Notebook

December 8, 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_images, project_dir + '\joblib\\train_images.joblib')
joblib.dump(test_images, project_dir + '\joblib\\test_images.joblib')
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')
```

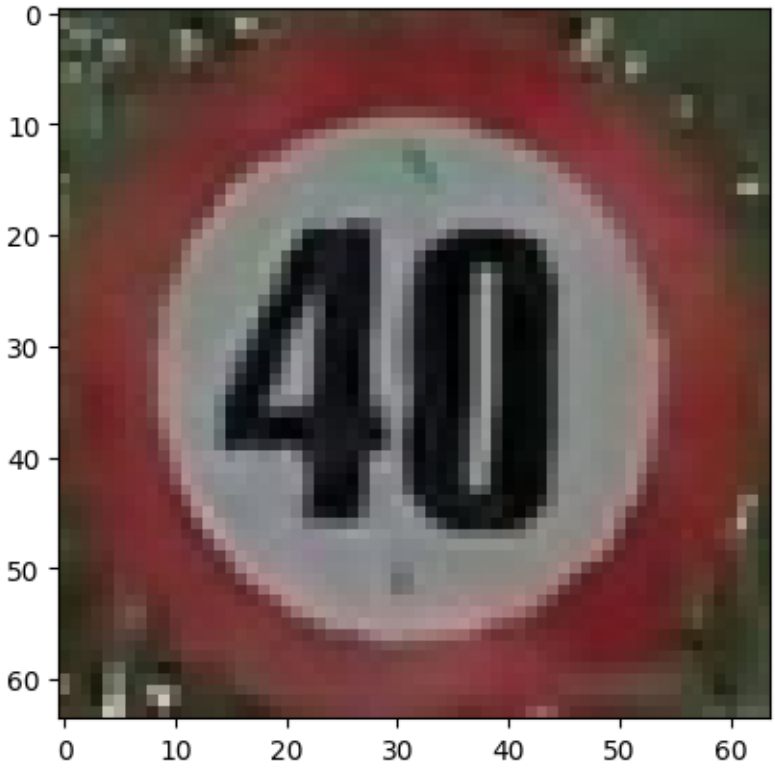
```
<>:1: SyntaxWarning: invalid escape sequence '\j'
<>:2: SyntaxWarning: invalid escape sequence '\j'
<>:3: SyntaxWarning: invalid escape sequence '\j'
```

```
<>:4: SyntaxWarning: invalid escape sequence '\j'
<>:5: SyntaxWarning: invalid escape sequence '\j'
<>:1: SyntaxWarning: invalid escape sequence '\j'
<>:2: SyntaxWarning: invalid escape sequence '\j'
<>:3: SyntaxWarning: invalid escape sequence '\j'
<>:4: SyntaxWarning: invalid escape sequence '\j'
<>:5: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\2963388047.py:1:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(train_images, project_dir + '\joblib\\train_images.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\2963388047.py:2:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(test_images, project_dir + '\joblib\\test_images.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\2963388047.py:3:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(train_labels_encoded, project_dir +
'\joblib\\train_labels_encoded.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\2963388047.py:4:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(test_labels_encoded, project_dir +
'\joblib\\test_labels_encoded.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\2963388047.py:5:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(label_encoder, project_dir + '\joblib\\label_encoder.joblib')
```

```
['e:\\Documents\\CS231\\project\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\label_encoder.joblib']
```

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

```
<matplotlib.image.AxesImage at 0x241ef981e50>
```




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

```
<matplotlib.image.AxesImage at 0x241b8740fb0>
```

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, [128], [0,␣
↪256]))
        histogram = histogram / size
        feature.extend(histogram)
    # print('color histogram')
    # print(feature)
    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=(8, 8), visualize=False, block_norm='L2-Hys',␣
 ↪transform_sqrt=True, channel_axis=2)
    # print('hog')
    # print(hog_features)
    return hog_features
```

```
# def extract_features(images):
#     blurred_images = [blur_image(image) for image in tqdm(images, desc="Blur␣
 ↪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
```

```
def extract_features(images):
    blurred_images = [blur_image(image) for image in tqdm(images, desc="Blur␣
 ↪Images")]

    # Color Histogram Features
    color_features = [color_histogram(image) for image in tqdm(blurred_images,␣
 ↪desc="Extracting Color Features")]
    print("Shape of one color_histogram feature:", np.array(color_features[0]).
 ↪shape)
    print("Min of color_histogram feature:", np.min(color_features))
    print("Max of color_histogram feature:", np.max(color_features))

    # HOG Features
    hog_features = [hog(image) for image in tqdm(blurred_images,␣
 ↪desc="Extracting HOG Features")]
    print("Shape of one hog feature:", np.array(hog_features[0]).shape)
    print("Min of HOG feature:", np.min(hog_features))
    print("Max of HOG feature:", np.max(hog_features))

    # Combined Features
    combined_features = [np.concatenate((color_feature, hog_feature))
                         for color_feature, hog_feature in␣
 ↪tqdm(zip(color_features, hog_features), desc="Combining Features")]
```

```
    print("Shape of one combined feature:", np.array(combined_features[0]).
↪shape)
    print("Min of combined feature:", np.min(combined_features))
    print("Max of combined feature:", np.max(combined_features))

    return combined_features
```

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

```
<>:2: SyntaxWarning: invalid escape sequence '\j'
<>:2: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\3158454822.py:2:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(train_features, project_dir + '\joblib\\train_features.joblib')
Blur Images: 100%|      | 1415/1415 [00:00<00:00, 3623.43it/s]
Extracting Color Features: 100%|      | 1415/1415 [00:00<00:00,
17353.17it/s]

Shape of one color_histogram feature: (384,)
Min of color_histogram feature: 0.0
Max of color_histogram feature: 0.8959961

Extracting HOG Features: 100%|      | 1415/1415 [00:01<00:00, 1246.67it/s]

Shape of one hog feature: (576,)
Min of HOG feature: 0.0
Max of HOG feature: 0.3347069433316224

Combining Features: 1415it [00:00, 47468.51it/s]

Shape of one combined feature: (960,)
Min of combined feature: 0.0
Max of combined feature: 0.89599609375
```

```
['e:\\Documents\\CS231\\project\\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')
```

```
<>:2: SyntaxWarning: invalid escape sequence '\j'
<>:2: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\1121528714.py:2:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(test_features, project_dir + '\joblib\\test_features.joblib')
Blur Images: 100%|      | 150/150 [00:00<00:00, 3469.69it/s]
Extracting Color Features: 100%|      | 150/150 [00:00<00:00, 24401.57it/s]
```

```
Shape of one color_histogram feature: (384,)
Min of color_histogram feature: 0.0
Max of color_histogram feature: 0.6118164
```

```
Extracting HOG Features: 100%|      | 150/150 [00:00<00:00, 1200.53it/s]
```

```
Shape of one hog feature: (576,)
Min of HOG feature: 0.0
Max of HOG feature: 0.23510294794071848
```

```
Combining Features: 150it [00:00, 42822.33it/s]
```

```
Shape of one combined feature: (960,)
Min of combined feature: 0.0
Max of combined feature: 0.61181640625
```

```
['e:\\Documents\\CS231\\project\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\test_features.joblib']
```

