degree=4, gamma=0.1, kernel=sigmoid;, score=0.544 total
time=   0.2s
[CV 3/3] END C=100, degree=4, gamma=0.1, kernel=sigmoid;, score=0.428 total
time=   0.3s
[CV 1/3] END C=100, degree=4, gamma=0.01, kernel=rbf;, score=0.849 total time=
0.6s
[CV 2/3] END C=100, degree=4, gamma=0.01, kernel=rbf;, score=0.866 total time=
0.6s
[CV 3/3] END C=100, degree=4, gamma=0.01, kernel=rbf;, score=0.881 total time=
0.6s
[CV 1/3] END C=100, degree=4, gamma=0.01, kernel=linear;, score=0.822 total
time=   0.4s
[CV 2/3] END C=100, degree=4, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.4s
[CV 3/3] END C=100, degree=4, gamma=0.01, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=100, degree=4, gamma=0.01, kernel=poly;, score=0.847 total time=
0.7s
[CV 2/3] END C=100, degree=4, gamma=0.01, kernel=poly;, score=0.884 total time=
0.7s
[CV 3/3] END C=100, degree=4, gamma=0.01, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=100, degree=4, gamma=0.01, kernel=sigmoid;, score=0.807 total
time=   0.4s
[CV 2/3] END C=100, degree=4, gamma=0.01, kernel=sigmoid;, score=0.810 total
time=   0.4s
[CV 3/3] END C=100, degree=4, gamma=0.01, kernel=sigmoid;, score=0.832 total
time=   0.3s
[CV 1/3] END C=100, degree=4, gamma=0.001, kernel=rbf;, score=0.835 total time=
0.6s
[CV 2/3] END C=100, degree=4, gamma=0.001, kernel=rbf;, score=0.831 total time=
0.6s
[CV 3/3] END C=100, degree=4, gamma=0.001, kernel=rbf;, score=0.845 total time=
0.6s
[CV 1/3] END C=100, degree=4, gamma=0.001, kernel=linear;, score=0.822 total
time=   0.5s
[CV 2/3] END C=100, degree=4, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.7s
[CV 3/3] END C=100, degree=4, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.6s
[CV 1/3] END C=100, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.0s
[CV 2/3] END C=100, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.2s
[CV 3/3] END C=100, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=100, degree=4, gamma=0.001, kernel=sigmoid;, score=0.842 total
time=   0.6s
[CV 2/3] END C=100, degree=4, gamma=0.001, kernel=sigmoid;, score=0.838 total
time=   0.7s
[CV 3/3] END C=100, degree=4, gamma=0.001, kernel=sigmoid;, score=0.850 total
time=   0.5s
```

```
GridSearchCV(cv=3, estimator=SVC(random_state=42),
             param_grid={'C': [0.1, 1, 10, 100], 'degree': [2, 3, 4],
                         'gamma': ['scale', 'auto', 0.1, 0.01, 0.001],
                         'kernel': ['rbf', 'linear', 'poly', 'sigmoid']},
             scoring='f1_macro', verbose=3)
```

```
best_svm = grid_search_svm.best_estimator_
# Get the best parameters and score
print("Best parameters:", grid_search_svm.best_params_)
best_svm.fit(train_features, train_labels_encoded)

y_pred_svm = best_svm.predict(test_features)

joblib.dump(best_svm, project_dir + '\joblib\\best_svm_model.joblib')
```

```
Best parameters: {'C': 0.1, 'degree': 3, 'gamma': 0.1, 'kernel': 'poly'}
```

```
['d:\\ASUS\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\best_svm_model.joblib']
```

7 Predict on test images for KNN

```
report_knn = classification_report(test_labels_encoded, y_pred_svm,␣
 ↪target_names=label_encoder.classes_)
print(report_knn)
```

