Notebook

November 19, 2024

1 Import libraries

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

2 Load data

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

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

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

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

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

train_images = []
test_images = []

train_labels = []
test_labels = []

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

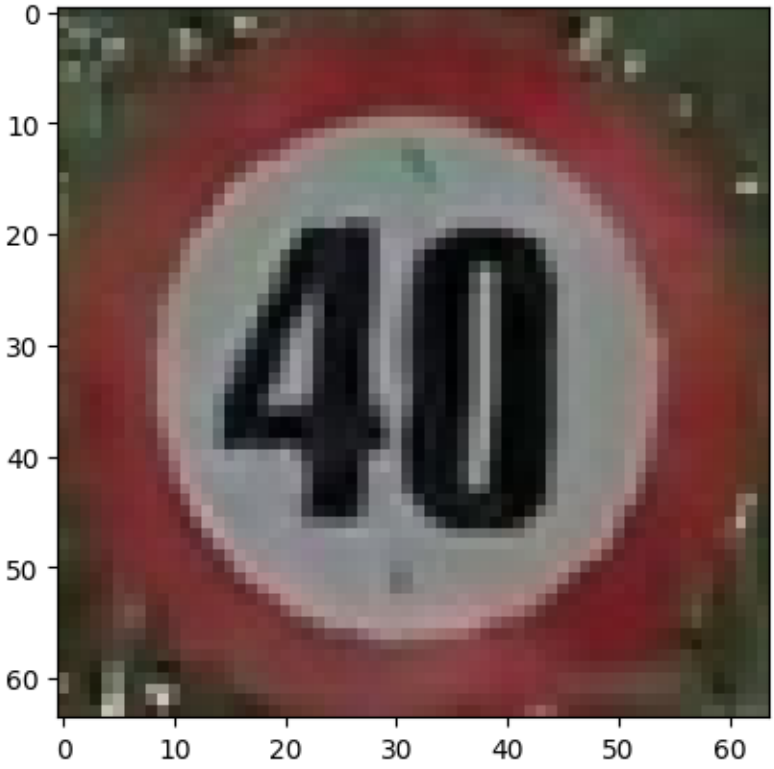
```
label_encoder = LabelEncoder()
train_labels_encoded = label_encoder.fit_transform(train_labels)
test_labels_encoded = label_encoder.transform(test_labels)
```

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

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

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

```
<matplotlib.image.AxesImage at 0x2341e4b0c50>
```




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

```
<matplotlib.image.AxesImage at 0x2341f6dd610>
```

3 Extract features

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

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

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

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

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

    return combined_features
```

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

```
Sharpening Images: 100%|      | 1415/1415 [00:00<00:00, 1613.74it/s]
Extracting Color Features: 100%|      | 1415/1415 [00:00<00:00, 9083.55it/s]
Extracting HOG Features: 100%|      | 1415/1415 [00:06<00:00, 212.38it/s]
Combining Features: 1415it [00:00, 28043.81it/s]

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

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

```
Sharpening Images: 100%|      | 150/150 [00:00<00:00, 1248.18it/s]
Extracting Color Features: 100%|      | 150/150 [00:00<00:00, 14898.78it/s]
Extracting HOG Features: 100%|      | 150/150 [00:00<00:00, 198.09it/s]
Combining Features: 150it [00:00, 4178.81it/s]

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

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

4 Distance metrics KNN

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

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

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

5 Gridsearch KNN

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

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

grid_search_knn.fit(X_train, y_train)
```

```
Fitting 3 folds for each of 504 candidates, totalling 1512 fits

[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.6s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.6s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.6s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.5s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.2s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.4s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.5s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.7s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.6s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.4s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   4.3s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.5s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.5s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.4s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.815 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.800 total time=   3.4s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.827 total time=   3.4s
[CV 1/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.850 total time=   3.3s
[CV 2/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.846 total time=   3.4s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   9.4s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   8.8s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.8s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   8.4s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   8.3s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.5s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.6s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.4s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   9.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.8s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   8.6s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   8.8s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
```

```
n_neighbors=5, weights=uniform;, score=0.821 total time=   8.5s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.7s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.7s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.9s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   9.2s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.9s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   9.0s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.7s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.7s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.7s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.6s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   9.3s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.9s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   8.9s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.6s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   8.5s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.6s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.757 total time=   8.7s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   9.3s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.789 total time=   8.9s
[CV 1/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.817 total time=   8.8s
[CV 2/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.833 total time=   8.6s
[CV 3/3] END leaf_size=5, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.813 total time=   8.8s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  18.5s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
```

```
n_neighbors=3, weights=uniform;, score=0.857 total time=  19.3s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  18.5s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  18.0s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  18.4s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.5s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  18.1s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.8s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  19.5s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  18.6s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.6s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  19.1s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  19.0s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
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[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  18.2s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  19.2s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  18.6s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  18.6s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  19.1s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  19.1s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  18.7s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  18.5s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  18.7s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  18.0s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  18.1s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
```

```
n_neighbors=7, weights=uniform;, score=0.826 total time=  18.1s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  18.9s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  18.1s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  18.3s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  19.2s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.822 total time=  19.6s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.787 total time=  19.0s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=  19.5s
[CV 1/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.828 total time=  19.1s
[CV 2/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.820 total time=  18.2s
[CV 3/3] END leaf_size=5, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.854 total time=  18.2s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.7s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.4s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   4.0s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.6s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.3s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.6s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.5s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.7s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.6s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.4s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.8s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.5s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
```

```
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.7s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.9s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.6s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.7s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.6s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   4.2s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.5s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.7s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.7s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.7s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.5s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.6s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.5s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.755 total time=   3.5s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.805 total time=   3.8s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.786 total time=   3.5s
[CV 1/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.4s
[CV 2/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.826 total time=   3.7s
[CV 3/3] END leaf_size=5, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.814 total time=   3.5s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.717 total time=
4.4s
```

```
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.9s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.6s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.4s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.693 total time=
4.3s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.3s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.716 total time=
3.9s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.2s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.0s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.0s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.0s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.2s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.761 total time=
4.2s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.2s
```

```
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.729 total time=
4.4s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.2s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.1s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.702 total time=
3.9s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.2s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.1s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.0s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.2s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.3s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.4s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.732 total time=
4.2s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.717 total time=
4.3s
[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.721 total time=
4.4s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.665 total time=
4.5s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.692 total time=
4.5s
```

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[CV 1/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.746 total time=
4.3s
[CV 2/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.720 total time=
4.3s
[CV 3/3] END leaf_size=5, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.732 total time=
4.3s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.794 total time=
4.3s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.803 total time=
3.8s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.797 total time=
4.0s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.832 total time=
3.9s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.822 total time=
3.8s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.8s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.763 total time=
3.7s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.6s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.9s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.8s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.811 total time=
3.6s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.812 total time=
3.9s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.780 total time=
4.2s
```

```
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.8s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.795 total time=
3.7s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.6s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.786 total time=
3.8s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.774 total time=
3.7s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.6s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.769 total time=
3.9s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.821 total time=
3.8s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.6s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.8s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.9s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.9s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.764 total time=
3.9s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.809 total time=
4.0s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.794 total time=
4.2s
```

```
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.785 total time=
4.4s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.750 total time=
4.0s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.752 total time=
3.9s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.771 total time=
4.0s
[CV 1/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.781 total time=
3.8s
[CV 2/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.763 total time=
3.9s
[CV 3/3] END leaf_size=5, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.774 total time=
4.0s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.4s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.5s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.5s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.4s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.5s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.5s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.638 total time=
3.5s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.4s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.5s
```

```
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.9s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.5s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.5s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.5s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.715 total time=
3.6s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.6s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.694 total time=
3.5s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.721 total time=
3.4s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.7s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.5s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.701 total time=
3.4s
```

```
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.6s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.684 total time=
3.4s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.2s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.8s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.7s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.700 total time=
3.3s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.713 total time=
3.3s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.695 total time=
3.3s
[CV 1/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=5, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.5s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.2s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.9s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.5s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.6s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.5s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.5s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.5s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.5s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.6s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.5s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.5s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.8s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.815 total time=   3.9s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=10, weights=uniform;, score=0.800 total time=   4.8s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.827 total time=   3.6s
[CV 1/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.850 total time=   3.5s
[CV 2/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.811 total time=   4.3s
[CV 3/3] END leaf_size=10, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.846 total time=   3.7s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   9.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=  10.1s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.7s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.7s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   9.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   9.0s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   9.9s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   9.5s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   9.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.7s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.8s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   9.8s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   9.1s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=  12.0s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   9.6s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.5s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   8.4s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.9s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
```