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 Load Best Model

```
# knn_model = joblib.load(project_dir + '\\joblib\\best_knn_model.joblib')
# svm_model = joblib.load(project_dir + '\\joblib\\best_svm_model.joblib')

# y_pred_knn = knn_model.predict(test_features)
# y_pred_svm = svm_model.predict(test_features)
```

6 Gridsearch KNN

```
knn_model = KNeighborsClassifier()
knn_model.fit(train_features, train_labels_encoded)
y_pred_knn = knn_model.predict(test_features)
```

```
param_grid = {
    'n_neighbors': [3, 4, 5, 6, 7, 10],
    'weights': ['uniform', 'distance'],
    'leaf_size': [3, 5, 10, 20, 30],
    '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(train_features, train_labels_encoded)
```

```
Fitting 3 folds for each of 360 candidates, totalling 1080 fits
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.866 total time=   2.2s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.822 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.867 total time=   2.2s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.816 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.850 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=4, weights=uniform;, score=0.811 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.805 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.858 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.840 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.804 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.849 total time=   2.2s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.829 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.826 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.855 total time=   2.2s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.824 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.821 total time=   2.2s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.828 total time=   2.2s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.809 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.820 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.838 total time=   2.2s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.810 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.817 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.829 total time=   2.2s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.820 total time=   2.2s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.842 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.809 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.829 total time=   2.2s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.837 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=10, weights=uniform;, score=0.798 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.801 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.844 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   3.3s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   3.2s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.765 total time=   3.2s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.841 total time=   3.3s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.829 total time=   3.3s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.780 total time=   3.3s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.833 total time=   3.4s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.789 total time=   3.5s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.771 total time=   3.3s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.849 total time=   3.3s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.816 total time=   3.4s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.772 total time=   3.2s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.835 total time=   3.4s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   3.4s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.775 total time=   3.4s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.842 total time=   3.5s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.811 total time=   3.4s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.790 total time=   3.3s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.824 total time=   3.2s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
```

```
n_neighbors=6, weights=uniform;, score=0.785 total time=   3.3s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.774 total time=   3.2s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   3.3s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.806 total time=   3.4s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.784 total time=   3.2s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.828 total time=   3.2s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.787 total time=   3.3s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.786 total time=   3.2s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.839 total time=   3.3s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.787 total time=   3.2s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.788 total time=   3.3s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   3.3s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.764 total time=   3.2s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.763 total time=   3.2s
[CV 1/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.839 total time=   3.3s
[CV 2/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.786 total time=   3.2s
[CV 3/3] END leaf_size=3, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.774 total time=   3.2s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.825 total time=   2.0s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.751 total time=   2.0s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.0s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.812 total time=   2.0s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.755 total time=   2.0s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   2.0s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=4, weights=uniform;, score=0.787 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.757 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.834 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.813 total time=   2.0s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.765 total time=   2.0s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.805 total time=   2.0s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.799 total time=   2.0s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.742 total time=   2.0s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.822 total time=   2.0s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.804 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.759 total time=   2.0s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.784 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.754 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.822 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.813 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.766 total time=   2.0s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.810 total time=   2.1s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.776 total time=   2.1s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.750 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.831 total time=   2.0s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.789 total time=   2.3s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.756 total time=   2.4s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.795 total time=   2.3s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=10, weights=uniform;, score=0.754 total time=   2.3s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.748 total time=   2.4s
[CV 1/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.816 total time=   2.3s
[CV 2/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.770 total time=   2.2s
[CV 3/3] END leaf_size=3, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.759 total time=   2.1s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.753 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.708 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.600 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.758 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.711 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.632 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.728 total time=
2.3s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.695 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.618 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.769 total time=
2.1s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.716 total time=
2.3s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.631 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.729 total time=
2.3s
```

```
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.708 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.617 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.761 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.724 total time=
2.3s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.620 total time=
2.1s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.701 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.710 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.599 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.750 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.729 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.621 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.704 total time=
2.3s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.713 total time=
2.3s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.598 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.750 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.723 total time=
2.2s
```

```
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.622 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.719 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.690 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.607 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.753 total time=
2.1s
[CV 2/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.705 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.623 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.845 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.796 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.771 total time=
2.3s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.850 total time=
2.3s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.804 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.773 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.834 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.779 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
2.2s
```

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[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.853 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.807 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.790 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.842 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.778 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.785 total time=
2.4s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.844 total time=
2.3s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.782 total time=
2.3s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.771 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.826 total time=
2.4s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.767 total time=
2.3s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.775 total time=
2.3s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.841 total time=
2.4s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.797 total time=
2.4s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.799 total time=
2.8s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.829 total time=
2.5s
```

```
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.775 total time=
2.4s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.767 total time=
2.4s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.834 total time=
2.3s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.786 total time=
2.2s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.780 total time=
2.3s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.832 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.780 total time=
2.3s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.778 total time=
2.2s
[CV 1/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.844 total time=
2.2s
[CV 2/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.3s
[CV 3/3] END leaf_size=3, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.3s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.820 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.750 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.705 total time=
1.9s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.9s
```

```
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.9s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.822 total time=
1.8s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.727 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.715 total time=
1.9s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
2.0s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.812 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.721 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.712 total time=
1.9s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.9s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.818 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.723 total time=
2.0s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.728 total time=
1.8s
```