```
              precision    recall  f1-score   support

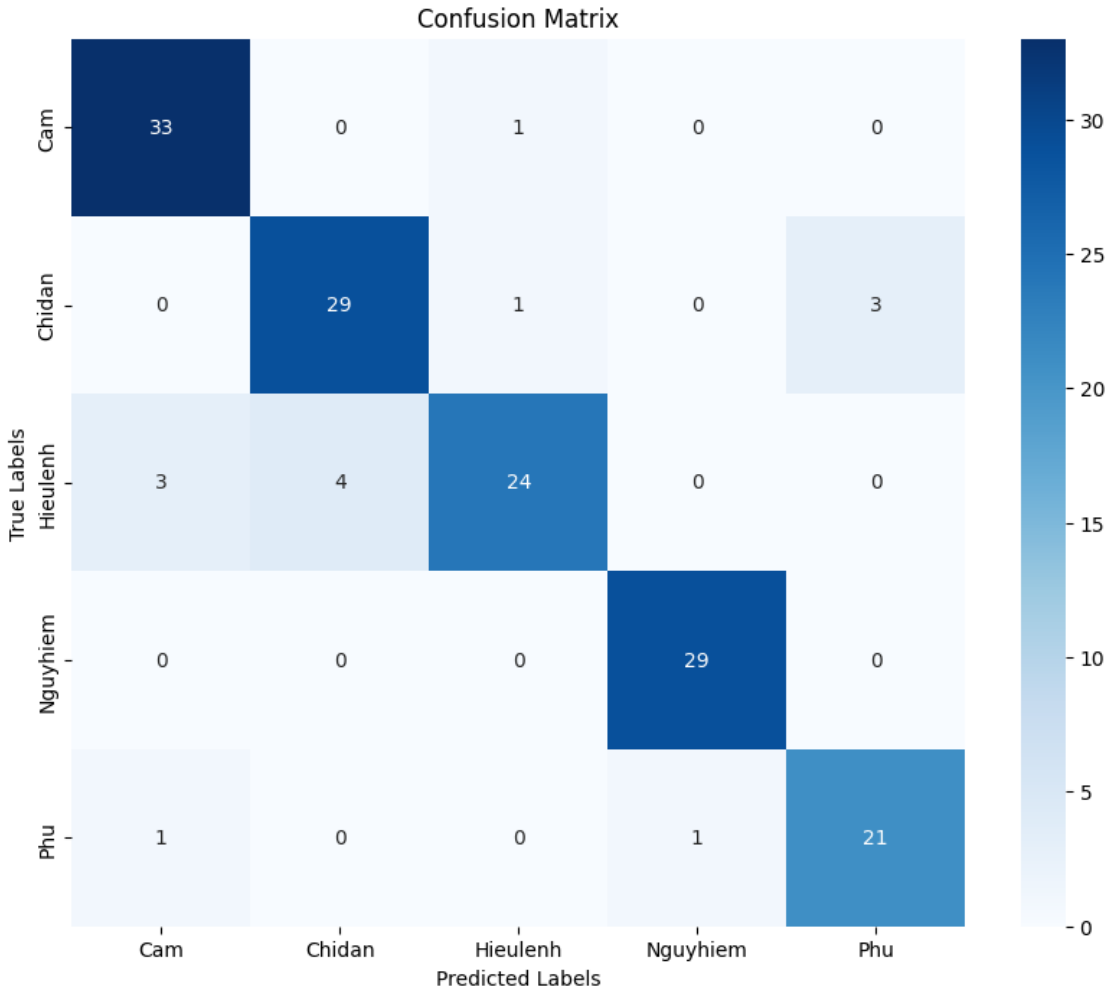
         Cam       0.89      0.97      0.93        34
      Chidan       0.88      0.88      0.88        33
    Hieulenh       0.92      0.77      0.84        31
    Nguyhiem       0.97      1.00      0.98        29
         Phu       0.88      0.91      0.89        23

    accuracy                           0.91       150
```

```
   macro avg       0.91      0.91      0.91       150
weighted avg       0.91      0.91      0.91       150
```