```
n_neighbors=6, weights=uniform;, score=0.815 total time=   8.5s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.3s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.4s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.4s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.3s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.8s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   9.2s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.6s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   8.6s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.8s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.757 total time=   8.8s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   8.6s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.789 total time=   8.4s
[CV 1/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.817 total time=   9.3s
[CV 2/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.833 total time=   8.2s
[CV 3/3] END leaf_size=10, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.813 total time=   8.4s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  18.3s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  18.0s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  19.1s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  18.4s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  18.4s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.4s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  18.6s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
```

```
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.0s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  18.0s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  18.8s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  17.9s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  17.8s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  18.1s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  19.0s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  18.1s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  18.0s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  19.4s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  18.5s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  18.2s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  18.1s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  18.7s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  17.9s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  18.1s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  19.0s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  18.2s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  18.3s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  18.0s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  18.7s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  17.9s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.0s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.822 total time=  18.4s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
```

```
n_neighbors=10, weights=uniform;, score=0.787 total time=  18.4s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=  18.0s
[CV 1/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.828 total time=  17.9s
[CV 2/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.820 total time=  19.5s
[CV 3/3] END leaf_size=10, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.854 total time=  18.2s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.7s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.7s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.5s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.8s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.5s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.2s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
```

```
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.2s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.5s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.3s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.3s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.7s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.755 total time=   3.7s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.805 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.786 total time=   3.4s
[CV 1/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.4s
[CV 2/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.826 total time=   3.4s
[CV 3/3] END leaf_size=10, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.814 total time=   3.3s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.717 total time=
4.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.2s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.1s
```

```
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.693 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.6s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.1s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.1s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.761 total time=
3.9s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.729 total time=
3.9s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.0s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.702 total time=
4.1s
```

```
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.0s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.721 total time=
3.9s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.5s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.732 total time=
4.2s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.717 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.721 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.665 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.692 total time=
3.9s
[CV 1/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.746 total time=
4.0s
[CV 2/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.720 total time=
4.1s
[CV 3/3] END leaf_size=10, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.732 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.794 total time=
3.6s
```

```
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.803 total time=
3.7s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.797 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.832 total time=
3.6s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.822 total time=
3.7s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.763 total time=
4.1s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.8s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.6s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.811 total time=
3.7s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.812 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.780 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.783 total time=
4.0s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.8s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.795 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.8s
```

```
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.786 total time=
3.7s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.774 total time=
3.6s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.8s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.769 total time=
3.7s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.821 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.6s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.794 total time=
4.0s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.9s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.7s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.764 total time=
3.7s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.809 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.8s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.785 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.750 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.752 total time=
3.6s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.771 total time=
3.7s
```

```
[CV 1/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.781 total time=
3.7s
[CV 2/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.763 total time=
3.6s
[CV 3/3] END leaf_size=10, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.774 total time=
3.6s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.4s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.3s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.5s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.638 total time=
3.4s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.3s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.2s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.2s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.3s
```