```
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.828 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.717 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.732 total time=
1.9s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.814 total time=
1.8s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.729 total time=
2.0s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.747 total time=
1.8s
[CV 1/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=3, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.866 total time=   2.1s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=3, weights=uniform;, score=0.833 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.822 total time=   2.1s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.867 total time=   2.2s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.816 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.850 total time=   2.1s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.805 total time=   2.1s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.858 total time=   2.1s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.840 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.804 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.849 total time=   2.1s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.829 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.826 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.855 total time=   2.3s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.824 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.821 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.828 total time=   2.1s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.809 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.820 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.838 total time=   2.2s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.810 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.817 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.829 total time=   2.3s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=7, weights=uniform;, score=0.803 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.820 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.842 total time=   2.2s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.809 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.829 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.837 total time=   2.1s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.801 total time=   2.1s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.844 total time=   2.3s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.765 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.841 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.829 total time=   3.5s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.780 total time=   3.4s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.833 total time=   3.5s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.789 total time=   3.6s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.771 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.849 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.816 total time=   3.6s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.772 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.835 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
```

```
n_neighbors=5, weights=uniform;, score=0.804 total time=   3.4s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.775 total time=   3.4s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.842 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.811 total time=   3.4s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.790 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.824 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.785 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.774 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.806 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.784 total time=   3.5s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.828 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.787 total time=   3.4s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.786 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.839 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.787 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.788 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.764 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.763 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.839 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.786 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.774 total time=   3.9s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.825 total time=   2.8s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=3, weights=uniform;, score=0.801 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.751 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.834 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.812 total time=   3.1s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.755 total time=   2.8s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   2.7s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.787 total time=   2.7s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.757 total time=   2.6s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.834 total time=   2.4s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.813 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.765 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.805 total time=   2.7s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.799 total time=   3.0s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.742 total time=   2.6s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.822 total time=   2.8s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.804 total time=   2.9s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.759 total time=   3.1s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   2.9s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.784 total time=   2.9s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.754 total time=   3.1s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.822 total time=   2.9s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.813 total time=   2.7s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.766 total time=   2.4s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.810 total time=   2.2s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=7, weights=uniform;, score=0.776 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.750 total time=   2.1s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.831 total time=   2.3s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.789 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.756 total time=   2.1s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.795 total time=   2.2s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.754 total time=   2.2s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.748 total time=   2.2s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.816 total time=   2.1s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.770 total time=   2.1s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.759 total time=   2.1s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.753 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.708 total time=
2.3s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.600 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.758 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.711 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.632 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.728 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.695 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.618 total time=
2.2s
```

```
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.769 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.716 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.631 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.729 total time=
2.3s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.708 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.617 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.761 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.724 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.620 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.701 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.710 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.599 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.750 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.729 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.621 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.704 total time=
2.2s
```

```
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.713 total time=
2.4s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.598 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.750 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.723 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.622 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.719 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.690 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.607 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.753 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.705 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.623 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.845 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.796 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.771 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.850 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.804 total time=
2.1s
```

```
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.773 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.834 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.779 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.853 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.807 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.790 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.842 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.778 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.785 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.844 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.782 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.771 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.826 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.767 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.775 total time=
2.2s
```

```
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.841 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.797 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.799 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.829 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.775 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.767 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.834 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.786 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.780 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.832 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.780 total time=
2.2s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.778 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.844 total time=
2.2s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.2s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.820 total time=
1.7s
```

```
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.750 total time=
1.7s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.705 total time=
1.9s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.822 total time=
1.7s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.727 total time=
1.7s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.715 total time=
1.8s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
2.1s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.812 total time=
2.1s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.721 total time=
2.3s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.712 total time=
2.4s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
2.4s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
```

```
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.818 total time=
1.8s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.723 total time=
1.8s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.728 total time=
1.8s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.828 total time=
1.8s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.717 total time=
2.1s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.732 total time=
1.9s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.814 total time=
1.9s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.729 total time=
1.9s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.747 total time=
1.9s
```

```
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.7s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.866 total time=   2.1s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   2.1s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.822 total time=   2.2s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.867 total time=   2.1s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.816 total time=   2.1s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.850 total time=   2.1s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   2.2s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.805 total time=   2.3s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.858 total time=   2.1s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.840 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.804 total time=   2.1s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.849 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.829 total time=   2.1s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.826 total time=   2.1s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.855 total time=   2.1s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.824 total time=   2.1s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.821 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.828 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=6, weights=uniform;, score=0.809 total time=   2.1s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.820 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.838 total time=   2.1s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.810 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.817 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.829 total time=   2.3s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   2.2s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.820 total time=   2.3s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.842 total time=   2.2s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.809 total time=   2.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.829 total time=   2.4s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.837 total time=   2.4s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=   2.5s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.801 total time=   2.8s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.844 total time=   2.2s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.1s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.4s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.765 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.841 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.829 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.780 total time=   3.1s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.833 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
```

```
n_neighbors=4, weights=uniform;, score=0.789 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.771 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.849 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.816 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.772 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.835 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.775 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.842 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.811 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.790 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.824 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.785 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.774 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.806 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.784 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.828 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.787 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.786 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.839 total time=   3.5s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.787 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.788 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
```

```
n_neighbors=10, weights=uniform;, score=0.764 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.763 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.839 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.786 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.774 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.825 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   2.1s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.751 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.812 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.755 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.787 total time=   2.1s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.757 total time=   2.1s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.834 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.813 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.765 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.805 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.799 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.742 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.822 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.804 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.759 total time=   2.2s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=6, weights=uniform;, score=0.784 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.754 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.822 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.813 total time=   1.9s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.766 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.810 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.776 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.750 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.831 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.789 total time=   2.2s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.756 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.795 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.754 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.748 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.816 total time=   2.0s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.770 total time=   2.0s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.759 total time=   2.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.753 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.708 total time=
2.3s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.600 total time=
2.3s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.758 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.711 total time=
2.1s
```

```
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.632 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.728 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.695 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.618 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.769 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.716 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.631 total time=
2.3s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.729 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.708 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.617 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.761 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.724 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.620 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.701 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.710 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.599 total time=
2.1s
```

```
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.750 total time=
2.3s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.729 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.621 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.704 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.713 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.598 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.750 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.723 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.622 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.719 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.690 total time=
2.3s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.607 total time=
2.2s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.753 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.705 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.623 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.845 total time=
2.2s
```

```
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.796 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.771 total time=
2.2s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.850 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.804 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.773 total time=
2.3s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.834 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.779 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.853 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.807 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.790 total time=
2.2s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.842 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.778 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.785 total time=
2.3s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.844 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.782 total time=
2.1s
```

```
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.771 total time=
2.2s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.826 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.767 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.775 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.841 total time=
2.1s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.797 total time=
2.1s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.799 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.829 total time=
2.4s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.775 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.767 total time=
2.2s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.834 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.786 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.780 total time=
2.2s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.832 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.780 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.778 total time=
2.1s
```