```
heatmap_label_knn = confusion_matrix(test_labels_encoded, y_pred_svm)

plt.figure(figsize=(10, 8))
sns.heatmap(heatmap_label_knn, annot=True, fmt='d', cmap='Blues',␣
 ↪xticklabels=label_encoder.classes_, yticklabels=label_encoder.classes_)
plt.title('Confusion Matrix')
plt.xlabel('Predicted Labels')
plt.ylabel('True Labels')
plt.show()
```




```
n_columns = 10
n_rows = math.ceil(len(test_images) / n_columns)
```

```
fig, axes = plt.subplots(n_rows, n_columns, figsize=(30, n_rows * 3))

for idx, (image, true_label, pred_label) in enumerate(zip(test_images,␣
 ↪test_labels_encoded, y_pred_knn)):
    row = idx // n_columns
    col = idx % n_columns

    axes[row, col].imshow(image)
    axes[row, col].set_title(f'True: {label_encoder.classes_[true_label]}\nPred:
 ↪ {label_encoder.classes_[pred_label]}')
    axes[row, col].axis('off')

for ax in axes.flat:
    if not ax.has_data():
        ax.axis('off')

plt.tight_layout()
plt.show()
```

8 Predict on test images for SVM

```
report_svm = classification_report(test_labels_encoded, y_pred_svm,␣
  ↪target_names=label_encoder.classes_)
print(report_svm)
```

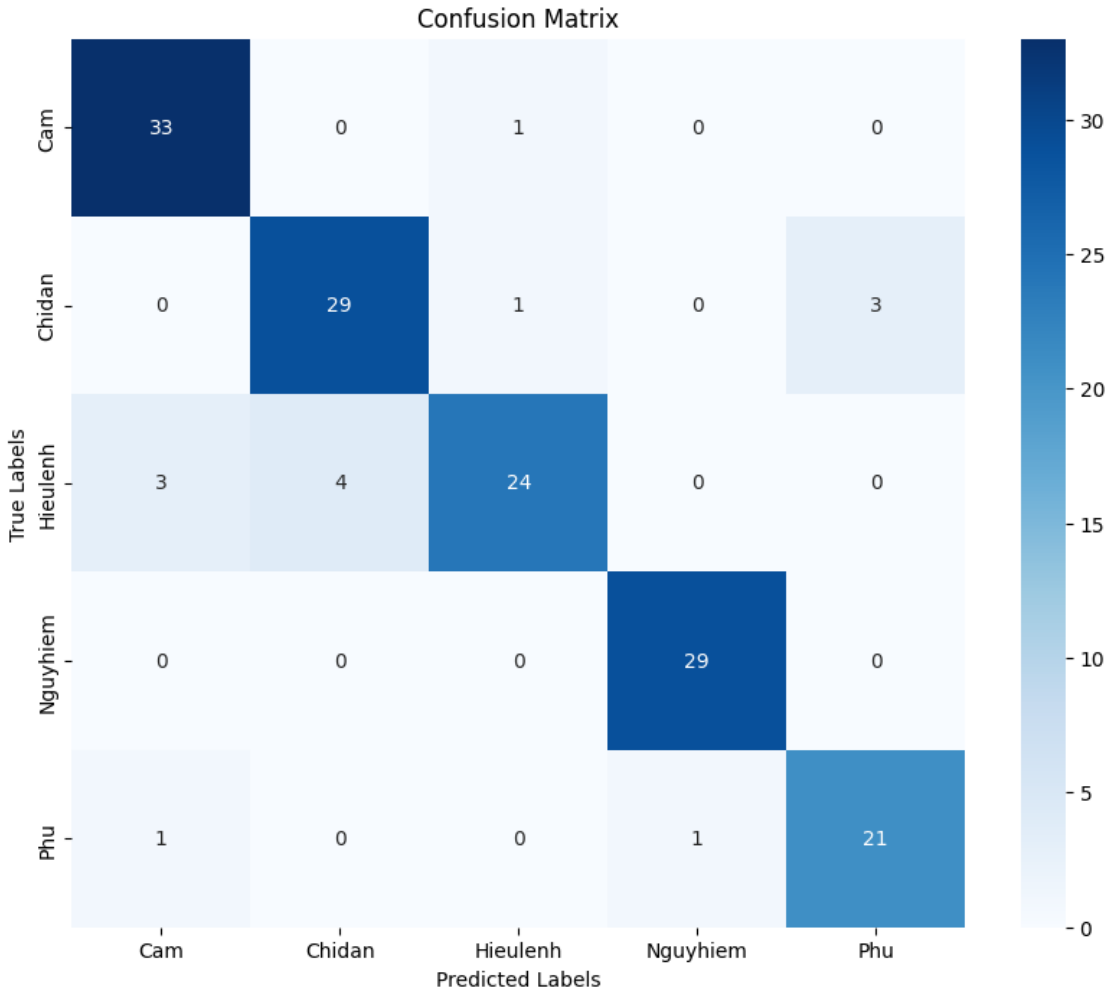
```
              precision    recall  f1-score   support

