

Notebook

December 9, 2024

1 Import libraries

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

2 Load data

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

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

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

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

```

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

train_images = []
test_images = []

train_labels = []
test_labels = []

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

```

```

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

```

```

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

```

```

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

```

```

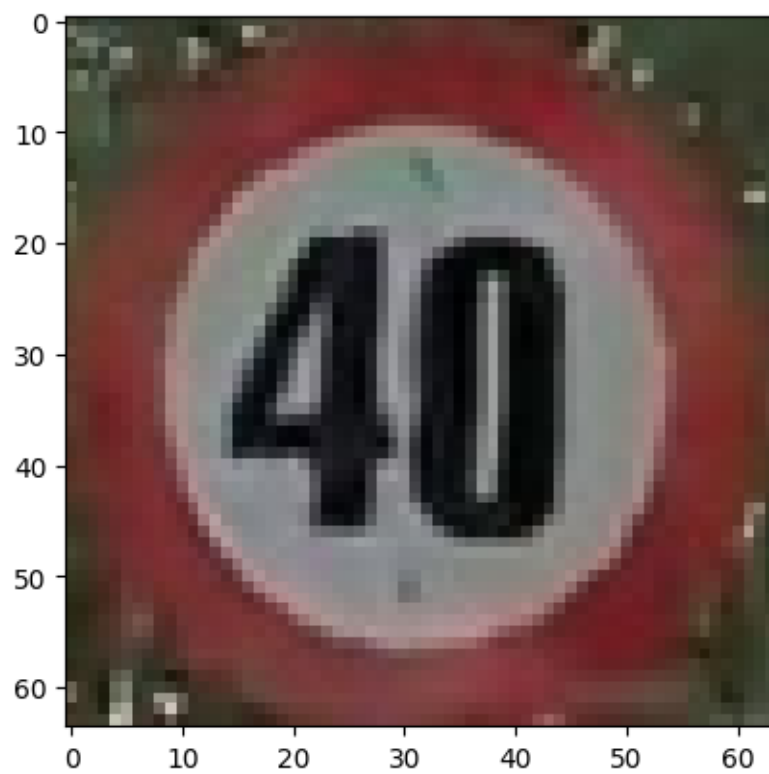
<>:4: SyntaxWarning: invalid escape sequence '\j'
<>:5: SyntaxWarning: invalid escape sequence '\j'
<>:1: SyntaxWarning: invalid escape sequence '\j'
<>:2: SyntaxWarning: invalid escape sequence '\j'
<>:3: SyntaxWarning: invalid escape sequence '\j'
<>:4: SyntaxWarning: invalid escape sequence '\j'
<>:5: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\2963388047.py:1:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(train_images, project_dir + '\joblib\\train_images.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\2963388047.py:2:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(test_images, project_dir + '\joblib\\test_images.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\2963388047.py:3:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(train_labels_encoded, project_dir +
'\joblib\\train_labels_encoded.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\2963388047.py:4:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(test_labels_encoded, project_dir +
'\joblib\\test_labels_encoded.joblib')
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\2963388047.py:5:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(label_encoder, project_dir + '\joblib\\label_encoder.joblib')

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

```

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

```
<matplotlib.image.AxesImage at 0x1bf91eb9460>
```



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

<matplotlib.image.AxesImage at 0x1bf948273b0>



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="Blur
    ↪Images")]
    color_features = [color_histogram(image) for image in tqdm(blurred_images,
    ↪desc="Extracting Color Features")]
    hog_features = [hog(image) for image in tqdm(blurred_images,
    ↪desc="Extracting HOG Features")]
    combined_features = [np.concatenate((color_feature, hog_feature))
    ↪for color_feature, hog_feature in
    ↪tqdm(zip(color_features, hog_features), desc="Combining Features")]

    return combined_features

```

```

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

```

```

<>:2: SyntaxWarning: invalid escape sequence '\j'
<>:2: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\3158454822.py:2:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(train_features, project_dir + '\joblib\\train_features.joblib')
Blur Images: 100%|      | 1415/1415 [00:00<00:00, 4220.77it/s]
Extracting Color Features: 100%|      | 1415/1415 [00:00<00:00,
30420.15it/s]
Extracting HOG Features: 100%|      | 1415/1415 [00:02<00:00, 655.87it/s]
Combining Features: 1415it [00:00, 78611.60it/s]

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

```

```

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

```

```

<>:2: SyntaxWarning: invalid escape sequence '\j'
<>:2: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\1121528714.py:2:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(test_features, project_dir + '\joblib\\test_features.joblib')
Blur Images: 100%|      | 150/150 [00:00<00:00, 3191.49it/s]
Extracting Color Features: 100%|      | 150/150 [00:00<00:00, 21429.39it/s]
Extracting HOG Features: 100%|      | 150/150 [00:00<00:00, 584.68it/s]
Combining Features: 150it [00:00, 75032.27it/s]

```

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

4 Distance metrics KNN

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

5 Load Best Model

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

6 Gridsearch KNN

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

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

```
knn_model = KNeighborsClassifier()
```

```

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

grid_search_knn.fit(train_features, train_labels_encoded)

```

```

Fitting 3 folds for each of 72 candidates, totalling 216 fits
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=3,
weights=uniform;; score=0.857 total time= 2.8s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=3,
weights=uniform;; score=0.814 total time= 2.5s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=3,
weights=uniform;; score=0.830 total time= 2.5s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=3,
weights=distance;; score=0.858 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=3,
weights=distance;; score=0.816 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=3,
weights=distance;; score=0.850 total time= 2.4s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=4,
weights=uniform;; score=0.839 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=4,
weights=uniform;; score=0.788 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=4,
weights=uniform;; score=0.795 total time= 2.4s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=4,
weights=distance;; score=0.877 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=4,
weights=distance;; score=0.825 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=4,
weights=distance;; score=0.830 total time= 2.5s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=5,
weights=uniform;; score=0.838 total time= 2.5s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=5,
weights=uniform;; score=0.787 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=5,
weights=uniform;; score=0.808 total time= 2.5s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=5,
weights=distance;; score=0.854 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=5,
weights=distance;; score=0.808 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=5,
weights=distance;; score=0.831 total time= 2.4s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=6,

```