```
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.3s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.715 total time=
3.2s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.694 total time=
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3.4s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
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3.4s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
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[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
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[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.5s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
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3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
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3.3s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.3s
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[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
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3.4s
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3.3s
[CV 1/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.4s
[CV 2/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=10, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.6s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.6s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.5s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
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n_neighbors=5, weights=uniform;, score=0.838 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.8s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.815 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.800 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.827 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.850 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.2s
[CV 3/3] END leaf_size=20, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.846 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   8.3s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
```

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n_neighbors=3, weights=uniform;, score=0.843 total time=   8.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.9s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.9s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   9.1s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   8.9s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.7s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.7s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.8s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.7s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   9.0s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   8.5s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   8.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.3s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.3s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   8.5s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.4s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   9.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.6s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.5s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.4s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.6s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.6s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
```

```
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.7s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   9.4s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.5s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   8.3s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.5s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.757 total time=   8.4s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=   8.3s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.789 total time=   8.3s
[CV 1/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.817 total time=   8.3s
[CV 2/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.833 total time=   9.2s
[CV 3/3] END leaf_size=20, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.813 total time=   8.3s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  18.6s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  18.1s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  19.1s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  18.2s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  18.8s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.4s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  18.9s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.1s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  18.3s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  19.0s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.2s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  18.1s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  18.7s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
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n_neighbors=5, weights=uniform;, score=0.824 total time=  19.2s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  18.0s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  18.2s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  18.6s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  18.0s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  18.1s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  18.0s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  19.0s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  18.0s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  18.1s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  18.2s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  19.3s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  18.8s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  18.1s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  19.0s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  18.2s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.0s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.822 total time=  18.0s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.787 total time=  18.8s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=  18.6s
[CV 1/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.828 total time=  18.5s
[CV 2/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.820 total time=  19.0s
[CV 3/3] END leaf_size=20, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.854 total time=  18.2s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
```

```
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.6s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.5s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.2s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.2s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
```

```
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.3s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.755 total time=   3.7s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.805 total time=   3.6s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.786 total time=   3.4s
[CV 1/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.4s
[CV 2/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.826 total time=   3.4s
[CV 3/3] END leaf_size=20, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.814 total time=   3.3s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.717 total time=
3.9s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.693 total time=
4.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.1s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.1s
```

```
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.6s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.0s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.0s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.761 total time=
3.9s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.2s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.729 total time=
4.5s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.8s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.8s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.702 total time=
4.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.1s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.0s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.3s
```

```
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.4s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.9s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.760 total time=
5.0s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.732 total time=
4.6s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.717 total time=
4.1s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.721 total time=
5.5s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.665 total time=
5.0s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.692 total time=
4.8s
[CV 1/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.746 total time=
4.7s
[CV 2/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.720 total time=
4.8s
[CV 3/3] END leaf_size=20, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.732 total time=
4.9s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.794 total time=
4.5s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.803 total time=
4.3s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.797 total time=
4.1s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.832 total time=
4.0s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.822 total time=
4.3s
```

```
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.8s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.763 total time=
3.7s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.8s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.7s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.7s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.811 total time=
3.7s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.812 total time=
3.7s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.780 total time=
3.7s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.783 total time=
3.8s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.7s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.795 total time=
3.7s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.7s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.786 total time=
3.6s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.774 total time=
3.7s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.7s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.769 total time=
3.8s
```

```
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.821 total time=
4.0s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.8s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.7s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.6s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.8s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.764 total time=
3.7s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.809 total time=
3.7s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.7s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.785 total time=
3.6s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.750 total time=
3.6s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.752 total time=
3.7s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.771 total time=
3.6s
[CV 1/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.781 total time=
3.6s
[CV 2/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.763 total time=
3.6s
[CV 3/3] END leaf_size=20, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.774 total time=
3.6s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.2s
```

```
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.7s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.4s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.2s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.638 total time=
3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.3s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.4s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.7s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.715 total time=
3.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.2s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.5s
```

```
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.694 total time=
3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.721 total time=
3.6s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.6s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.5s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.701 total time=
3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.684 total time=
3.3s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.2s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.2s
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.700 total time=
3.3s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.713 total time=
3.3s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.695 total time=
3.2s
```

```
[CV 1/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.2s
[CV 2/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=20, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.6s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.6s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.5s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.815 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.800 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.827 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.850 total time=   3.2s
[CV 2/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.846 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   8.6s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   8.5s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   9.2s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.7s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   9.0s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   8.9s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.7s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
```

```
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.7s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.8s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   9.0s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.9s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   8.5s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   8.5s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   8.9s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.6s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.7s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.6s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   9.1s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=   8.6s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   8.6s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.7s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.5s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.7s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.8s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.9s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   9.2s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   8.7s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.5s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   8.5s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=   8.5s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.757 total time=   8.4s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
```

```
n_neighbors=10, weights=uniform;, score=0.808 total time=   8.5s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.789 total time=   9.1s
[CV 1/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.817 total time=   8.4s
[CV 2/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.833 total time=   8.7s
[CV 3/3] END leaf_size=30, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.813 total time=  10.0s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  24.6s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  26.6s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  21.5s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  20.1s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  21.6s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.8s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  19.9s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  20.3s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  19.2s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  19.7s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  21.0s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  19.9s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  19.5s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  19.4s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  23.0s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  26.2s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  22.7s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  22.4s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  22.3s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
```

```
n_neighbors=6, weights=uniform;, score=0.813 total time=  22.6s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  21.7s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  21.9s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  23.1s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  21.1s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  20.8s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  25.1s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  22.5s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  22.1s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  21.8s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  21.0s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.822 total time=  19.9s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.787 total time=  19.2s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=  18.8s
[CV 1/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.828 total time=  19.1s
[CV 2/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.820 total time=  18.7s
[CV 3/3] END leaf_size=30, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.854 total time=  19.3s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.3s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.6s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.6s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
```

```
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.5s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.8s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   4.3s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.8s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   4.3s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   4.1s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.7s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.5s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.5s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.5s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.4s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.5s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.5s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.755 total time=   3.6s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
```

```
n_neighbors=10, weights=uniform;, score=0.805 total time=   3.8s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.786 total time=   3.7s
[CV 1/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.3s
[CV 2/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.826 total time=   3.4s
[CV 3/3] END leaf_size=30, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.814 total time=   3.4s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.717 total time=
4.4s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.0s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.693 total time=
4.1s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.0s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.3s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.0s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.7s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.6s
```

```
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.7s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.4s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.761 total time=
4.4s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.7s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.729 total time=
4.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.0s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.1s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.702 total time=
4.3s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.6s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.2s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.7s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.6s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.692 total time=
5.0s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.732 total time=
4.4s
```

```
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.717 total time=
4.6s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.721 total time=
6.1s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.665 total time=
5.7s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.692 total time=
8.2s
[CV 1/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.746 total time=
4.8s
[CV 2/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.720 total time=
4.5s
[CV 3/3] END leaf_size=30, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.732 total time=
6.4s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.794 total time=
5.6s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.803 total time=
4.9s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.797 total time=
5.0s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.832 total time=
4.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.822 total time=
3.9s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.9s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.763 total time=
4.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.9s
```

```
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.813 total time=
4.3s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.811 total time=
3.9s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.812 total time=
3.7s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.780 total time=
4.1s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.7s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.795 total time=
3.6s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.8s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.786 total time=
3.8s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.774 total time=
4.0s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.769 total time=
3.6s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.821 total time=
3.6s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.6s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.7s
```

```
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.764 total time=
3.6s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.809 total time=
3.6s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.785 total time=
3.6s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.750 total time=
3.6s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.752 total time=
3.8s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.771 total time=
3.6s
[CV 1/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.781 total time=
3.8s
[CV 2/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.763 total time=
3.7s
[CV 3/3] END leaf_size=30, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.774 total time=
4.0s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.5s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.3s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.6s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
4.6s
```

```
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
5.2s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.638 total time=
5.3s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.4s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.5s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
4.3s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.4s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.728 total time=
4.9s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.715 total time=
5.9s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
7.0s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
4.6s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
5.7s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.694 total time=
4.7s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.721 total time=
5.2s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.707 total time=
4.2s
```

```
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.701 total time=
4.2s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.724 total time=
6.6s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.684 total time=
4.6s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.6s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.6s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
5.9s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.700 total time=
3.5s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.713 total time=
4.8s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.695 total time=
4.1s
[CV 1/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
4.8s
[CV 2/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
4.6s
[CV 3/3] END leaf_size=30, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
4.2s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.9s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   4.1s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   4.0s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.6s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.827 total time=   4.4s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   4.6s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   4.5s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   4.2s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.7s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.9s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.7s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.8s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.8s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.9s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.4s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.6s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   4.1s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.8s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.4s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   4.0s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.7s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
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n_neighbors=7, weights=uniform;, score=0.822 total time=   4.4s
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[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   5.9s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.7s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.4s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.815 total time=   3.6s
[CV 2/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.800 total time=   4.3s
[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.827 total time=   4.3s
[CV 1/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.850 total time=   3.3s
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[CV 3/3] END leaf_size=40, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.846 total time=   3.9s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   9.9s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   9.2s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=  14.8s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=  10.1s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   9.6s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=  10.5s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.1s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=   8.4s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   8.8s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.6s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   9.0s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   8.5s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   9.1s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
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n_neighbors=5, weights=uniform;, score=0.821 total time=   8.7s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.4s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=  11.2s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   8.9s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=   8.9s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=  10.8s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.815 total time=  10.3s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   8.6s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   8.2s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.5s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.6s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.4s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=  10.0s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=  10.2s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   9.8s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   9.7s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=  10.7s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.757 total time=   9.8s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=  10.0s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.789 total time=   9.8s
[CV 1/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.817 total time=   9.5s
[CV 2/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.833 total time=   9.5s
[CV 3/3] END leaf_size=40, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.813 total time=   9.5s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  21.3s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
```

```
n_neighbors=3, weights=uniform;, score=0.857 total time=  20.5s
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[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  21.9s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  20.8s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  21.2s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  23.1s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.813 total time=  22.7s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  23.9s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
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[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  20.7s
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[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  21.2s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  21.1s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
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n_neighbors=5, weights=distance;, score=0.855 total time=  20.3s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  18.9s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  20.6s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  20.3s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  20.7s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  21.4s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  19.7s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  19.9s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  20.0s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
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```
n_neighbors=7, weights=uniform;, score=0.826 total time=  17.9s
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[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  20.1s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  19.1s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.5s
[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.822 total time=  21.3s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.787 total time=  20.3s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
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[CV 1/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.828 total time=  25.7s
[CV 2/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.820 total time=  20.4s
[CV 3/3] END leaf_size=40, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.854 total time=  18.8s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.3s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.2s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
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n_neighbors=4, weights=uniform;, score=0.811 total time=   3.3s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.7s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.2s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
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[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
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n_neighbors=5, weights=uniform;, score=0.823 total time=   3.2s
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[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
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[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.2s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.3s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.3s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
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[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   3.4s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.5s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   3.9s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   4.0s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   4.1s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
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[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
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[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   3.9s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   3.8s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.755 total time=   4.0s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.805 total time=   4.2s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.786 total time=   3.5s
[CV 1/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.811 total time=   4.2s
[CV 2/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.826 total time=   3.8s
[CV 3/3] END leaf_size=40, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.814 total time=   3.4s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.717 total time=
4.2s
```

```
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.6s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.749 total time=
6.4s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.707 total time=
5.6s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.693 total time=
5.3s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.6s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.662 total time=
4.3s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.716 total time=
4.4s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.1s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.1s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.720 total time=
4.1s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.1s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.669 total time=
4.1s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.704 total time=
4.0s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.761 total time=
4.0s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.711 total time=
4.1s
```

```
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.729 total time=
4.1s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.712 total time=
4.4s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.689 total time=
4.8s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.702 total time=
4.5s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.749 total time=
4.4s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.707 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.721 total time=
4.2s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.5s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.4s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.692 total time=
4.3s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.6s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.732 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.717 total time=
4.3s
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.721 total time=
4.3s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.665 total time=
4.3s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.692 total time=
4.4s
```

```
[CV 1/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.746 total time=
4.1s
[CV 2/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.720 total time=
4.2s
[CV 3/3] END leaf_size=40, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.732 total time=
4.4s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.794 total time=
4.2s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.803 total time=
4.1s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.797 total time=
3.8s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.832 total time=
3.7s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.822 total time=
4.0s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.8s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.763 total time=
4.2s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.783 total time=
4.0s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.771 total time=
4.1s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.813 total time=
3.8s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.811 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.812 total time=
3.9s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.780 total time=
4.0s
```

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[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.783 total time=
4.0s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.773 total time=
3.9s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.795 total time=
4.0s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.794 total time=
3.9s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.786 total time=
3.7s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.774 total time=
3.7s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.782 total time=
3.8s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.769 total time=
3.7s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.821 total time=
3.7s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.783 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.6s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.795 total time=
3.8s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.791 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.764 total time=
3.6s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.809 total time=
3.7s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.794 total time=
3.7s
```