```
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.844 total time=
2.2s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.2s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.1s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.820 total time=
1.8s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.750 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.705 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.822 total time=
1.7s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.727 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.715 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.812 total time=
1.8s
```

```
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.721 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.712 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.818 total time=
1.8s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.723 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.728 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.828 total time=
1.8s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.717 total time=
1.7s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.732 total time=
1.7s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.7s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
```

```
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.814 total time=
1.8s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.729 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.747 total time=
1.9s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.866 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.822 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.867 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.816 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.850 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   2.2s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.805 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.858 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.840 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.804 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.849 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=5, weights=uniform;, score=0.829 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.826 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.855 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.824 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.821 total time=   2.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.828 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.809 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.820 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.838 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.810 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.817 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.829 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.820 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.842 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.809 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.829 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.837 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.801 total time=   2.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.844 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
```

```
n_neighbors=3, weights=uniform;, score=0.801 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.765 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.841 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.829 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.780 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.833 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.789 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.771 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.849 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.816 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.772 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.835 total time=   3.1s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.775 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.842 total time=   3.1s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.811 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.790 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.824 total time=   3.1s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.785 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.774 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.806 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.784 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.828 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
```

```
n_neighbors=7, weights=uniform;, score=0.787 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.786 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.839 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.787 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.788 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.764 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.763 total time=   3.1s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.839 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.786 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.774 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.825 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.751 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.812 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.755 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.787 total time=   2.2s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.757 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.834 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.813 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.765 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.805 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=5, weights=uniform;, score=0.799 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.742 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.822 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.804 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.759 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.784 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.754 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.822 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.813 total time=   2.0s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.766 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.810 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.776 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.750 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.831 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.789 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.756 total time=   2.0s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.795 total time=   2.0s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.754 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.748 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.816 total time=   2.1s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.770 total time=   2.1s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.759 total time=   2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.753 total time=
2.2s
```

```
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.708 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.600 total time=
2.3s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.758 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.711 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.632 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.728 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.695 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.618 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.769 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.716 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.631 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.729 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.708 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.617 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.761 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.724 total time=
2.1s
```

```
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.620 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.701 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.710 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.599 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.750 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.729 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.621 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.704 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.713 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.598 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.750 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.723 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.622 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.719 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.690 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.607 total time=
2.3s
```

```
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.753 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.705 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.623 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.845 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.796 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.771 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.850 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.804 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.773 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.834 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.779 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.853 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.807 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.790 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.842 total time=
2.1s
```

```
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.778 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.785 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.844 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.782 total time=
2.3s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.771 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.826 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.767 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.775 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.841 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.797 total time=
2.1s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.799 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.829 total time=
2.2s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.775 total time=
2.3s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.767 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.834 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.786 total time=
2.1s
```

```
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.780 total time=
2.1s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.832 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.780 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.778 total time=
2.2s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.844 total time=
2.1s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.2s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.820 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.750 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.705 total time=
1.7s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.822 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.727 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.715 total time=
1.8s
```

```
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.7s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.812 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.721 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.712 total time=
1.8s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.7s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.7s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.818 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.723 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.728 total time=
1.8s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.828 total time=
1.8s
```

```
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.717 total time=
1.7s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.732 total time=
1.8s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.7s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.814 total time=
1.8s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.729 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.747 total time=
1.9s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.866 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=uniform;, score=0.822 total time=   2.1s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.867 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=3, weights=distance;, score=0.816 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.850 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=4, weights=uniform;, score=0.811 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=uniform;, score=0.805 total time=   2.1s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.858 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.840 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=4, weights=distance;, score=0.804 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.849 total time=   2.1s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.829 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=uniform;, score=0.826 total time=   2.1s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.855 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.824 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=5, weights=distance;, score=0.821 total time=   2.1s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.828 total time=   2.2s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.809 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=uniform;, score=0.820 total time=   2.1s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.838 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.810 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=6, weights=distance;, score=0.817 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.829 total time=   2.1s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=uniform;, score=0.820 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.842 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.809 total time=   2.2s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=7, weights=distance;, score=0.829 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.837 total time=   2.1s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
```

```
n_neighbors=10, weights=uniform;, score=0.798 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=uniform;, score=0.801 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.844 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x00000241B1F140E0>,
n_neighbors=10, weights=distance;, score=0.818 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.833 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=uniform;, score=0.765 total time=   3.1s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.841 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.829 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=3, weights=distance;, score=0.780 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.833 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.789 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=uniform;, score=0.771 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.849 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.816 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=4, weights=distance;, score=0.772 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.835 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=uniform;, score=0.775 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.842 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.811 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=5, weights=distance;, score=0.790 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.824 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
```

```
n_neighbors=6, weights=uniform;, score=0.785 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=uniform;, score=0.774 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.806 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=6, weights=distance;, score=0.784 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.828 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.787 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=uniform;, score=0.786 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.839 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.787 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=7, weights=distance;, score=0.788 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.764 total time=   3.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=uniform;, score=0.763 total time=   3.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.839 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.786 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x00000241B1EEBD80>,
n_neighbors=10, weights=distance;, score=0.774 total time=   3.1s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.825 total time=   2.1s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.801 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=uniform;, score=0.751 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.834 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.812 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=3, weights=distance;, score=0.755 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=4, weights=uniform;, score=0.787 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=uniform;, score=0.757 total time=   2.2s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.834 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.813 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=4, weights=distance;, score=0.765 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.805 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.799 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=uniform;, score=0.742 total time=   2.1s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.822 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.804 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=5, weights=distance;, score=0.759 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   2.1s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.784 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=uniform;, score=0.754 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.822 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.813 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=6, weights=distance;, score=0.766 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.810 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.776 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=uniform;, score=0.750 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.831 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.789 total time=   2.1s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=7, weights=distance;, score=0.756 total time=   2.2s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.795 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
```

```
n_neighbors=10, weights=uniform;, score=0.754 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=uniform;, score=0.748 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.816 total time=   2.0s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.770 total time=   2.0s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x00000241B1EEBC40>,
n_neighbors=10, weights=distance;, score=0.759 total time=   2.0s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.753 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.708 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=uniform;, score=0.600 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.758 total time=
2.2s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.711 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=3, weights=distance;, score=0.632 total time=
2.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.728 total time=
2.3s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.695 total time=
2.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=uniform;, score=0.618 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.769 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.716 total time=
2.4s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=4, weights=distance;, score=0.631 total time=
2.4s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.729 total time=
2.5s
```