```

weights=uniform;; score=0.826 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=6,
weights=uniform;; score=0.788 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=6,
weights=uniform;; score=0.799 total time= 2.4s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=6,
weights=distance;; score=0.862 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=6,
weights=distance;; score=0.799 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=6,
weights=distance;; score=0.824 total time= 2.4s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=7,
weights=uniform;; score=0.847 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=7,
weights=uniform;; score=0.783 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=7,
weights=uniform;; score=0.778 total time= 2.4s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=7,
weights=distance;; score=0.855 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=7,
weights=distance;; score=0.795 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=7,
weights=distance;; score=0.809 total time= 2.4s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=10,
weights=uniform;; score=0.823 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=10,
weights=uniform;; score=0.766 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=10,
weights=uniform;; score=0.746 total time= 2.5s
[CV 1/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=10,
weights=distance;; score=0.861 total time= 2.4s
[CV 2/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=10,
weights=distance;; score=0.791 total time= 2.4s
[CV 3/3] END metric=<function cityblock at 0x000001BF90038040>, n_neighbors=10,
weights=distance;; score=0.787 total time= 2.5s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=3,
weights=uniform;; score=0.853 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=3,
weights=uniform;; score=0.785 total time= 3.6s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=3,
weights=uniform;; score=0.779 total time= 3.6s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=3,
weights=distance;; score=0.864 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=3,
weights=distance;; score=0.807 total time= 3.5s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=3,
weights=distance;; score=0.797 total time= 3.5s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=4,

```

```

weights=uniform;; score=0.817 total time= 3.4s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=4,
weights=uniform;; score=0.749 total time= 3.5s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=4,
weights=uniform;; score=0.766 total time= 3.9s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=4,
weights=distance;; score=0.858 total time= 3.6s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=4,
weights=distance;; score=0.804 total time= 3.4s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=4,
weights=distance;; score=0.800 total time= 3.4s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=5,
weights=uniform;; score=0.824 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=5,
weights=uniform;; score=0.776 total time= 3.6s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=5,
weights=uniform;; score=0.769 total time= 3.7s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=5,
weights=distance;; score=0.854 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=5,
weights=distance;; score=0.803 total time= 3.4s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=5,
weights=distance;; score=0.797 total time= 3.5s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=6,
weights=uniform;; score=0.809 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=6,
weights=uniform;; score=0.759 total time= 3.5s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=6,
weights=uniform;; score=0.753 total time= 3.5s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=6,
weights=distance;; score=0.872 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=6,
weights=distance;; score=0.798 total time= 3.4s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=6,
weights=distance;; score=0.790 total time= 3.5s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=7,
weights=uniform;; score=0.813 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=7,
weights=uniform;; score=0.755 total time= 3.5s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=7,
weights=uniform;; score=0.757 total time= 3.4s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=7,
weights=distance;; score=0.846 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=7,
weights=distance;; score=0.789 total time= 3.5s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=7,
weights=distance;; score=0.773 total time= 3.4s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=10,

```

```

weights=uniform;; score=0.802 total time= 3.5s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=10,
weights=uniform;; score=0.758 total time= 3.5s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=10,
weights=uniform;; score=0.733 total time= 3.4s
[CV 1/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=10,
weights=distance;; score=0.836 total time= 3.4s
[CV 2/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=10,
weights=distance;; score=0.776 total time= 3.4s
[CV 3/3] END metric=<function cosine at 0x000001BF9000FCE0>, n_neighbors=10,
weights=distance;; score=0.761 total time= 3.6s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=3,
weights=uniform;; score=0.848 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=3,
weights=uniform;; score=0.782 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=3,
weights=uniform;; score=0.774 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=3,
weights=distance;; score=0.858 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=3,
weights=distance;; score=0.802 total time= 2.3s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=3,
weights=distance;; score=0.793 total time= 2.3s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=4,
weights=uniform;; score=0.812 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=4,
weights=uniform;; score=0.752 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=4,
weights=uniform;; score=0.763 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=4,
weights=distance;; score=0.856 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=4,
weights=distance;; score=0.797 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=4,
weights=distance;; score=0.798 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=5,
weights=uniform;; score=0.824 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=5,
weights=uniform;; score=0.773 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=5,
weights=uniform;; score=0.767 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=5,
weights=distance;; score=0.850 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=5,
weights=distance;; score=0.791 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=5,
weights=distance;; score=0.792 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=6,

```