```
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.785 total time=
3.7s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.750 total time=
3.8s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.752 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.771 total time=
3.9s
[CV 1/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.781 total time=
4.1s
[CV 2/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.763 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.774 total time=
3.8s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.4s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.5s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.4s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.3s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.5s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.638 total time=
3.5s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.4s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.4s
```

```
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.4s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.4s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.4s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.715 total time=
3.4s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.7s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.4s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.694 total time=
3.5s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.721 total time=
3.7s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.4s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.5s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.8s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.701 total time=
3.6s
```

```
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.4s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.684 total time=
3.5s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.4s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.3s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.3s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.700 total time=
3.3s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.713 total time=
3.4s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.695 total time=
3.3s
[CV 1/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.6s
[CV 3/3] END leaf_size=40, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.2s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.841 total time=   3.3s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.3s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=uniform;, score=0.879 total time=   3.4s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.855 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.888 total time=   3.7s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=3, weights=distance;, score=0.881 total time=   3.6s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.842 total time=   3.9s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=4, weights=uniform;, score=0.827 total time=   3.9s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=uniform;, score=0.859 total time=   3.9s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.5s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.872 total time=   3.6s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=4, weights=distance;, score=0.879 total time=   3.6s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.856 total time=   3.7s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.838 total time=   3.6s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=uniform;, score=0.865 total time=   3.7s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.869 total time=   3.9s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.850 total time=   3.6s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=5, weights=distance;, score=0.865 total time=   3.4s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.829 total time=   3.8s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.827 total time=   3.6s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=uniform;, score=0.847 total time=   3.9s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.869 total time=   3.7s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.853 total time=   3.6s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=6, weights=distance;, score=0.862 total time=   3.4s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.827 total time=   3.6s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.822 total time=   3.9s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=uniform;, score=0.835 total time=   3.6s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.850 total time=   3.7s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.838 total time=   3.6s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=7, weights=distance;, score=0.862 total time=   3.6s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.815 total time=   3.8s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
```

```
n_neighbors=10, weights=uniform;, score=0.800 total time=   3.7s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=uniform;, score=0.827 total time=   3.7s
[CV 1/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.850 total time=   3.8s
[CV 2/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.8s
[CV 3/3] END leaf_size=50, metric=<function cityblock at 0x000002341ACCF1A0>,
n_neighbors=10, weights=distance;, score=0.846 total time=   3.6s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.821 total time=   9.5s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   9.2s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=uniform;, score=0.837 total time=   8.8s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.846 total time=   8.7s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.860 total time=   9.2s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=3, weights=distance;, score=0.847 total time=   9.4s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=  10.6s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.816 total time=  10.1s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=uniform;, score=0.803 total time=   9.7s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.853 total time=   8.9s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.855 total time=   8.7s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=4, weights=distance;, score=0.843 total time=   9.2s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.815 total time=   9.0s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.821 total time=   8.5s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=uniform;, score=0.804 total time=   8.7s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=   9.6s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.834 total time=  10.4s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=5, weights=distance;, score=0.829 total time=  10.7s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.805 total time=  10.7s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
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```
n_neighbors=6, weights=uniform;, score=0.815 total time=  10.6s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=uniform;, score=0.795 total time=   9.9s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.825 total time=   9.8s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.837 total time=   8.2s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=6, weights=distance;, score=0.824 total time=   8.1s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.798 total time=   8.4s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.804 total time=   8.3s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=uniform;, score=0.800 total time=   9.1s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.820 total time=   8.6s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.823 total time=   9.6s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=7, weights=distance;, score=0.828 total time=  10.2s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.757 total time=  10.9s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.808 total time=  10.2s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=uniform;, score=0.789 total time=   9.4s
[CV 1/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.817 total time=   9.7s
[CV 2/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.833 total time=   8.4s
[CV 3/3] END leaf_size=50, metric=<function cosine at 0x000002341ACCEE80>,
n_neighbors=10, weights=distance;, score=0.813 total time=   8.4s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.832 total time=  18.4s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.857 total time=  18.7s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=uniform;, score=0.870 total time=  20.8s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.846 total time=  21.2s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.865 total time=  21.8s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=3, weights=distance;, score=0.879 total time=  18.9s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.840 total time=  18.3s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
```

```
n_neighbors=4, weights=uniform;, score=0.813 total time=  18.3s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=uniform;, score=0.829 total time=  18.7s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.866 total time=  18.1s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.864 total time=  18.1s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=4, weights=distance;, score=0.882 total time=  17.7s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.851 total time=  18.4s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.824 total time=  18.3s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=uniform;, score=0.853 total time=  19.7s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.863 total time=  19.3s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.855 total time=  18.5s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=5, weights=distance;, score=0.865 total time=  18.1s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.822 total time=  18.3s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.813 total time=  18.8s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=uniform;, score=0.807 total time=  18.0s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.862 total time=  18.3s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.839 total time=  19.8s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=6, weights=distance;, score=0.846 total time=  24.7s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.828 total time=  22.8s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.826 total time=  22.4s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=uniform;, score=0.825 total time=  18.4s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.840 total time=  18.1s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.842 total time=  18.0s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=7, weights=distance;, score=0.849 total time=  18.6s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.822 total time=  17.9s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
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n_neighbors=10, weights=uniform;, score=0.787 total time=  17.7s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=uniform;, score=0.798 total time=  18.7s
[CV 1/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.828 total time=  18.3s
[CV 2/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.820 total time=  18.3s
[CV 3/3] END leaf_size=50, metric=<function correlation at 0x000002341ACCEDE0>,
n_neighbors=10, weights=distance;, score=0.854 total time=  18.2s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.826 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=uniform;, score=0.832 total time=   3.8s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.849 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.859 total time=   3.3s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=3, weights=distance;, score=0.842 total time=   3.3s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.814 total time=   3.6s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.811 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=uniform;, score=0.806 total time=   3.4s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.856 total time=   3.7s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.852 total time=   3.8s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=4, weights=distance;, score=0.843 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.810 total time=   3.6s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.823 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=uniform;, score=0.801 total time=   3.4s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.831 total time=   3.3s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.843 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=5, weights=distance;, score=0.826 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.797 total time=   3.4s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
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```
n_neighbors=6, weights=uniform;, score=0.815 total time=   3.6s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=uniform;, score=0.799 total time=   4.3s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.825 total time=   3.8s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.843 total time=   3.4s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=6, weights=distance;, score=0.824 total time=   4.0s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.803 total time=   3.5s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.807 total time=   3.8s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=uniform;, score=0.797 total time=   4.6s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.817 total time=   3.9s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.821 total time=   4.1s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=7, weights=distance;, score=0.825 total time=   5.1s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.755 total time=   4.7s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.805 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=uniform;, score=0.786 total time=   3.3s
[CV 1/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.811 total time=   3.2s
[CV 2/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.826 total time=   3.5s
[CV 3/3] END leaf_size=50, metric=<function sqeuclidean at 0x000002341ACCED40>,
n_neighbors=10, weights=distance;, score=0.814 total time=   3.5s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.717 total time=
5.5s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.701 total time=
4.3s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=uniform;, score=0.693 total time=
4.1s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.749 total time=
4.4s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.707 total time=
4.5s
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```
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=3, weights=distance;, score=0.693 total time=
4.7s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.731 total time=
4.3s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.662 total time=
5.6s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=uniform;, score=0.716 total time=
5.3s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.748 total time=
4.4s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.704 total time=
4.3s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=4, weights=distance;, score=0.720 total time=
5.2s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.742 total time=
4.4s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.669 total time=
6.0s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=uniform;, score=0.704 total time=
6.5s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.761 total time=
6.2s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.711 total time=
6.6s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=5, weights=distance;, score=0.729 total time=
6.5s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.712 total time=
5.7s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.689 total time=
5.2s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=uniform;, score=0.702 total time=
5.0s
```

```
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.749 total time=
5.3s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.707 total time=
5.0s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=6, weights=distance;, score=0.721 total time=
5.2s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.709 total time=
4.8s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.690 total time=
4.9s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=uniform;, score=0.692 total time=
5.0s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.760 total time=
4.9s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.732 total time=
5.0s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=7, weights=distance;, score=0.717 total time=
5.0s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.721 total time=
5.4s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.665 total time=
5.2s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=uniform;, score=0.692 total time=
4.5s
[CV 1/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.746 total time=
4.2s
[CV 2/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.720 total time=
4.1s
[CV 3/3] END leaf_size=50, metric=<function chi_square_distance at
0x000002341F7AF100>, n_neighbors=10, weights=distance;, score=0.732 total time=
4.2s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.794 total time=
4.4s
```