```
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.708 total time=
2.3s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=uniform;, score=0.617 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.761 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.724 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=5, weights=distance;, score=0.620 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.701 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.710 total time=
2.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=uniform;, score=0.599 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.750 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.729 total time=
2.4s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=6, weights=distance;, score=0.621 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.704 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.713 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=uniform;, score=0.598 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.750 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.723 total time=
2.1s
```

```
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=7, weights=distance;, score=0.622 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.719 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.690 total time=
2.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=uniform;, score=0.607 total time=
2.4s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.753 total time=
2.3s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.705 total time=
2.5s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x00000241B879DB20>, n_neighbors=10, weights=distance;, score=0.623 total time=
2.6s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.845 total time=
2.5s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.796 total time=
2.3s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=uniform;, score=0.771 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.850 total time=
2.2s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.804 total time=
2.8s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=3, weights=distance;, score=0.773 total time=
2.3s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.834 total time=
2.3s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.779 total time=
2.3s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=uniform;, score=0.783 total time=
2.2s
```

```
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.853 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.807 total time=
2.2s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=4, weights=distance;, score=0.790 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.842 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.778 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=uniform;, score=0.785 total time=
2.2s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.844 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.782 total time=
2.2s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=5, weights=distance;, score=0.771 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.826 total time=
2.2s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.767 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=uniform;, score=0.775 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.841 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.797 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=6, weights=distance;, score=0.799 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.829 total time=
2.2s
```

```
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.775 total time=
2.2s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=uniform;, score=0.767 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.834 total time=
2.2s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.786 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=7, weights=distance;, score=0.780 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.832 total time=
2.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.780 total time=
2.1s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=uniform;, score=0.778 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.844 total time=
2.2s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.2s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x00000241B879D9E0>, n_neighbors=10, weights=distance;, score=0.791 total time=
2.1s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.820 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.750 total time=
1.8s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=uniform;, score=0.705 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
```

```
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=3, weights=distance;, score=0.076 total time=
1.7s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.822 total time=
1.7s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.727 total time=
1.8s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=uniform;, score=0.715 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.7s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=4, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.812 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.721 total time=
1.8s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=uniform;, score=0.712 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.7s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=5, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.818 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.723 total time=
1.7s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=uniform;, score=0.728 total time=
1.8s
```

```
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.9s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=6, weights=distance;, score=0.076 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.828 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.717 total time=
1.8s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=uniform;, score=0.732 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.7s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.7s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=7, weights=distance;, score=0.076 total time=
1.7s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.814 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.729 total time=
1.7s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=uniform;, score=0.747 total time=
1.8s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.8s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x00000241B879CAE0>, n_neighbors=10, weights=distance;, score=0.076 total time=
1.7s
```

```
GridSearchCV(cv=3, estimator=KNeighborsClassifier(),
             param_grid={'leaf_size': [3, 5, 10, 20, 30],
                         'metric': [<function cityblock at 0x00000241B1F140E0>,
                                    <function cosine at 0x00000241B1EEBD80>,
                                    <function sqeuclidean at
0x00000241B1EEBC40>,
                                    <function chi_square_distance at
0x00000241B879DB20>,
                                    <function bhattacharyya_distance at
0x00000241B879D9E0>,
                                    <function intersection_distance at
0x00000241B879CAE0>],
                         'n_neighbors': [3, 4, 5, 6, 7, 10],
                         'weights': ['uniform', 'distance']},
             scoring='f1_macro', verbose=3)
```

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


y_pred_knn = best_knn.predict(test_features)

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

```
Best Params: {'leaf_size': 3, 'metric': <function cityblock at
0x00000241B1F140E0>, 'n_neighbors': 3, 'weights': 'uniform'}
```

```
<>:7: SyntaxWarning: invalid escape sequence '\j'
<>:7: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\3493465004.py:7:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(best_knn, project_dir + '\joblib\\best_knn_model.joblib')
```

```
['e:\\Documents\\CS231\\project\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\best_knn_model.joblib']
```

7 Gridsearch SVM

```
svm_model = SVC()
svm_model.fit(train_features, train_labels_encoded)
y_pred_svm = svm_model.predict(test_features)
```

```
param_grid = {
    'C': [0.1, 0.2, 0.3, 0.4],
    'kernel': ['rbf', 'linear', 'poly', 'sigmoid'],
    'gamma': ['scale', 'auto', 0.1, 0.01, 0.001],
    'degree': [2, 3, 4],
```

```
}

svm_model = SVC()

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

grid_search_svm.fit(train_features, train_labels_encoded)
```

```
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=0.586 total time=
0.2s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.565 total time=
0.2s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.521 total time=
0.2s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.619 total
time=   0.0s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.659 total time=
0.1s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.596 total time=
0.1s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.630 total time=
0.1s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.543 total
time=   0.1s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.542 total
time=   0.1s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.560 total
time=   0.1s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.619 total
```

```
time=   0.0s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.437 total time=
0.2s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.454 total time=
0.2s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.421 total time=
0.2s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.667 total time=
0.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.619 total time=
0.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.670 total time=
0.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.379 total
time=   0.1s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.356 total
time=   0.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.308 total
time=   0.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.619 total
```

```
time=   0.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.619 total
time=   0.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.586 total time=
0.2s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.565 total time=
0.2s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.521 total time=
0.2s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.619 total
```

```
time=   0.1s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.670 total
time=   0.1s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.626 total time=
0.1s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.577 total time=
0.1s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.547 total time=
0.1s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.543 total
time=   0.1s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.542 total
time=   0.1s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.560 total
time=   0.1s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.619 total
time=   0.0s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.437 total time=
0.2s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.454 total time=
0.2s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.421 total time=
0.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.667 total time=
0.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.619 total time=
```

```
0.0s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.670 total time=
0.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.379 total
time=   0.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.356 total
time=   0.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.308 total
time=   0.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.3s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.3s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.619 total
time=   0.0s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.619 total
```

```
time=   0.0s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.586 total time=
0.2s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.565 total time=
0.2s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.521 total time=
0.2s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.619 total
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.567 total time=
0.1s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.548 total time=
0.1s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.492 total time=
0.1s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.543 total
time=   0.1s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.542 total
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.560 total
time=   0.1s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.619 total
```

```
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.437 total time=
0.2s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.454 total time=
0.2s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.421 total time=
0.2s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.667 total time=
0.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.619 total time=
0.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.670 total time=
0.0s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.379 total
time=   0.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.356 total
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.308 total
time=   0.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.619 total
```