```

weights=uniform;; score=0.814 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=6,
weights=uniform;; score=0.759 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=6,
weights=uniform;; score=0.767 total time= 2.3s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=6,
weights=distance;; score=0.864 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=6,
weights=distance;; score=0.798 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=6,
weights=distance;; score=0.794 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=7,
weights=uniform;; score=0.824 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=7,
weights=uniform;; score=0.757 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=7,
weights=uniform;; score=0.754 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=7,
weights=distance;; score=0.843 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=7,
weights=distance;; score=0.789 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>, n_neighbors=7,
weights=distance;; score=0.773 total time= 2.3s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>,
n_neighbors=10, weights=uniform;; score=0.803 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>,
n_neighbors=10, weights=uniform;; score=0.747 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>,
n_neighbors=10, weights=uniform;; score=0.737 total time= 2.2s
[CV 1/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>,
n_neighbors=10, weights=distance;; score=0.836 total time= 2.2s
[CV 2/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>,
n_neighbors=10, weights=distance;; score=0.767 total time= 2.2s
[CV 3/3] END metric=<function sqeuclidean at 0x000001BF9000FBA0>,
n_neighbors=10, weights=distance;; score=0.767 total time= 2.2s
[CV 1/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
n_neighbors=3, weights=uniform;; score=0.716 total time= 2.9s
[CV 2/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
n_neighbors=3, weights=uniform;; score=0.713 total time= 2.9s
[CV 3/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
n_neighbors=3, weights=uniform;; score=0.678 total time= 2.9s
[CV 1/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
n_neighbors=3, weights=distance;; score=0.728 total time= 2.9s
[CV 2/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
n_neighbors=3, weights=distance;; score=0.720 total time= 2.9s
[CV 3/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
n_neighbors=3, weights=distance;; score=0.692 total time= 2.9s
[CV 1/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,

```


n_neighbors=10, weights=uniform;; score=0.684 total time= 2.9s
 [CV 2/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
 n_neighbors=10, weights=uniform;; score=0.697 total time= 2.9s
 [CV 3/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
 n_neighbors=10, weights=uniform;; score=0.678 total time= 2.9s
 [CV 1/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
 n_neighbors=10, weights=distance;; score=0.725 total time= 2.9s
 [CV 2/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
 n_neighbors=10, weights=distance;; score=0.712 total time= 2.9s
 [CV 3/3] END metric=<function chi_square_distance at 0x000001BF969D0CC0>,
 n_neighbors=10, weights=distance;; score=0.716 total time= 2.9s
 [CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=3, weights=uniform;; score=0.827 total time= 2.9s
 [CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=3, weights=uniform;; score=0.741 total time= 3.0s
 [CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=3, weights=uniform;; score=0.731 total time= 3.0s
 [CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=3, weights=distance;; score=0.846 total time= 3.0s
 [CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=3, weights=distance;; score=0.749 total time= 3.0s
 [CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=3, weights=distance;; score=0.750 total time= 2.9s
 [CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=4, weights=uniform;; score=0.797 total time= 3.0s
 [CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=4, weights=uniform;; score=0.719 total time= 3.0s
 [CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=4, weights=uniform;; score=0.719 total time= 3.0s
 [CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=4, weights=distance;; score=0.850 total time= 3.0s
 [CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=4, weights=distance;; score=0.762 total time= 2.9s
 [CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=4, weights=distance;; score=0.744 total time= 3.0s
 [CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=5, weights=uniform;; score=0.826 total time= 2.9s
 [CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=5, weights=uniform;; score=0.715 total time= 2.9s
 [CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=5, weights=uniform;; score=0.713 total time= 3.0s
 [CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=5, weights=distance;; score=0.837 total time= 3.0s
 [CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=5, weights=distance;; score=0.739 total time= 2.9s
 [CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
 n_neighbors=5, weights=distance;; score=0.734 total time= 2.9s
 [CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,

```

n_neighbors=6, weights=uniform;; score=0.812 total time= 3.0s
[CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=6, weights=uniform;; score=0.707 total time= 3.0s
[CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=6, weights=uniform;; score=0.731 total time= 3.0s
[CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=6, weights=distance;; score=0.832 total time= 3.0s
[CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=6, weights=distance;; score=0.743 total time= 3.0s
[CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=6, weights=distance;; score=0.741 total time= 3.0s
[CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=7, weights=uniform;; score=0.812 total time= 3.0s
[CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=7, weights=uniform;; score=0.719 total time= 3.0s
[CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=7, weights=uniform;; score=0.718 total time= 3.0s
[CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=7, weights=distance;; score=0.822 total time= 3.0s
[CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=7, weights=distance;; score=0.729 total time= 3.0s
[CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=7, weights=distance;; score=0.724 total time= 3.0s
[CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=10, weights=uniform;; score=0.796 total time= 3.0s
[CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=10, weights=uniform;; score=0.713 total time= 3.0s
[CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=10, weights=uniform;; score=0.717 total time= 3.0s
[CV 1/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=10, weights=distance;; score=0.823 total time= 3.0s
[CV 2/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=10, weights=distance;; score=0.743 total time= 3.0s
[CV 3/3] END metric=<function bhattacharyya_distance at 0x000001BF969D11C0>,
n_neighbors=10, weights=distance;; score=0.721 total time= 3.0s
[CV 1/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=3, weights=uniform;; score=0.779 total time= 2.2s
[CV 2/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=3, weights=uniform;; score=0.664 total time= 2.2s
[CV 3/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=3, weights=uniform;; score=0.678 total time= 2.2s
[CV 1/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=3, weights=distance;; score=0.076 total time= 2.2s
[CV 2/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=3, weights=distance;; score=0.076 total time= 2.2s
[CV 3/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=3, weights=distance;; score=0.076 total time= 2.2s
[CV 1/3] END metric=<function intersection_distance at 0x000001BF969D1940>,

```

[illegible]


```

n_neighbors=10, weights=uniform;; score=0.732 total time= 2.2s
[CV 2/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=10, weights=uniform;; score=0.656 total time= 2.2s
[CV 3/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=10, weights=uniform;; score=0.662 total time= 2.2s
[CV 1/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=10, weights=distance;; score=0.076 total time= 2.2s
[CV 2/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=10, weights=distance;; score=0.076 total time= 2.2s
[CV 3/3] END metric=<function intersection_distance at 0x000001BF969D1940>,
n_neighbors=10, weights=distance;; score=0.076 total time= 2.2s