```
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.803 total time=
3.7s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=uniform;, score=0.797 total time=
4.0s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.832 total time=
4.0s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.822 total time=
3.9s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=3, weights=distance;, score=0.800 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.763 total time=
3.7s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.783 total time=
4.0s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=uniform;, score=0.771 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.813 total time=
4.0s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.811 total time=
4.1s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=4, weights=distance;, score=0.812 total time=
5.0s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.780 total time=
4.3s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.783 total time=
4.4s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=uniform;, score=0.773 total time=
4.2s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.795 total time=
4.4s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.794 total time=
4.5s
```

```
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=5, weights=distance;, score=0.786 total time=
4.1s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.774 total time=
4.2s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.782 total time=
4.5s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=uniform;, score=0.769 total time=
4.0s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.821 total time=
4.0s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.783 total time=
4.1s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=6, weights=distance;, score=0.794 total time=
3.9s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.795 total time=
4.1s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.791 total time=
4.0s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=uniform;, score=0.764 total time=
4.0s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.809 total time=
4.1s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.794 total time=
4.2s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=7, weights=distance;, score=0.785 total time=
4.1s
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.750 total time=
4.0s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.752 total time=
4.1s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=uniform;, score=0.771 total time=
4.0s
```

```
[CV 1/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.781 total time=
3.9s
[CV 2/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.763 total time=
4.1s
[CV 3/3] END leaf_size=50, metric=<function bhattacharyya_distance at
0x000002341F7AFF60>, n_neighbors=10, weights=distance;, score=0.774 total time=
4.3s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.700 total time=
3.7s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.745 total time=
3.7s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=uniform;, score=0.721 total time=
3.5s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.5s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.7s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=3, weights=distance;, score=0.076 total time=
3.7s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.638 total time=
3.7s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.723 total time=
3.8s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=uniform;, score=0.690 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.7s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.7s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=4, weights=distance;, score=0.076 total time=
3.7s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.683 total time=
3.7s
```

```
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.728 total time=
3.8s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=uniform;, score=0.715 total time=
3.6s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.9s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
4.1s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=5, weights=distance;, score=0.076 total time=
3.6s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.694 total time=
3.6s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.721 total time=
3.6s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=uniform;, score=0.707 total time=
3.6s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.6s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.6s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=6, weights=distance;, score=0.076 total time=
3.7s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.701 total time=
3.8s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.724 total time=
3.6s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=uniform;, score=0.684 total time=
3.6s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.7s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.7s
```

```
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=7, weights=distance;, score=0.076 total time=
3.8s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.700 total time=
3.7s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.713 total time=
3.8s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=uniform;, score=0.695 total time=
3.7s
[CV 1/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.8s
[CV 2/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.8s
[CV 3/3] END leaf_size=50, metric=<function intersection_distance at
0x000002341F7AFA60>, n_neighbors=10, weights=distance;, score=0.076 total time=
3.7s

GridSearchCV(cv=3, estimator=KNeighborsClassifier(),
             param_grid={'leaf_size': [5, 10, 20, 30, 40, 50],
                         'metric': [<function cityblock at 0x000002341ACCF1A0>,
                                    <function cosine at 0x000002341ACCEE80>,
                                    <function correlation at
0x000002341ACCEDE0>,
                                    <function sqeuclidean at
0x000002341ACCED40>,
                                    <function chi_square_distance at
0x000002341F7AF100>,
                                    <function bhattacharyya_distance at
0x000002341F7AFF60>,
                                    <function intersection_distance at
0x000002341F7AFA60>],
                         'n_neighbors': [3, 4, 5, 6, 7, 10],
                         'weights': ['uniform', 'distance']},
             scoring='f1_macro', verbose=3)
```

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

best_knn.fit(train_features, train_labels_encoded)

y_pred_knn = best_knn.predict(test_features)
```

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

```
Best Params: {'leaf_size': 5, 'metric': <function cityblock at
0x000002341ACCF1A0>, 'n_neighbors': 3, 'weights': 'distance'}
```