         Cam       0.89      0.97      0.93        34
      Chidan       0.88      0.88      0.88        33
    Hieulenh       0.92      0.77      0.84        31
    Nguyhiem       0.97      1.00      0.98        29
         Phu       0.88      0.91      0.89        23

    accuracy                           0.91       150
   macro avg       0.91      0.91      0.91       150
weighted avg       0.91      0.91      0.91       150
```

```
heatmap_label_svm = confusion_matrix(test_labels_encoded, y_pred_svm)

plt.figure(figsize=(10, 8))
sns.heatmap(heatmap_label_svm, annot=True, fmt='d', cmap='Blues',␣
  ↪xticklabels=label_encoder.classes_, yticklabels=label_encoder.classes_)
plt.title('Confusion Matrix')
plt.xlabel('Predicted Labels')
plt.ylabel('True Labels')
plt.show()
```




```
n_columns = 10
n_rows = math.ceil(len(test_images) / n_columns)

fig, axes = plt.subplots(n_rows, n_columns, figsize=(30, n_rows * 3))

for idx, (image, true_label, pred_label) in enumerate(zip(test_images,␣
 ↪test_labels_encoded, y_pred_svm)):
    row = idx // n_columns
    col = idx % n_columns

    axes[row, col].imshow(image)
    axes[row, col].set_title(f'True: {label_encoder.classes_[true_label]}\nPred:
 ↪ {label_encoder.classes_[pred_label]}')
    axes[row, col].axis('off')
```

```
for ax in axes.flat:
    if not ax.has_data():
        ax.axis('off')

plt.tight_layout()
plt.show()
```

```
## Predict on test images for SVM
report_svm = classification_report(test_labels_encoded, y_pred_svm,␣
 ↪target_names=label_encoder.classes_)
print(report_svm)
heatmap_label_svm = confusion_matrix(test_labels_encoded, y_pred_svm)

plt.figure(figsize=(10, 8))
sns.heatmap(heatmap_label_svm, annot=True, fmt='d', cmap='Blues',␣
 ↪xticklabels=label_encoder.classes_, yticklabels=label_encoder.classes_)
plt.title('Confusion Matrix')
plt.xlabel('Predicted Labels')
plt.ylabel('True Labels')
plt.show()
n_columns = 10
n_rows = math.ceil(len(test_images) / n_columns)

fig, axes = plt.subplots(n_rows, n_columns, figsize=(30, n_rows * 3))

for idx, (image, true_label, pred_label) in enumerate(zip(test_images,␣
 ↪test_labels_encoded, y_pred_svm)):
    row = idx // n_columns
    col = idx % n_columns