GridSearchCV(cv=3, estimator=KNeighborsClassifier(),
             param_grid={'metric': [<function cityblock at 0x000001BF90038040>,
                                     <function cosine at 0x000001BF9000FCE0>,
                                     <function sqeuclidean at
0x000001BF9000FBA0>,
                                     <function chi_square_distance at
0x000001BF969D0CC0>,
                                     <function bhattacharyya_distance at
0x000001BF969D11C0>,
                                     <function intersection_distance at
0x000001BF969D1940>],
                         'n_neighbors': [3, 4, 5, 6, 7, 10],
                         'weights': ['uniform', 'distance']},
             scoring='f1_macro', verbose=3)

```

```

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

print(f"Thuật toán sử dụng: {best_knn.algorithm}")

y_pred_knn = best_knn.predict(test_features)

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

```

```

Best Params: {'metric': <function cityblock at 0x000001BF90038040>,
'n_neighbors': 4, 'weights': 'distance'}
Thuật toán sử dụng: auto

```

```

<>:8: SyntaxWarning: invalid escape sequence '\j'
<>:8: SyntaxWarning: invalid escape sequence '\j'
C:\Users\Legion 5 Pro\AppData\Local\Temp\ipykernel_15248\1882519064.py:8:
SyntaxWarning: invalid escape sequence '\j'
    joblib.dump(best_knn, project_dir + '\\joblib\\best_knn_model.joblib')

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

```

7 Gridsearch SVM

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

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

svm_model = SVC()

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

grid_search_svm.fit(train_features, train_labels_encoded)
```

Fitting 3 folds for each of 240 candidates, totalling 720 fits

```
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;; score=0.521 total time=
0.5s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;; score=0.538 total time=
0.6s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=rbf;; score=0.517 total time=
0.5s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=linear;; score=0.840 total
time= 0.1s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=linear;; score=0.805 total
time= 0.1s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=linear;; score=0.798 total
time= 0.1s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=poly;; score=0.755 total time=
0.2s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=poly;; score=0.734 total time=
0.2s
[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=poly;; score=0.660 total time=
0.2s
[CV 1/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;; score=0.512 total
time= 0.3s
[CV 2/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;; score=0.503 total
time= 0.3s
```

[CV 3/3] END C=0.1, degree=2, gamma=scale, kernel=sigmoid;; score=0.497 total time= 0.3s

[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;; score=0.076 total time= 0.7s

[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;; score=0.392 total time= 0.6s

[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;; score=0.420 total time= 0.7s

[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=rbf;; score=0.372 total time= 0.6s

[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;; score=0.881 total time= 0.2s

[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;; score=0.852 total time= 0.2s

[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=poly;; score=0.818 total time= 0.1s

[CV 1/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;; score=0.325 total time= 0.4s

[CV 2/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;; score=0.313 total time= 0.5s

[CV 3/3] END C=0.1, degree=2, gamma=0.1, kernel=sigmoid;; score=0.308 total time= 0.5s

[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;; score=0.475 total time= 0.6s

[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;; score=0.513 total time= 0.6s

[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=rbf;; score=0.487 total time= 0.5s

[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;; score=0.445 total time= 0.4s

[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;; score=0.460 total time= 0.4s

[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=poly;; score=0.429 total time= 0.4s

[CV 1/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;; score=0.447 total time= 0.3s

[CV 2/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;; score=0.469 total time= 0.4s

[CV 3/3] END C=0.1, degree=2, gamma=0.01, kernel=sigmoid;; score=0.452 total time= 0.4s

[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.6s

[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.6s

[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=2, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;; score=0.521 total time= 0.5s

[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;; score=0.538 total time= 0.5s

[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=rbf;; score=0.517 total time= 0.5s

[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=poly;; score=0.804 total time= 0.2s

[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=poly;; score=0.778 total time= 0.2s

[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=poly;; score=0.709 total time= 0.2s

[CV 1/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;; score=0.512 total time= 0.3s

[CV 2/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;; score=0.503 total time= 0.3s

[CV 3/3] END C=0.1, degree=3, gamma=scale, kernel=sigmoid;; score=0.497 total time= 0.3s

[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;; score=0.392 total time= 0.7s

[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;; score=0.420 total time= 0.7s

[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=rbf;; score=0.372 total time= 0.7s

[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;; score=0.883 total time= 0.3s

[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;; score=0.865 total time= 0.3s

[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=poly;; score=0.823 total time= 0.2s

[CV 1/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;; score=0.325 total time= 0.4s

[CV 2/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;; score=0.313 total time= 0.4s

[CV 3/3] END C=0.1, degree=3, gamma=0.1, kernel=sigmoid;; score=0.308 total time= 0.5s

[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;; score=0.475 total time= 0.6s

[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;; score=0.513 total time= 0.6s

[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=rbf;; score=0.487 total time= 0.6s

[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=linear;; score=0.798 total time= 0.2s

[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;; score=0.076 total time= 0.5s

[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;; score=0.076 total time= 0.5s

[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=poly;; score=0.076 total time= 0.5s

[CV 1/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;; score=0.447 total time= 0.5s

[CV 2/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;; score=0.469 total time= 0.4s