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

6 Gridsearch SVM

```
param_grid = {
    'C': [0.1, 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(random_state=42)

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

grid_search_svm.fit(X_train, y_train)
```

```
Fitting 3 folds for each of 240 candidates, totalling 720 fits
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.471 total time=
1.5s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.481 total time=
1.3s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;, score=0.476 total time=
1.4s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.838 total
time=   0.7s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=linear;, score=0.850 total
time=   0.6s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.736 total time=
0.9s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.690 total time=
0.7s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=poly;, score=0.701 total time=
```

```
0.8s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.494 total
time=   1.0s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.485 total
time=   1.0s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;, score=0.500 total
time=   1.1s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.4s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.4s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.3s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.838 total
time=   0.7s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=linear;, score=0.850 total
time=   0.6s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.3s
[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.2s
[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.249 total time=
1.6s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.226 total time=
1.5s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;, score=0.224 total time=
1.4s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.842 total time=
0.4s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.838 total time=
0.7s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;, score=0.850 total time=
0.5s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.858 total time=
0.7s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.9s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;, score=0.888 total time=
```

```
1.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.208 total
time=   1.3s
[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.264 total
time=   1.1s
[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;, score=0.246 total
time=   1.0s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.459 total time=
1.2s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.460 total time=
1.2s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;, score=0.454 total time=
1.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.398 total time=
1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.386 total time=
1.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;, score=0.389 total time=
1.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.443 total
time=   1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.451 total
time=   1.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;, score=0.449 total
time=   0.9s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.5s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.3s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.3s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.471 total time=
1.3s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.481 total time=
1.1s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;, score=0.476 total time=
1.1s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=linear;, score=0.850 total
time=   0.5s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.774 total time=
0.8s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.782 total time=
0.7s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=poly;, score=0.758 total time=
0.8s
[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.494 total
time=   0.8s
[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.485 total
time=   0.9s
[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;, score=0.500 total
time=   0.9s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.4s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.249 total time=
1.4s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.226 total time=
1.3s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;, score=0.224 total time=
1.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.842 total time=
0.5s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.838 total time=
0.5s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;, score=0.850 total time=
0.4s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
0.8s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
0.8s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.208 total
time=   1.1s
[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.264 total
time=   1.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;, score=0.246 total
time=   1.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.459 total time=
1.5s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.460 total time=
1.1s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;, score=0.454 total time=
1.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;, score=0.850 total
time=   0.5s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.443 total
time=   0.9s
[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.451 total
time=   0.9s
[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;, score=0.449 total
time=   1.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.4s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.3s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;, score=0.850 total
time=   0.4s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.471 total time=
1.2s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.481 total time=
1.1s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;, score=0.476 total time=
1.1s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=linear;, score=0.850 total
time=   0.5s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.792 total time=
0.8s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.819 total time=
0.8s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=poly;, score=0.811 total time=
```

```
0.9s
[CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.494 total
time=   0.8s
[CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.485 total
time=   0.8s
[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;, score=0.500 total
time=   0.8s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.3s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.842 total
time=   0.4s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.838 total
time=   0.5s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=linear;, score=0.850 total
time=   0.5s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.249 total time=
1.4s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.226 total time=
1.2s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;, score=0.224 total time=
1.3s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.842 total time=
0.4s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.838 total time=
0.5s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;, score=0.850 total time=
0.5s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
0.9s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
0.8s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
```

```
0.9s
[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.208 total
time=   1.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.264 total
time=   1.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;, score=0.246 total
time=   1.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.459 total time=
1.2s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.460 total time=
1.3s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;, score=0.454 total time=
1.2s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.842 total
time=   0.6s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.838 total
time=   0.7s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;, score=0.850 total
time=   0.6s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.443 total
time=   0.9s
[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.451 total
time=   1.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;, score=0.449 total
time=   1.0s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.3s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.842 total
time=   0.5s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.838 total
time=   0.7s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;, score=0.850 total
time=   0.5s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;, score=0.584 total time=
1.1s
[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;, score=0.562 total time=
1.0s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;, score=0.558 total time=
1.0s
[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=linear;, score=0.827 total
time=   0.6s
[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=linear;, score=0.823 total
time=   0.6s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=linear;, score=0.848 total
time=   0.5s
[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=poly;, score=0.769 total time=
0.6s
[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=poly;, score=0.792 total time=
0.7s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=poly;, score=0.775 total time=
0.7s
[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;, score=0.532 total
time=   0.8s
[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;, score=0.511 total
time=   0.9s
[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;, score=0.522 total
time=   0.8s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.4s
[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=linear;, score=0.823 total
time=   0.5s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=linear;, score=0.848 total
time=   0.6s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
1.0s
[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;, score=0.408 total time=
1.3s
[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;, score=0.409 total time=
1.2s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;, score=0.411 total time=
1.2s
[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;, score=0.827 total time=
0.6s
[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;, score=0.823 total time=
0.6s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;, score=0.848 total time=
0.5s
[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;, score=0.851 total time=
0.6s
[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.7s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;, score=0.897 total time=
0.6s
[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;, score=0.382 total
time=   1.0s
[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;, score=0.393 total
time=   1.0s
[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;, score=0.407 total
time=   1.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;, score=0.543 total time=
1.1s
[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;, score=0.520 total time=
1.0s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;, score=0.533 total time=
1.0s
[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;, score=0.823 total
time=   0.6s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;, score=0.848 total
time=   0.5s
[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;, score=0.448 total time=
1.0s
[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;, score=0.451 total time=
1.1s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;, score=0.455 total time=
```

```
1.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;, score=0.500 total
time=   0.9s
[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;, score=0.516 total
time=   0.9s
[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;, score=0.514 total
time=   0.9s
[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;, score=0.252 total time=
1.3s
[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;, score=0.271 total time=
1.2s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;, score=0.263 total time=
1.2s
[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;, score=0.823 total
time=   0.6s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;, score=0.848 total
time=   0.6s
[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;, score=0.584 total time=
1.1s
[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;, score=0.562 total time=
1.0s
[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;, score=0.558 total time=
1.0s
[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=linear;, score=0.823 total
time=   0.7s
[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=linear;, score=0.848 total
time=   0.5s
[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=poly;, score=0.815 total time=
0.6s
[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=poly;, score=0.834 total time=
0.7s
[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=poly;, score=0.856 total time=
```

```
0.7s
[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;, score=0.532 total
time=   0.7s
[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;, score=0.511 total
time=   0.8s
[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;, score=0.522 total
time=   0.9s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.3s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=linear;, score=0.823 total
time=   0.6s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=linear;, score=0.848 total
time=   0.6s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.2s
[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;, score=0.408 total time=
1.3s
[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;, score=0.409 total time=
1.2s
[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;, score=0.411 total time=
1.3s
[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;, score=0.827 total time=
0.5s
[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;, score=0.823 total time=
0.6s
[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;, score=0.848 total time=
0.5s
[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
0.8s
[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
0.7s
[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
```

```
0.8s
[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;, score=0.382 total
time=   1.0s
[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;, score=0.393 total
time=   1.0s
[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;, score=0.407 total
time=   1.0s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;, score=0.543 total time=
1.1s
[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;, score=0.520 total time=
1.0s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;, score=0.533 total time=
1.0s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;, score=0.827 total
time=   0.4s
[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;, score=0.823 total
time=   0.5s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;, score=0.848 total
time=   0.5s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;, score=0.344 total time=
1.1s
[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;, score=0.340 total time=
1.0s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;, score=0.337 total time=
1.0s
[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;, score=0.500 total
time=   0.8s
[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;, score=0.516 total
time=   0.8s
[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;, score=0.514 total
time=   0.8s
[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;, score=0.252 total time=
1.4s
[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;, score=0.271 total time=
1.5s
[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;, score=0.263 total time=
1.5s
[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;, score=0.823 total
time=   0.8s
[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;, score=0.848 total
time=   0.5s
[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.0s
[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.2s
[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;, score=0.584 total time=
1.1s
[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;, score=0.562 total time=
1.0s
[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;, score=0.558 total time=
1.0s
[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=linear;, score=0.823 total
time=   0.7s
[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=linear;, score=0.848 total
time=   0.6s
[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=poly;, score=0.854 total time=
0.8s
[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=poly;, score=0.876 total time=
0.8s
[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=poly;, score=0.879 total time=
0.9s
[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;, score=0.532 total
time=   0.7s
[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;, score=0.511 total
time=   0.8s
[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;, score=0.522 total
time=   0.8s
[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.3s
[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=linear;, score=0.823 total
time=   0.6s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=linear;, score=0.848 total
time=   0.6s
[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
1.0s
[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   0.9s
[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;, score=0.408 total time=
1.3s
[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;, score=0.409 total time=
1.2s
[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;, score=0.411 total time=
1.3s
[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;, score=0.827 total time=
0.6s
[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;, score=0.823 total time=
0.5s
[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;, score=0.848 total time=
0.5s
[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
0.8s
[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
0.8s
[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
0.9s
[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;, score=0.382 total
time=   1.0s
[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;, score=0.393 total
time=   1.1s
[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;, score=0.407 total
time=   1.0s
[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=rbf;, score=0.543 total time=
1.1s
[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=rbf;, score=0.520 total time=
1.0s
[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=rbf;, score=0.533 total time=
1.0s
[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;, score=0.823 total
time=   0.6s
[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;, score=0.848 total
time=   0.5s
[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=sigmoid;, score=0.500 total
time=   0.8s
[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=sigmoid;, score=0.516 total
time=   0.8s
[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=sigmoid;, score=0.514 total
time=   0.9s
[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=rbf;, score=0.252 total time=
1.3s
[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=rbf;, score=0.271 total time=
1.2s
[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=rbf;, score=0.263 total time=
1.2s
[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;, score=0.827 total
time=   0.5s
[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;, score=0.823 total
time=   0.7s
[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;, score=0.848 total
time=   0.5s
[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.3s
[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=rbf;, score=0.726 total time=
1.1s
[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=rbf;, score=0.669 total time=
1.0s
[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=rbf;, score=0.689 total time=
1.0s
[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=poly;, score=0.807 total time=
0.6s
[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=poly;, score=0.826 total time=
0.6s
[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=poly;, score=0.827 total time=
```

```
0.6s
[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=sigmoid;, score=0.617 total
time=   0.7s