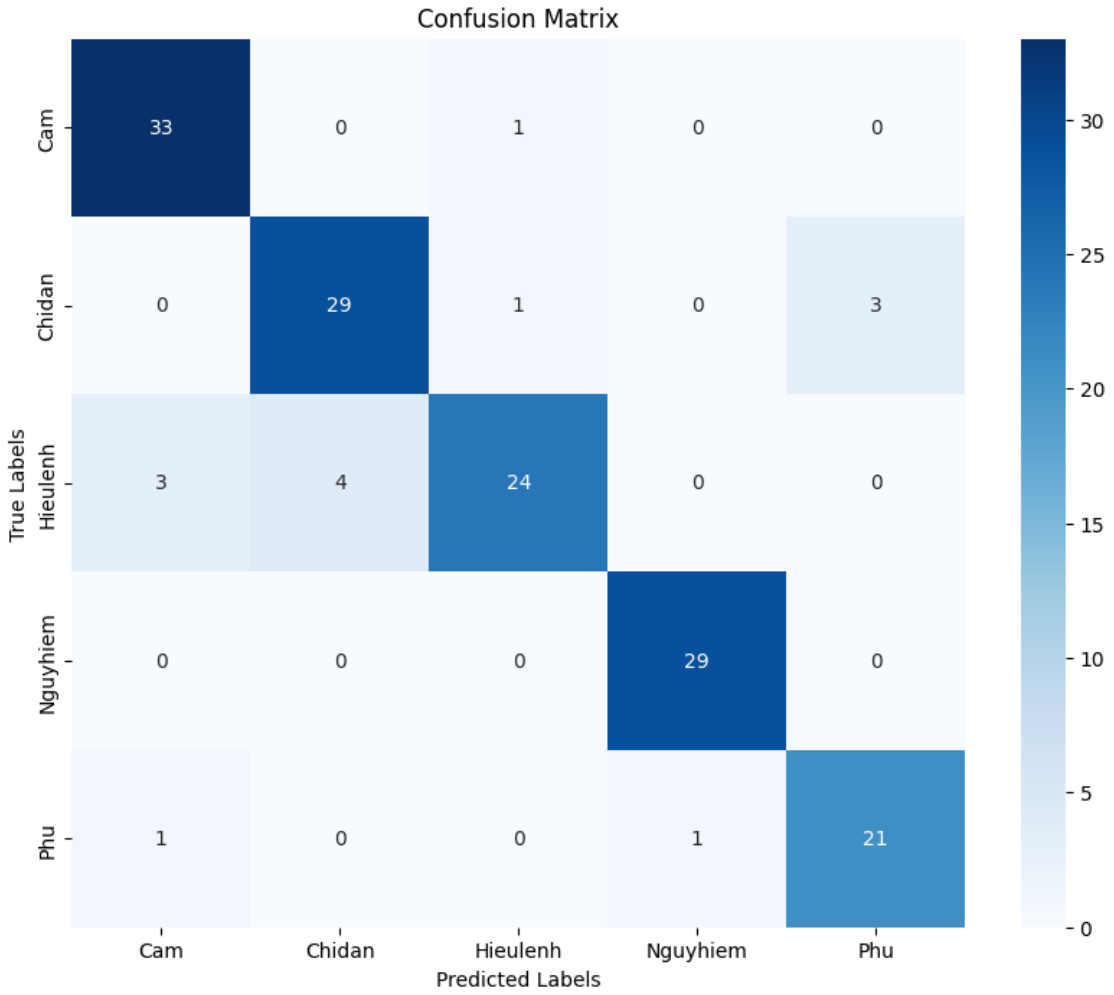
    axes[row, col].imshow(image)
    axes[row, col].set_title(f'True: {label_encoder.classes_[true_label]}\nPred:
 ↪ {label_encoder.classes_[pred_label]}')
    axes[row, col].axis('off')

for ax in axes.flat:
    if not ax.has_data():
        ax.axis('off')

plt.tight_layout()
plt.show()
```

	precision	recall	f1-score	support
Cam	0.89	0.97	0.93	34
Chidan	0.88	0.88	0.88	33
Hieulenh	0.92	0.77	0.84	31
Nguyhiem	0.97	1.00	0.98	29
Phu	0.88	0.91	0.89	23
accuracy			0.91	150
macro avg	0.91	0.91	0.91	150