[CV 3/3] END C=0.1, degree=3, gamma=0.01, kernel=sigmoid;; score=0.452 total time= 0.4s
 [CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.7s
 [CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.7s
 [CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.8s
 [CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;; score=0.840 total time= 0.1s
 [CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;; score=0.805 total time= 0.1s
 [CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=linear;; score=0.798 total time= 0.2s
 [CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s
 [CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s
 [CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.5s
 [CV 1/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.5s
 [CV 2/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.5s
 [CV 3/3] END C=0.1, degree=3, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.5s
 [CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;; score=0.521 total time= 0.6s
 [CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;; score=0.538 total time= 0.6s
 [CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=rbf;; score=0.517 total time= 0.5s
 [CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=linear;; score=0.840 total time= 0.1s
 [CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=linear;; score=0.805 total time= 0.1s
 [CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=linear;; score=0.798 total time= 0.1s
 [CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=poly;; score=0.834 total time= 0.2s
 [CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=poly;; score=0.814 total time= 0.2s
 [CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=poly;; score=0.751 total time= 0.3s
 [CV 1/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;; score=0.512 total time= 0.3s
 [CV 2/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;; score=0.503 total time= 0.3s

[CV 3/3] END C=0.1, degree=4, gamma=scale, kernel=sigmoid;; score=0.497 total time= 0.3s

[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=rbf;; score=0.076 total time= 0.7s

[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;; score=0.392 total time= 0.6s

[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;; score=0.420 total time= 0.7s

[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=rbf;; score=0.372 total time= 0.6s

[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;; score=0.873 total time= 0.3s

[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;; score=0.854 total time= 0.3s

[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=poly;; score=0.825 total time= 0.3s

[CV 1/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;; score=0.325 total time= 0.5s

[CV 2/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;; score=0.313 total time= 0.5s

[CV 3/3] END C=0.1, degree=4, gamma=0.1, kernel=sigmoid;; score=0.308 total time= 0.5s

[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;; score=0.475 total time= 0.5s

[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;; score=0.513 total time= 0.5s

[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=rbf;; score=0.487 total time= 0.5s

[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;; score=0.447 total time= 0.3s

[CV 2/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;; score=0.469 total time= 0.3s

[CV 3/3] END C=0.1, degree=4, gamma=0.01, kernel=sigmoid;; score=0.452 total time= 0.3s

[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.6s

[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=rbf;; score=0.076 total time= 0.7s

[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;; score=0.840 total time= 0.1s

[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;; score=0.805 total time= 0.1s

[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=linear;; score=0.798 total time= 0.1s

[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.1, degree=4, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;; score=0.610 total time= 0.5s

[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;; score=0.585 total time= 0.5s

[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=rbf;; score=0.584 total time= 0.5s

[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=poly;; score=0.806 total time= 0.2s

[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=poly;; score=0.786 total time= 0.2s

[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=poly;; score=0.735 total time= 0.2s

[CV 1/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;; score=0.542 total time= 0.3s

[CV 2/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;; score=0.527 total time= 0.2s

[CV 3/3] END C=0.2, degree=2, gamma=scale, kernel=sigmoid;; score=0.540 total time= 0.2s

[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;; score=0.417 total time= 0.6s

[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;; score=0.440 total time= 0.6s

[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=rbf;; score=0.382 total time= 0.6s

[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;; score=0.887 total time= 0.2s

[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;; score=0.848 total time= 0.2s

[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=poly;; score=0.825 total time= 0.2s

[CV 1/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;; score=0.420 total time= 0.4s

[CV 2/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;; score=0.432 total time= 0.4s

[CV 3/3] END C=0.2, degree=2, gamma=0.1, kernel=sigmoid;; score=0.435 total time= 0.4s

[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;; score=0.558 total time= 0.5s

[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;; score=0.547 total time= 0.5s

[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=rbf;; score=0.537 total time= 0.5s

[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;; score=0.455 total time= 0.3s

[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;; score=0.489 total time= 0.3s

[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=poly;; score=0.472 total time= 0.3s

[CV 1/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;; score=0.533 total time= 0.3s

[CV 2/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;; score=0.519 total time= 0.3s

[CV 3/3] END C=0.2, degree=2, gamma=0.01, kernel=sigmoid;; score=0.516 total time= 0.3s

[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;; score=0.384 total time= 0.6s

[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;; score=0.391 total time= 0.6s

[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=rbf;; score=0.372 total time= 0.6s

[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=2, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;; score=0.610 total time= 0.5s

[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;; score=0.585 total time= 0.5s

[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=rbf;; score=0.584 total time= 0.5s

[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=poly;; score=0.848 total time= 0.2s

[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=poly;; score=0.834 total time= 0.2s

[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=poly;; score=0.774 total time= 0.2s

[CV 1/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;; score=0.542 total time= 0.2s

[CV 2/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;; score=0.527 total time= 0.3s

[CV 3/3] END C=0.2, degree=3, gamma=scale, kernel=sigmoid;; score=0.540 total time= 0.3s

[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;; score=0.417 total time= 0.6s

[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;; score=0.440 total time= 0.6s

[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=rbf;; score=0.382 total time= 0.6s

[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;; score=0.883 total time= 0.2s

[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;; score=0.865 total time= 0.2s

[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=poly;; score=0.823 total time= 0.2s

[CV 1/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;; score=0.420 total time= 0.4s

[CV 2/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;; score=0.432 total time= 0.4s

[CV 3/3] END C=0.2, degree=3, gamma=0.1, kernel=sigmoid;; score=0.435 total time= 0.4s

[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;; score=0.558 total time= 0.5s

[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;; score=0.547 total time= 0.5s

[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=rbf;; score=0.537 total time= 0.5s

[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;; score=0.419 total time= 0.4s

[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;; score=0.428 total time= 0.4s

[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=poly;; score=0.399 total time= 0.4s

[CV 1/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;; score=0.533 total time= 0.3s

[CV 2/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;; score=0.519 total time= 0.3s