```
time=   0.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.667 total
time=   0.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.619 total
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.670 total
time=   0.0s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;, score=0.719 total time=
0.2s
[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;, score=0.690 total time=
0.2s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;, score=0.697 total time=
0.2s
[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=linear;, score=0.752 total
```

```
time=   0.0s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=linear;, score=0.733 total
time=   0.0s
[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=poly;, score=0.810 total time=
0.0s
[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=poly;, score=0.762 total time=
0.0s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=poly;, score=0.755 total time=
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[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;, score=0.718 total
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[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;, score=0.714 total
time=   0.0s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;, score=0.688 total
time=   0.1s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
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[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=linear;, score=0.752 total
time=   0.1s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=linear;, score=0.733 total
time=   0.0s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;, score=0.488 total time=
0.2s
[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;, score=0.527 total time=
0.2s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;, score=0.501 total time=
0.2s
[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;, score=0.789 total time=
0.0s
[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;, score=0.752 total time=
```

```
0.0s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;, score=0.733 total time=
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[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
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[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;, score=0.438 total
time=   0.1s
[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;, score=0.457 total
time=   0.1s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   0.1s
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[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.3s
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time=   0.0s
[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;, score=0.752 total
time=   0.0s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;, score=0.733 total
time=   0.0s
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[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
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[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;, score=0.752 total
```

```
time=   0.0s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;, score=0.733 total
time=   0.0s
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[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;, score=0.719 total time=
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[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;, score=0.690 total time=
0.2s
[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;, score=0.697 total time=
0.1s
[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=linear;, score=0.752 total
time=   0.0s
[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=linear;, score=0.733 total
time=   0.0s
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[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=poly;, score=0.736 total time=
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[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;, score=0.718 total
time=   0.0s
[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;, score=0.714 total
time=   0.1s
[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;, score=0.688 total
time=   0.0s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=linear;, score=0.752 total
```

```
time=   0.0s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=linear;, score=0.733 total
time=   0.0s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;, score=0.488 total time=
0.2s
[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;, score=0.527 total time=
0.2s
[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;, score=0.501 total time=
0.2s
[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;, score=0.789 total time=
0.0s
[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;, score=0.752 total time=
0.0s
[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;, score=0.733 total time=
0.0s
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[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
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[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;, score=0.438 total
time=   0.1s
[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;, score=0.457 total
time=   0.1s
[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   0.1s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;, score=0.752 total
```

```
time=   0.1s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;, score=0.733 total
time=   0.0s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
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[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
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0.3s
[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;, score=0.752 total
time=   0.0s
[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;, score=0.733 total
time=   0.0s
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[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;, score=0.719 total time=
0.2s
[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;, score=0.690 total time=
0.2s
[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;, score=0.697 total time=
0.2s
[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=linear;, score=0.752 total
```

```
time=   0.0s
[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=linear;, score=0.733 total
time=   0.0s
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time=   0.0s
[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;, score=0.714 total
time=   0.0s
[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;, score=0.688 total
time=   0.0s
[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
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[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=linear;, score=0.752 total
time=   0.0s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=linear;, score=0.733 total
time=   0.0s
[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
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time=   0.1s
[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;, score=0.488 total time=
0.2s
[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;, score=0.527 total time=
0.2s
[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;, score=0.501 total time=
0.2s
[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;, score=0.789 total time=
0.0s
[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;, score=0.752 total time=
```

```
0.0s
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time=   0.1s
[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;, score=0.457 total
time=   0.1s
[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   0.1s
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[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;, score=0.752 total
time=   0.0s
[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;, score=0.733 total
time=   0.0s
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time=   0.1s
[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
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time=   0.1s
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0.2s
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0.2s
[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;, score=0.789 total
time=   0.0s
[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;, score=0.752 total
```

```
time=   0.0s
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time=   0.1s
[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
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time=   0.0s
[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=linear;, score=0.770 total
time=   0.0s
[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=linear;, score=0.772 total
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time=   0.0s
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[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
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[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=linear;, score=0.770 total
```

```
time=   0.0s
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time=   0.1s
[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
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[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;, score=0.770 total time=
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[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;, score=0.772 total time=
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[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
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0.1s
[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
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time=   0.1s
[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;, score=0.505 total
time=   0.1s
[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;, score=0.487 total
time=   0.1s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;, score=0.770 total
```

```
time=   0.0s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;, score=0.770 total
time=   0.0s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;, score=0.772 total
time=   0.1s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;, score=0.790 total time=
0.1s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;, score=0.763 total time=
0.2s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;, score=0.759 total time=
0.1s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=linear;, score=0.770 total
```

```
time=   0.0s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=poly;, score=0.805 total time=
0.1s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=poly;, score=0.769 total time=
0.1s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=poly;, score=0.762 total time=
0.0s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;, score=0.739 total
time=   0.0s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;, score=0.734 total
time=   0.0s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;, score=0.710 total
time=   0.0s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=linear;, score=0.770 total
time=   0.0s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;, score=0.582 total time=
0.2s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;, score=0.545 total time=
0.2s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;, score=0.525 total time=
0.2s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;, score=0.805 total time=
0.0s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;, score=0.770 total time=
```

```
0.0s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;, score=0.772 total time=
0.0s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;, score=0.450 total
time=   0.1s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;, score=0.505 total
time=   0.1s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;, score=0.487 total
time=   0.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;, score=0.770 total
time=   0.0s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;, score=0.770 total
```

```
time=   0.0s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;, score=0.790 total time=
0.2s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;, score=0.763 total time=
0.2s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;, score=0.759 total time=
0.2s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=linear;, score=0.770 total
time=   0.0s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=poly;, score=0.797 total time=
0.1s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=poly;, score=0.764 total time=
0.1s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=poly;, score=0.734 total time=
0.1s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;, score=0.739 total
time=   0.0s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;, score=0.734 total
time=   0.1s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;, score=0.710 total
time=   0.0s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=linear;, score=0.770 total
```

```
time=   0.0s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;, score=0.582 total time=
0.2s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;, score=0.545 total time=
0.2s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;, score=0.525 total time=
0.2s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;, score=0.805 total time=
0.0s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;, score=0.770 total time=
0.0s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;, score=0.772 total time=
0.0s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;, score=0.450 total
time=   0.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;, score=0.505 total
time=   0.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;, score=0.487 total
time=   0.1s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;, score=0.770 total
```