[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=sigmoid;, score=0.533 total
time=   0.7s
[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=sigmoid;, score=0.569 total
time=   0.7s
[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.5s
[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=linear;, score=0.843 total
time=   0.6s
[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=rbf;, score=0.422 total time=
1.3s
[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=rbf;, score=0.439 total time=
1.3s
[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=rbf;, score=0.441 total time=
1.3s
[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;, score=0.825 total time=
0.5s
[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;, score=0.817 total time=
0.7s
[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;, score=0.843 total time=
0.5s
[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;, score=0.851 total time=
0.6s
[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.6s
[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;, score=0.897 total time=
```

```
0.7s
[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   1.0s
[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   1.0s
[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;, score=0.422 total
time=   1.1s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;, score=0.589 total time=
1.1s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;, score=0.529 total time=
0.9s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;, score=0.564 total time=
0.9s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.5s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;, score=0.494 total time=
0.9s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;, score=0.490 total time=
0.9s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;, score=0.489 total time=
1.0s
[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;, score=0.534 total
time=   0.8s
[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;, score=0.515 total
time=   0.8s
[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;, score=0.527 total
time=   0.8s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;, score=0.414 total time=
1.4s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;, score=0.424 total time=
1.2s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;, score=0.424 total time=
1.2s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.0s
[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.2s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;, score=0.726 total time=
1.2s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;, score=0.669 total time=
1.1s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;, score=0.689 total time=
1.1s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=linear;, score=0.843 total
time=   0.6s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=poly;, score=0.848 total time=
0.7s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=poly;, score=0.875 total time=
0.7s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=poly;, score=0.876 total time=
0.8s
[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;, score=0.617 total
time=   0.7s
[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;, score=0.533 total
time=   0.7s
[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;, score=0.569 total
time=   0.7s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.4s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=linear;, score=0.817 total
time=   0.5s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;, score=0.422 total time=
1.4s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;, score=0.439 total time=
1.2s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;, score=0.441 total time=
1.2s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;, score=0.825 total time=
0.5s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;, score=0.817 total time=
0.6s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;, score=0.843 total time=
0.5s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
0.8s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
0.8s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
0.8s
[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   1.0s
[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   0.9s
[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;, score=0.422 total
time=   1.0s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;, score=0.589 total time=
1.2s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;, score=0.529 total time=
0.9s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;, score=0.564 total time=
0.9s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;, score=0.434 total time=
1.0s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;, score=0.438 total time=
1.0s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;, score=0.443 total time=
```

```
1.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;, score=0.534 total
time=   0.8s
[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;, score=0.515 total
time=   0.7s
[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;, score=0.527 total
time=   0.8s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;, score=0.414 total time=
1.4s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;, score=0.424 total time=
1.2s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;, score=0.424 total time=
1.2s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;, score=0.726 total time=
1.2s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;, score=0.669 total time=
1.0s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;, score=0.689 total time=
0.9s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=poly;, score=0.852 total time=
1.0s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=poly;, score=0.884 total time=
1.1s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=poly;, score=0.894 total time=
```

```
1.0s
[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;, score=0.617 total
time=   0.9s
[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;, score=0.533 total
time=   0.8s
[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;, score=0.569 total
time=   0.7s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.4s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;, score=0.422 total time=
1.5s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;, score=0.439 total time=
1.2s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;, score=0.441 total time=
1.2s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;, score=0.825 total time=
0.5s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;, score=0.817 total time=
0.6s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;, score=0.843 total time=
0.5s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
0.9s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
1.0s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
```

```
1.0s
[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   1.0s
[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;, score=0.425 total
time=   1.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;, score=0.422 total
time=   1.0s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;, score=0.589 total time=
1.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;, score=0.529 total time=
0.9s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;, score=0.564 total time=
0.9s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.1s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;, score=0.534 total
time=   0.8s
[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;, score=0.515 total
time=   0.8s
[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;, score=0.527 total
time=   0.8s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;, score=0.414 total time=
1.4s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;, score=0.424 total time=
1.2s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;, score=0.424 total time=
1.2s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;, score=0.825 total
time=   0.5s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;, score=0.843 total
time=   0.5s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;, score=0.757 total time=
1.0s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;, score=0.758 total time=
1.0s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;, score=0.738 total time=
0.9s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=poly;, score=0.826 total time=
0.7s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=poly;, score=0.841 total time=
0.6s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=poly;, score=0.833 total time=
0.7s
[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;, score=0.701 total
time=   0.6s
[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;, score=0.638 total
time=   0.7s
[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;, score=0.661 total
time=   0.6s
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1.5s
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1.5s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=rbf;, score=0.317 total time=
1.4s
[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=linear;, score=0.819 total
time=   0.6s
[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
1.1s
[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.0s
[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;, score=0.444 total time=
1.5s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;, score=0.456 total time=
1.2s
[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;, score=0.457 total time=
1.2s
[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;, score=0.819 total time=
0.5s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;, score=0.817 total time=
0.5s
[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;, score=0.845 total time=
0.5s
[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;, score=0.851 total time=
0.7s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;, score=0.877 total time=
0.7s
[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;, score=0.897 total time=
0.7s
[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;, score=0.440 total
time=   0.9s
[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;, score=0.436 total
time=   0.9s
[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;, score=0.437 total
time=   0.9s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;, score=0.695 total time=
1.0s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;, score=0.644 total time=
1.0s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;, score=0.664 total time=
0.9s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.5s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;, score=0.520 total time=
0.8s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;, score=0.518 total time=
0.9s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;, score=0.522 total time=
```

```
0.9s
[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;, score=0.566 total
time=   0.7s
[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;, score=0.519 total
time=   0.7s
[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;, score=0.551 total
time=   0.7s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;, score=0.443 total time=
1.4s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;, score=0.446 total time=
1.2s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;, score=0.452 total time=
1.2s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
0.9s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;, score=0.267 total
time=   1.0s
[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;, score=0.299 total
time=   1.0s
[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;, score=0.291 total
time=   1.0s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;, score=0.757 total time=
1.0s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;, score=0.758 total time=
1.0s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;, score=0.738 total time=
0.9s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=poly;, score=0.856 total time=
0.8s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=poly;, score=0.891 total time=
0.7s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=poly;, score=0.892 total time=
```

```
0.8s
[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;, score=0.701 total
time=   0.7s
[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;, score=0.638 total
time=   0.6s
[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;, score=0.661 total
time=   0.7s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;, score=0.311 total time=
1.3s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;, score=0.322 total time=
1.2s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;, score=0.317 total time=
1.3s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=poly;, score=0.076 total time=
1.2s
[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.2s
[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;, score=0.444 total time=
1.3s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;, score=0.456 total time=
1.3s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;, score=0.457 total time=
1.4s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;, score=0.819 total time=
0.6s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;, score=0.817 total time=
0.9s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;, score=0.845 total time=
0.7s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;, score=0.851 total time=
0.9s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;, score=0.901 total time=
1.0s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;, score=0.897 total time=
```

```
0.9s
[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;, score=0.440 total
time=   1.3s
[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;, score=0.436 total
time=   1.0s
[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;, score=0.437 total
time=   1.5s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;, score=0.695 total time=
1.1s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;, score=0.644 total time=
1.2s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;, score=0.664 total time=
1.0s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;, score=0.819 total
time=   0.6s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.8s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;, score=0.845 total
time=   0.8s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;, score=0.442 total time=
1.2s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;, score=0.451 total time=
1.2s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;, score=0.451 total time=
1.4s
[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;, score=0.566 total
time=   0.9s
[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;, score=0.519 total
time=   0.8s
[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;, score=0.551 total
time=   1.0s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;, score=0.443 total time=
1.6s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;, score=0.446 total time=
1.3s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;, score=0.452 total time=
1.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;, score=0.819 total
time=   0.6s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.8s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.6s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.2s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;, score=0.076 total time=
```

```
1.2s
[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;, score=0.267 total
time=   1.2s
[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;, score=0.299 total
time=   1.1s
[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;, score=0.291 total
time=   1.0s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;, score=0.757 total time=
1.0s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;, score=0.758 total time=
1.1s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;, score=0.738 total time=
1.1s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=linear;, score=0.819 total
time=   0.7s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=linear;, score=0.817 total
time=   0.7s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=linear;, score=0.845 total
time=   0.6s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=poly;, score=0.847 total time=
0.9s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=poly;, score=0.884 total time=
0.9s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=poly;, score=0.897 total time=
1.0s
[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;, score=0.701 total
time=   0.8s
[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;, score=0.638 total
time=   0.8s
[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;, score=0.661 total
time=   0.8s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;, score=0.311 total time=
1.5s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;, score=0.322 total time=
1.2s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;, score=0.317 total time=
1.4s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
1.1s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=poly;, score=0.076 total time=
```

```
1.3s
[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.3s
[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;, score=0.076 total
time=   1.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;, score=0.444 total time=
1.3s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;, score=0.456 total time=
1.3s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;, score=0.457 total time=
1.3s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;, score=0.819 total time=
0.5s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;, score=0.817 total time=
0.6s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;, score=0.845 total time=
0.6s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;, score=0.847 total time=
0.9s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;, score=0.884 total time=
0.9s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;, score=0.897 total time=
1.2s
[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;, score=0.440 total
time=   1.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;, score=0.436 total
time=   1.0s
[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;, score=0.437 total
time=   0.9s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;, score=0.695 total time=
1.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;, score=0.644 total time=
1.0s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;, score=0.664 total time=
0.9s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;, score=0.088 total time=
1.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;, score=0.114 total time=
1.1s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;, score=0.104 total time=
```

```
1.2s
[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;, score=0.566 total
time=   0.7s
[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;, score=0.519 total
time=   0.7s
[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;, score=0.551 total
time=   0.7s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;, score=0.443 total time=
1.3s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;, score=0.446 total time=
1.3s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;, score=0.452 total time=
1.3s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;, score=0.819 total
time=   0.5s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;, score=0.817 total
time=   0.6s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;, score=0.845 total
time=   0.5s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.0s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;, score=0.076 total time=
1.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;, score=0.267 total
time=   1.0s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;, score=0.299 total
time=   1.1s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;, score=0.291 total
time=   1.0s

 GridSearchCV(cv=3, estimator=SVC(random_state=42),
              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_)
best_svm.fit(train_features, train_labels_encoded)

y_pred_svm = best_svm.predict(test_features)

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

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

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

7 Predict on test images for KNN

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

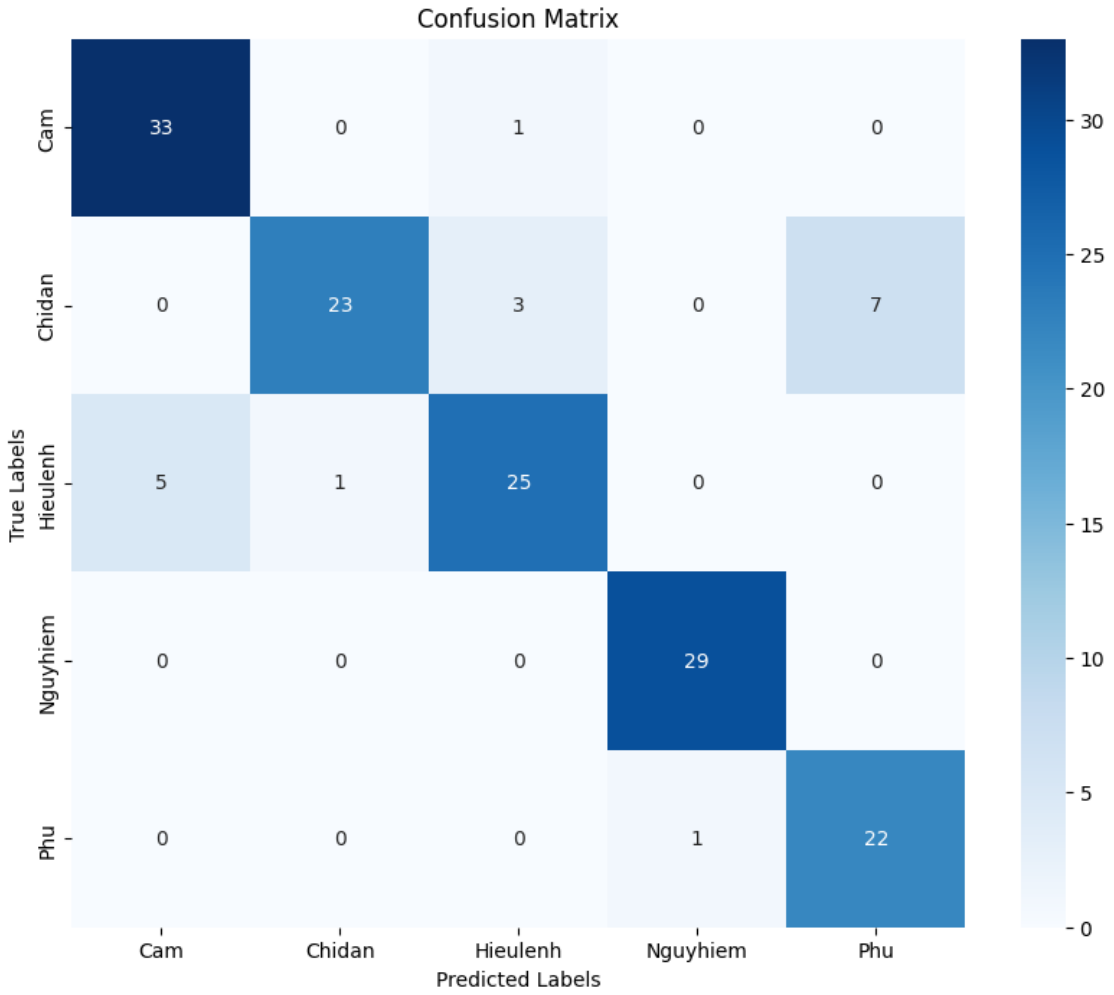
```
              precision    recall  f1-score   support