[CV 3/3] END C=0.2, degree=3, gamma=0.01, kernel=sigmoid;; score=0.516 total time= 0.3s

[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;; score=0.384 total time= 0.6s

[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;; score=0.391 total time= 0.6s

[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=rbf;; score=0.372 total time= 0.6s

[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=3, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;; score=0.610 total time= 0.5s

[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;; score=0.585 total time= 0.5s

[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=rbf;; score=0.584 total time= 0.5s

[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=poly;; score=0.873 total time= 0.2s

[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=poly;; score=0.841 total time= 0.3s

[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=poly;; score=0.822 total time= 0.2s

[CV 1/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;; score=0.542 total time= 0.2s

[CV 2/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;; score=0.527 total time= 0.3s

[CV 3/3] END C=0.2, degree=4, gamma=scale, kernel=sigmoid;; score=0.540 total time= 0.2s

[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=rbf;; score=0.076 total time= 0.6s

[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;; score=0.417 total time= 0.6s

[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;; score=0.440 total time= 0.6s

[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=rbf;; score=0.382 total time= 0.6s

[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=poly;; score=0.873 total time= 0.3s

[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=poly;; score=0.854 total time= 0.3s

[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=poly;; score=0.825 total time= 0.3s

[CV 1/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;; score=0.420 total time= 0.4s

[CV 2/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;; score=0.432 total time= 0.4s

[CV 3/3] END C=0.2, degree=4, gamma=0.1, kernel=sigmoid;; score=0.435 total time= 0.4s

[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=rbf;; score=0.558 total time= 0.5s

[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=rbf;; score=0.547 total time= 0.5s

[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=rbf;; score=0.537 total time= 0.5s

[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=4, gamma=0.01, kernel=sigmoid;; score=0.533 total time= 0.3s

[CV 2/3] END C=0.2, degree=4, gamma=0.01, kernel=sigmoid;; score=0.519 total time= 0.3s

[CV 3/3] END C=0.2, degree=4, gamma=0.01, kernel=sigmoid;; score=0.516 total time= 0.3s

[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=rbf;; score=0.384 total time= 0.6s

[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=rbf;; score=0.391 total time= 0.6s

[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=rbf;; score=0.372 total time= 0.6s

[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;; score=0.853 total time= 0.1s

[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=linear;; score=0.802 total time= 0.1s

[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.2, degree=4, gamma=0.001, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=rbf;; score=0.743 total time= 0.5s

[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=rbf;; score=0.714 total time= 0.5s

[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=rbf;; score=0.668 total time= 0.4s

[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=poly;; score=0.836 total time= 0.2s

[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=poly;; score=0.811 total time= 0.2s

[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=poly;; score=0.763 total time= 0.2s

[CV 1/3] END C=0.3, degree=2, gamma=scale, kernel=sigmoid;; score=0.588 total time= 0.2s

[CV 2/3] END C=0.3, degree=2, gamma=scale, kernel=sigmoid;; score=0.607 total time= 0.2s

[CV 3/3] END C=0.3, degree=2, gamma=scale, kernel=sigmoid;; score=0.604 total time= 0.2s

[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=rbf;; score=0.347 total time= 0.6s

[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=rbf;; score=0.318 total time= 0.6s

[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=rbf;; score=0.267 total time= 0.7s

[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=rbf;; score=0.450 total time= 0.6s

[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=rbf;; score=0.465 total time= 0.6s

[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=rbf;; score=0.420 total time= 0.6s

[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;; score=0.887 total time= 0.2s

[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;; score=0.846 total time= 0.2s

[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=poly;; score=0.818 total time= 0.2s

[CV 1/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;; score=0.432 total time= 0.4s

[CV 2/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;; score=0.446 total time= 0.4s

[CV 3/3] END C=0.3, degree=2, gamma=0.1, kernel=sigmoid;; score=0.453 total time= 0.4s

[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;; score=0.593 total time= 0.4s

[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;; score=0.604 total time= 0.4s

[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=rbf;; score=0.574 total time= 0.4s

[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;; score=0.531 total time= 0.3s

[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;; score=0.533 total time= 0.3s

[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=poly;; score=0.518 total time= 0.3s

[CV 1/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;; score=0.553 total time= 0.2s

[CV 2/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;; score=0.531 total time= 0.2s

[CV 3/3] END C=0.3, degree=2, gamma=0.01, kernel=sigmoid;; score=0.535 total time= 0.2s

[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;; score=0.442 total time= 0.6s

[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;; score=0.462 total time= 0.6s

[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=rbf;; score=0.443 total time= 0.6s

[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;; score=0.323 total time= 0.4s

[CV 2/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;; score=0.286 total time= 0.4s

[CV 3/3] END C=0.3, degree=2, gamma=0.001, kernel=sigmoid;; score=0.247 total time= 0.4s

[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;; score=0.743 total time= 0.5s

[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;; score=0.714 total time= 0.4s

[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=rbf;; score=0.668 total time= 0.4s

[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=poly;; score=0.868 total time= 0.2s

[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=poly;; score=0.854 total time= 0.2s

[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=poly;; score=0.806 total time= 0.2s

[CV 1/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;; score=0.588 total time= 0.2s

[CV 2/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;; score=0.607 total time= 0.3s

[CV 3/3] END C=0.3, degree=3, gamma=scale, kernel=sigmoid;; score=0.604 total time= 0.2s

[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;; score=0.347 total time= 0.7s

[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;; score=0.318 total time= 0.6s

[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=rbf;; score=0.267 total time= 0.6s

[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;; score=0.450 total time= 0.6s

[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;; score=0.465 total time= 0.6s