```
weighted avg       0.91      0.91      0.91       150
```



9 Save grid search results

```
def save_grid_search_results_with_timestamp(grid_search, image_size,␣
 ↪project_dir):
    results_dir = os.path.join(project_dir)
    os.makedirs(results_dir, exist_ok=True)
    current_time = datetime.now().strftime('%Y-%m-%d_%H_%M_%S')
    file_path = os.path.join(results_dir, f'grid_search_results_{current_time}.
 ↪txt')

    # Lấy tất cả kết quả từ cv_results_
    cv_results = grid_search.cv_results_
```

```
    # Chuẩn bị nội dung ghi vào file
    results = [
        f"Date and Time: {current_time}",
        f"Image Size: {image_size}",
        f"Best Parameters: {grid_search.best_params_}",
        f"Best Score: {grid_search.best_score_}",
        "Detailed Grid Search Results:"
    ]

    # Lấy các tham số của mỗi lần huấn luyện
    param_keys = [key for key in cv_results if key.startswith("param_")]
    score_keys = [key for key in cv_results if key.startswith("mean") or key.
 ↪startswith("std")]

    # In từng kết quả từ cv_results_
    for i in range(len(cv_results['params'])):
        result = [f"Result {i + 1}:"]

        # Thêm các tham số của lần chạy hiện tại
        for key in param_keys:
            result.append(f"  {key}: {cv_results[key][i]}")

        # Thêm điểm số của lần chạy hiện tại
        for key in score_keys:
            result.append(f"  {key}: {cv_results[key][i]}")

        results.extend(result)

    # Ghi nội dung vào file .txt
    with open(file_path, 'w') as f:
        f.write("\n".join(results))

    print(f'Results saved to {file_path}')
```

```
image_size = (width, height)
save_grid_search_results_with_timestamp(grid_search_knn, image_size,␣
 ↪project_dir + '\grid_search_results\knn')
```

```
image_size = (width, height)
save_grid_search_results_with_timestamp(grid_search_svm, image_size,␣
 ↪project_dir + '\grid_search_results\svm')
```

```
def export_notebook_to_pdf(notebook_path, project_dir):
    results_dir = os.path.join(project_dir, "results")
    os.makedirs(results_dir, exist_ok=True)
```

```
    # Đọc notebook
    with open(notebook_path, 'r', encoding='utf-8') as f:
        nb = nbformat.read(f, as_version=4)

    # Cấu hình PDF exporter
    pdf_exporter = PDFExporter()
    pdf_exporter.exclude_input_prompt = True
    pdf_exporter.exclude_output_prompt = True

    # Thêm template và style cơ bản
    pdf_exporter.template_name = 'classic'

    # Chuyển đổi sang PDF
    pdf_data, resources = pdf_exporter.from_notebook_node(nb)

    # Tạo tên file với timestamp
    current_time = datetime.now().strftime('%Y-%m-%d_%H_%M_%S')
    pdf_file = os.path.join(results_dir, f"notebook_export_{current_time}.pdf")

    # Lưu file PDF
    with open(pdf_file, 'wb') as f:
        f.write(pdf_data)

    print(f"Đã xuất file PDF thành công: {pdf_file}")
    return pdf_file
```

```
# project_dir = os.path.dirname(project_dir)
notebook_path = project_dir + "\\model\\main.ipynb"
proj_dir = project_dir + "\\grid_search_results"

export_notebook_to_pdf(notebook_path, proj_dir)
```