         Cam       0.87      0.97      0.92        34
      Chidan       0.96      0.70      0.81        33
    Hieulenh       0.86      0.81      0.83        31
    Nguyhiem       0.97      1.00      0.98        29
         Phu       0.76      0.96      0.85        23

    accuracy                           0.88       150
   macro avg       0.88      0.89      0.88       150
weighted avg       0.89      0.88      0.88       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()
```

8 Predict on test images for SVM

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

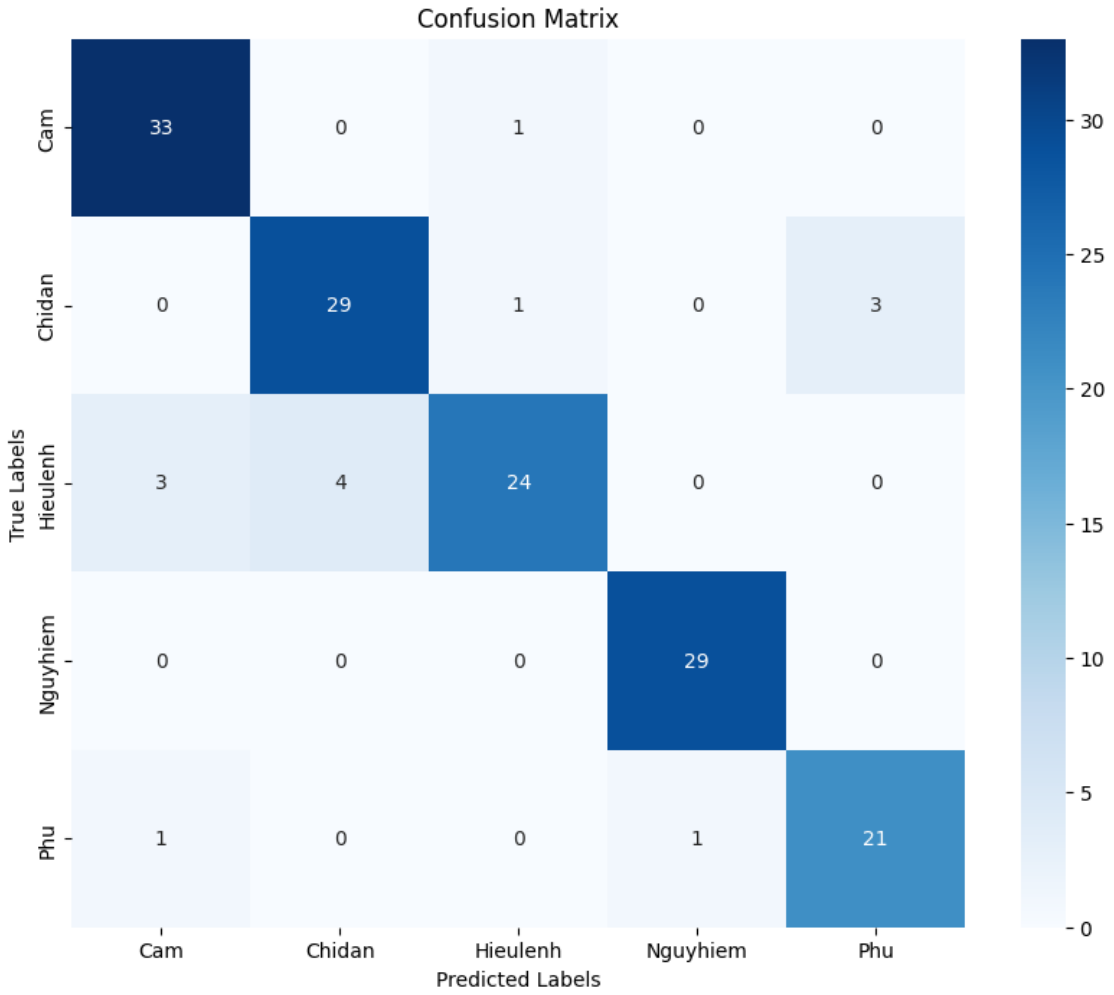
```
              precision    recall  f1-score   support

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

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

```
heatmap_label_svm = confusion_matrix(test_labels_encoded, y_pred_svm)

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




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

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

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

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

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

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

9 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)
```

```
Đã xuất file PDF thành công: d:\ASUS\Deploy-Traffic-Sign-Classification-through-Images\grid_search_results\notebook_export_2024-11-19_22_46_59.pdf
```

```
'd:\\ASUS\\Deploy-Traffic-Sign-Classification-through-
Images\\grid_search_results\\notebook_export_2024-11-19_22_46_59.pdf'
```