```
time=   0.0s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;, score=0.805 total
time=   0.0s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;, score=0.770 total
time=   0.0s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;, score=0.772 total
time=   0.0s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;, score=0.809 total time=
0.1s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;, score=0.765 total time=
0.1s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;, score=0.788 total time=
0.1s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=linear;, score=0.778 total
```

```
time=   0.0s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=poly;, score=0.819 total time=
0.0s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=poly;, score=0.776 total time=
0.0s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=poly;, score=0.794 total time=
0.0s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;, score=0.761 total
time=   0.0s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;, score=0.743 total
time=   0.0s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;, score=0.720 total
time=   0.0s
[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=linear;, score=0.778 total
time=   0.0s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;, score=0.583 total time=
0.2s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;, score=0.553 total time=
0.2s
[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;, score=0.556 total time=
0.2s
[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;, score=0.819 total time=
0.0s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;, score=0.778 total time=
```

```
0.0s
[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;, score=0.774 total time=
0.0s
[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
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time=   0.1s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;, score=0.534 total
time=   0.1s
[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;, score=0.503 total
time=   0.1s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;, score=0.331 total time=
0.3s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;, score=0.171 total time=
0.3s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;, score=0.178 total time=
0.3s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;, score=0.778 total
time=   0.0s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.4s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;, score=0.778 total
```

```
time=   0.0s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;, score=0.809 total time=
0.1s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;, score=0.765 total time=
0.2s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;, score=0.788 total time=
0.3s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=linear;, score=0.778 total
time=   0.0s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=poly;, score=0.823 total time=
0.1s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=poly;, score=0.771 total time=
0.1s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=poly;, score=0.781 total time=
0.0s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;, score=0.761 total
time=   0.0s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;, score=0.743 total
time=   0.0s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;, score=0.720 total
time=   0.0s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.3s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.3s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=linear;, score=0.778 total
```

```
time=   0.0s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;, score=0.583 total time=
0.2s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;, score=0.553 total time=
0.2s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;, score=0.556 total time=
0.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;, score=0.819 total time=
0.0s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;, score=0.778 total time=
0.1s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;, score=0.774 total time=
0.0s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;, score=0.521 total
time=   0.1s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;, score=0.534 total
time=   0.1s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;, score=0.503 total
time=   0.1s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;, score=0.331 total time=
0.3s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;, score=0.171 total time=
0.3s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;, score=0.178 total time=
0.3s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;, score=0.778 total
```

```
time=   0.0s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;, score=0.778 total
time=   0.0s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;, score=0.809 total time=
0.2s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;, score=0.765 total time=
0.2s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;, score=0.788 total time=
0.2s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=linear;, score=0.778 total
```

```
time=   0.0s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=poly;, score=0.823 total time=
0.1s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=poly;, score=0.764 total time=
0.1s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=poly;, score=0.751 total time=
0.1s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;, score=0.761 total
time=   0.0s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;, score=0.743 total
time=   0.0s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;, score=0.720 total
time=   0.1s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
0.3s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=linear;, score=0.778 total
time=   0.0s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;, score=0.583 total time=
0.2s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;, score=0.553 total time=
0.2s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;, score=0.556 total time=
0.3s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;, score=0.819 total time=
0.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;, score=0.778 total time=
```

```
0.0s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;, score=0.774 total time=
0.0s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;, score=0.521 total
time=   0.1s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;, score=0.534 total
time=   0.1s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;, score=0.503 total
time=   0.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;, score=0.331 total time=
0.3s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;, score=0.171 total time=
0.3s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;, score=0.178 total time=
0.2s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;, score=0.778 total
time=   0.0s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.3s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
0.2s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;, score=0.819 total
time=   0.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;, score=0.778 total
```

```
time=   0.0s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;, score=0.774 total
time=   0.0s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
0.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.2s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   0.1s
```

```
GridSearchCV(cv=3, estimator=SVC(),
             param_grid={'C': [0.1, 0.2, 0.3, 0.4], '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_)

y_pred_svm = best_svm.predict(test_features)

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

```
Best parameters: {'C': 0.4, 'degree': 2, 'gamma': 'scale', 'kernel': 'poly'}
```

```
<>:7: SyntaxWarning: invalid escape sequence '\j'
<>:7: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_17472\952400143.py:7:
SyntaxWarning: invalid escape sequence '\j'
  joblib.dump(best_svm, project_dir + '\joblib\\best_svm_model.joblib')
```

```
['e:\\Documents\\CS231\\project\\Deploy-Traffic-Sign-Classification-through-
Images\\joblib\\best_svm_model.joblib']
```