[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=rbf;; score=0.420 total time= 0.6s

[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;; score=0.883 total time= 0.2s

[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;; score=0.865 total time= 0.2s

[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=poly;; score=0.823 total time= 0.2s

[CV 1/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;; score=0.432 total time= 0.4s

[CV 2/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;; score=0.446 total time= 0.4s

[CV 3/3] END C=0.3, degree=3, gamma=0.1, kernel=sigmoid;; score=0.453 total time= 0.4s

[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;; score=0.593 total time= 0.4s

[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;; score=0.604 total time= 0.5s

[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=rbf;; score=0.574 total time= 0.5s

[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;; score=0.448 total time= 0.4s

[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;; score=0.465 total time= 0.4s

[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=poly;; score=0.425 total time= 0.4s

[CV 1/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;; score=0.553 total time= 0.2s

[CV 2/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;; score=0.531 total time= 0.2s

[CV 3/3] END C=0.3, degree=3, gamma=0.01, kernel=sigmoid;; score=0.535 total time= 0.3s

[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;; score=0.442 total time= 0.6s

[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;; score=0.462 total time= 0.6s

[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=rbf;; score=0.443 total time= 0.6s

[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;; score=0.323 total time= 0.4s

[CV 2/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;; score=0.286 total time= 0.4s

[CV 3/3] END C=0.3, degree=3, gamma=0.001, kernel=sigmoid;; score=0.247 total time= 0.4s

[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;; score=0.743 total time= 0.4s

[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;; score=0.714 total time= 0.5s

[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=rbf;; score=0.668 total time= 0.4s

[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=poly;; score=0.871 total time= 0.2s

[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=poly;; score=0.854 total time= 0.3s

[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=poly;; score=0.827 total time= 0.3s

[CV 1/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;; score=0.588 total time= 0.2s

[CV 2/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;; score=0.607 total time= 0.2s

[CV 3/3] END C=0.3, degree=4, gamma=scale, kernel=sigmoid;; score=0.604 total time= 0.2s

[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;; score=0.347 total time= 0.6s

[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;; score=0.318 total time= 0.6s

[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=rbf;; score=0.267 total time= 0.6s

[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.5s

[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;; score=0.450 total time= 0.6s

[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;; score=0.465 total time= 0.6s

[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=rbf;; score=0.420 total time= 0.6s

[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;; score=0.873 total time= 0.2s

[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;; score=0.854 total time= 0.3s

[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=poly;; score=0.825 total time= 0.3s

[CV 1/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;; score=0.432 total time= 0.4s

[CV 2/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;; score=0.446 total time= 0.4s

[CV 3/3] END C=0.3, degree=4, gamma=0.1, kernel=sigmoid;; score=0.453 total time= 0.4s

[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;; score=0.593 total time= 0.4s

[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;; score=0.604 total time= 0.5s

[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=rbf;; score=0.574 total time= 0.6s

[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;; score=0.112 total time= 0.5s

[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=poly;; score=0.121 total time= 0.5s

[CV 1/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;; score=0.553 total time= 0.3s

[CV 2/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;; score=0.531 total time= 0.3s

[CV 3/3] END C=0.3, degree=4, gamma=0.01, kernel=sigmoid;; score=0.535 total time= 0.3s

[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;; score=0.442 total time= 0.7s

[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;; score=0.462 total time= 0.7s

[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=rbf;; score=0.443 total time= 0.7s

[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;; score=0.323 total time= 0.4s

[CV 2/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;; score=0.286 total time= 0.4s

[CV 3/3] END C=0.3, degree=4, gamma=0.001, kernel=sigmoid;; score=0.247 total time= 0.5s

[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;; score=0.787 total time= 0.5s

[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;; score=0.769 total time= 0.4s

[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=rbf;; score=0.697 total time= 0.4s

[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=poly;; score=0.849 total time= 0.2s

[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=poly;; score=0.832 total time= 0.2s

[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=poly;; score=0.781 total time= 0.1s

[CV 1/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;; score=0.664 total time= 0.2s

[CV 2/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;; score=0.681 total time= 0.2s

[CV 3/3] END C=0.4, degree=2, gamma=scale, kernel=sigmoid;; score=0.643 total time= 0.2s

[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=rbf;; score=0.408 total time= 0.6s

[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=rbf;; score=0.417 total time= 0.6s

[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=rbf;; score=0.405 total time= 0.6s

[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=2, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;; score=0.474 total time= 0.6s

[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;; score=0.498 total time= 0.6s

[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=rbf;; score=0.466 total time= 0.6s

[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;; score=0.887 total time= 0.2s

[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;; score=0.846 total time= 0.2s

[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=poly;; score=0.818 total time= 0.2s

[CV 1/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;; score=0.430 total time= 0.3s

[CV 2/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;; score=0.453 total time= 0.4s

[CV 3/3] END C=0.4, degree=2, gamma=0.1, kernel=sigmoid;; score=0.474 total time= 0.4s

[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;; score=0.706 total time= 0.4s

[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;; score=0.691 total time= 0.4s

[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=rbf;; score=0.649 total time= 0.4s

[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;; score=0.565 total time= 0.3s

[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;; score=0.548 total time= 0.3s

[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=poly;; score=0.534 total time= 0.3s

[CV 1/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;; score=0.569 total time= 0.2s

[CV 2/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;; score=0.566 total time= 0.2s

[CV 3/3] END C=0.4, degree=2, gamma=0.01, kernel=sigmoid;; score=0.561 total time= 0.2s

[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;; score=0.445 total time= 0.6s

[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;; score=0.469 total time= 0.6s

[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=rbf;; score=0.443 total time= 0.6s