8 Predict on test images for KNN

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

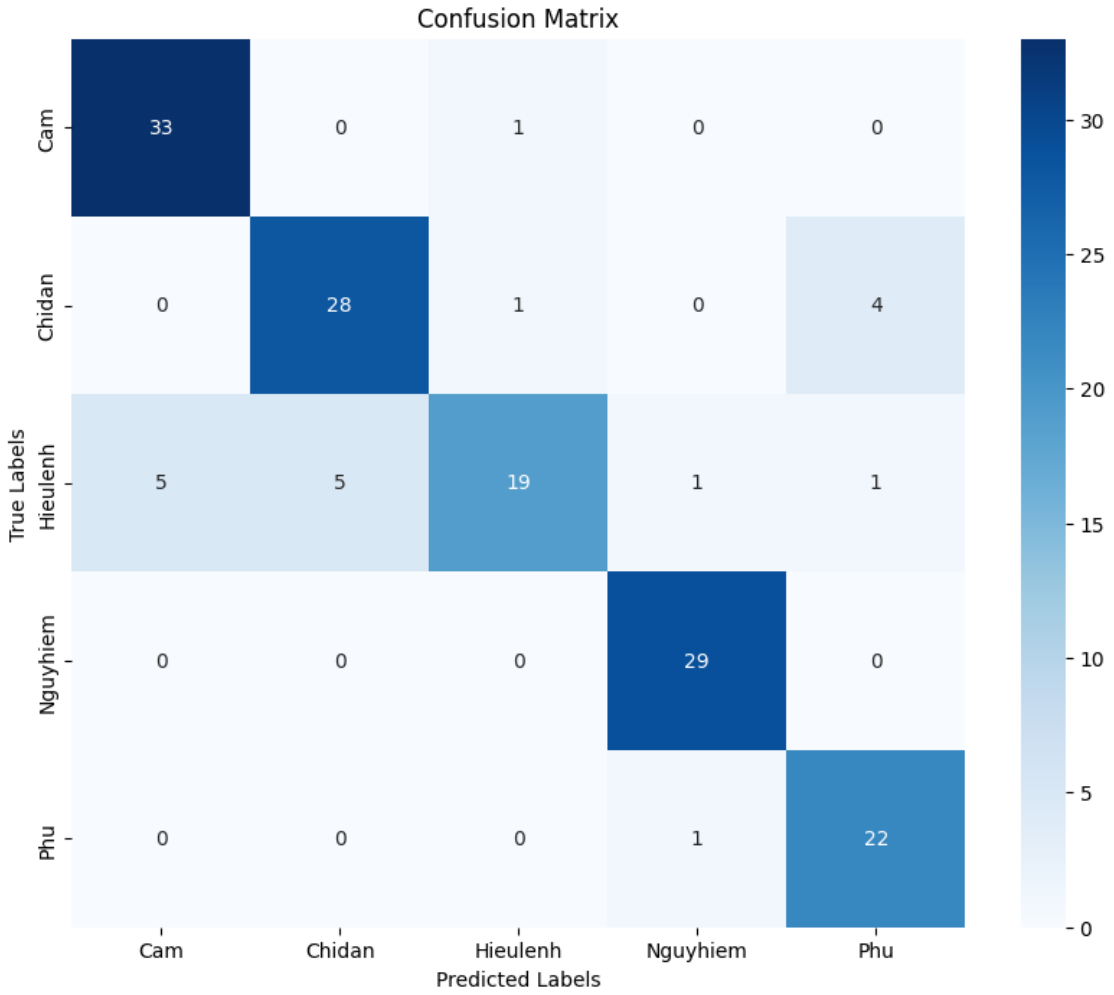
```
              precision    recall  f1-score   support
```

```
          Cam       0.87      0.97      0.92        34
       Chidan       0.85      0.85      0.85        33
    Hieulenh       0.90      0.61      0.73        31
    Nguyhiem       0.94      1.00      0.97        29
          Phu       0.81      0.96      0.88        23

    accuracy                           0.87       150
   macro avg       0.87      0.88      0.87       150
weighted avg       0.88      0.87      0.87       150
```

```
heatmap_label_knn = confusion_matrix(test_labels_encoded, y_pred_knn)

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()
```

9 Predict on test images for SVM

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

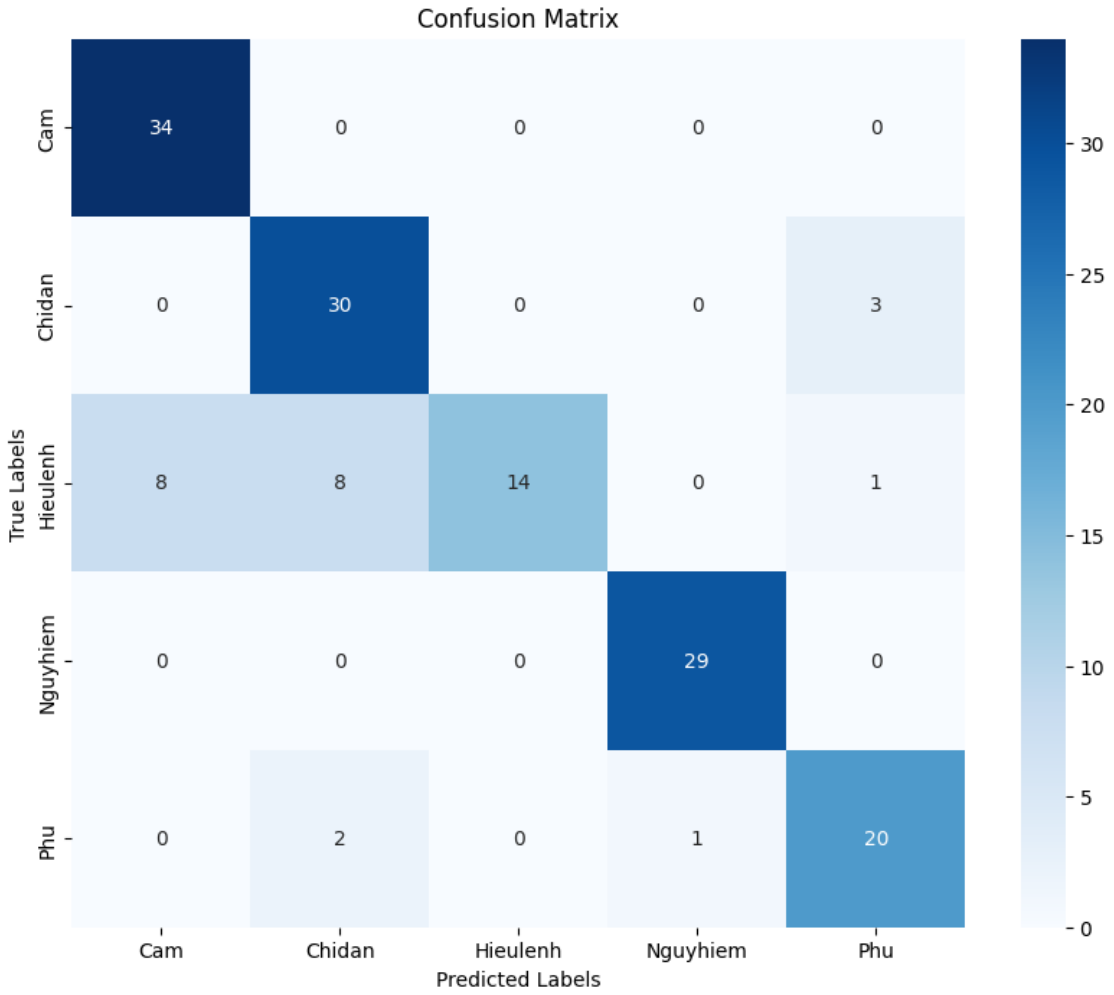
```
              precision    recall  f1-score   support

         Cam       0.81      1.00      0.89        34
      Chidan       0.75      0.91      0.82        33
    Hieulenh       1.00      0.45      0.62        31
    Nguyhiem       0.97      1.00      0.98        29
         Phu       0.83      0.87      0.85        23

    accuracy                           0.85       150
   macro avg       0.87      0.85      0.83       150
weighted avg       0.87      0.85      0.83       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()
```

10 Save grid search results

```
def export_notebook_to_pdf(notebook_path, project_dir):
    results_dir = os.path.join(project_dir)
    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)
```