[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;; score=0.396 total time= 0.4s

[CV 2/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;; score=0.404 total time= 0.4s

[CV 3/3] END C=0.4, degree=2, gamma=0.001, kernel=sigmoid;; score=0.382 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;; score=0.787 total time= 0.4s

[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;; score=0.769 total time= 0.4s

[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=rbf;; score=0.697 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=poly;; score=0.874 total time= 0.2s

[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=poly;; score=0.856 total time= 0.2s

[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=poly;; score=0.824 total time= 0.2s

[CV 1/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;; score=0.664 total time= 0.2s

[CV 2/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;; score=0.681 total time= 0.2s

[CV 3/3] END C=0.4, degree=3, gamma=scale, kernel=sigmoid;; score=0.643 total time= 0.2s

[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;; score=0.408 total time= 0.6s

[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;; score=0.417 total time= 0.6s

[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=rbf;; score=0.405 total time= 0.6s

[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=3, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;; score=0.474 total time= 0.6s

[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;; score=0.498 total time= 0.6s

[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=rbf;; score=0.466 total time= 0.6s

[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;; score=0.883 total time= 0.2s

[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;; score=0.865 total time= 0.2s

[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=poly;; score=0.823 total time= 0.2s

[CV 1/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;; score=0.430 total time= 0.3s

[CV 2/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;; score=0.453 total time= 0.4s

[CV 3/3] END C=0.4, degree=3, gamma=0.1, kernel=sigmoid;; score=0.474 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;; score=0.706 total time= 0.4s

[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;; score=0.691 total time= 0.4s

[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=rbf;; score=0.649 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;; score=0.452 total time= 0.3s

[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;; score=0.472 total time= 0.3s

[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=poly;; score=0.433 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;; score=0.569 total time= 0.2s

[CV 2/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;; score=0.566 total time= 0.2s

[CV 3/3] END C=0.4, degree=3, gamma=0.01, kernel=sigmoid;; score=0.561 total time= 0.2s

[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;; score=0.445 total time= 0.6s

[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;; score=0.469 total time= 0.6s

[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=rbf;; score=0.443 total time= 0.6s

[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;; score=0.396 total time= 0.4s

[CV 2/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;; score=0.404 total time= 0.4s

[CV 3/3] END C=0.4, degree=3, gamma=0.001, kernel=sigmoid;; score=0.382 total time= 0.4s

[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;; score=0.787 total time= 0.4s

[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;; score=0.769 total time= 0.4s

[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=rbf;; score=0.697 total time= 0.4s

[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=poly;; score=0.873 total time= 0.3s

[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=poly;; score=0.854 total time= 0.3s

[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=poly;; score=0.825 total time= 0.2s

[CV 1/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;; score=0.664 total time= 0.2s

[CV 2/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;; score=0.681 total time= 0.2s

[CV 3/3] END C=0.4, degree=4, gamma=scale, kernel=sigmoid;; score=0.643 total time= 0.2s

[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;; score=0.408 total time= 0.6s

[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;; score=0.417 total time= 0.6s

[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=rbf;; score=0.405 total time= 0.6s

[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=poly;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 2/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 3/3] END C=0.4, degree=4, gamma=auto, kernel=sigmoid;; score=0.076 total time= 0.4s

[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;; score=0.474 total time= 0.6s

[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;; score=0.498 total time= 0.6s

[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=rbf;; score=0.466 total time= 0.6s

[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;; score=0.873 total time= 0.2s

[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;; score=0.854 total time= 0.3s

[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=poly;; score=0.825 total time= 0.2s

[CV 1/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;; score=0.430 total time= 0.3s

[CV 2/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;; score=0.453 total time= 0.4s

[CV 3/3] END C=0.4, degree=4, gamma=0.1, kernel=sigmoid;; score=0.474 total time= 0.4s

[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;; score=0.706 total time= 0.4s

[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;; score=0.691 total time= 0.4s

[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=rbf;; score=0.649 total time= 0.4s

[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;; score=0.842 total time= 0.1s

[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;; score=0.796 total time= 0.1s

[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=linear;; score=0.792 total time= 0.1s

[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;; score=0.359 total time= 0.4s

[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;; score=0.344 total time= 0.4s

[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=poly;; score=0.334 total time= 0.4s

[CV 1/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;; score=0.569 total time= 0.2s

[CV 2/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;; score=0.566 total time= 0.2s

```

[CV 3/3] END C=0.4, degree=4, gamma=0.01, kernel=sigmoid;; score=0.561 total
time= 0.2s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;; score=0.445 total time=
0.6s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;; score=0.469 total time=
0.6s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=rbf;; score=0.443 total time=
0.6s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;; score=0.842 total
time= 0.1s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;; score=0.796 total
time= 0.1s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=linear;; score=0.792 total
time= 0.1s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time=
0.4s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time=
0.4s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=poly;; score=0.076 total time=
0.4s
[CV 1/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;; score=0.396 total
time= 0.4s
[CV 2/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;; score=0.404 total
time= 0.4s
[CV 3/3] END C=0.4, degree=4, gamma=0.001, kernel=sigmoid;; score=0.382 total
time= 0.4s

```

```

GridSearchCV(cv=3, estimator=SVC(),
              param_grid={'C': [0.1, 0.2, 0.3, 0.4], 'degree': [2, 3, 4],
                           'gamma': ['scale', 'auto', 0.1, 0.01, 0.001],
                           'kernel': ['rbf', 'linear', 'poly', 'sigmoid']},
              scoring='f1_macro', verbose=3)

```

```

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

y_pred_svm = best_svm.predict(test_features)

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

```

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

```

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

```

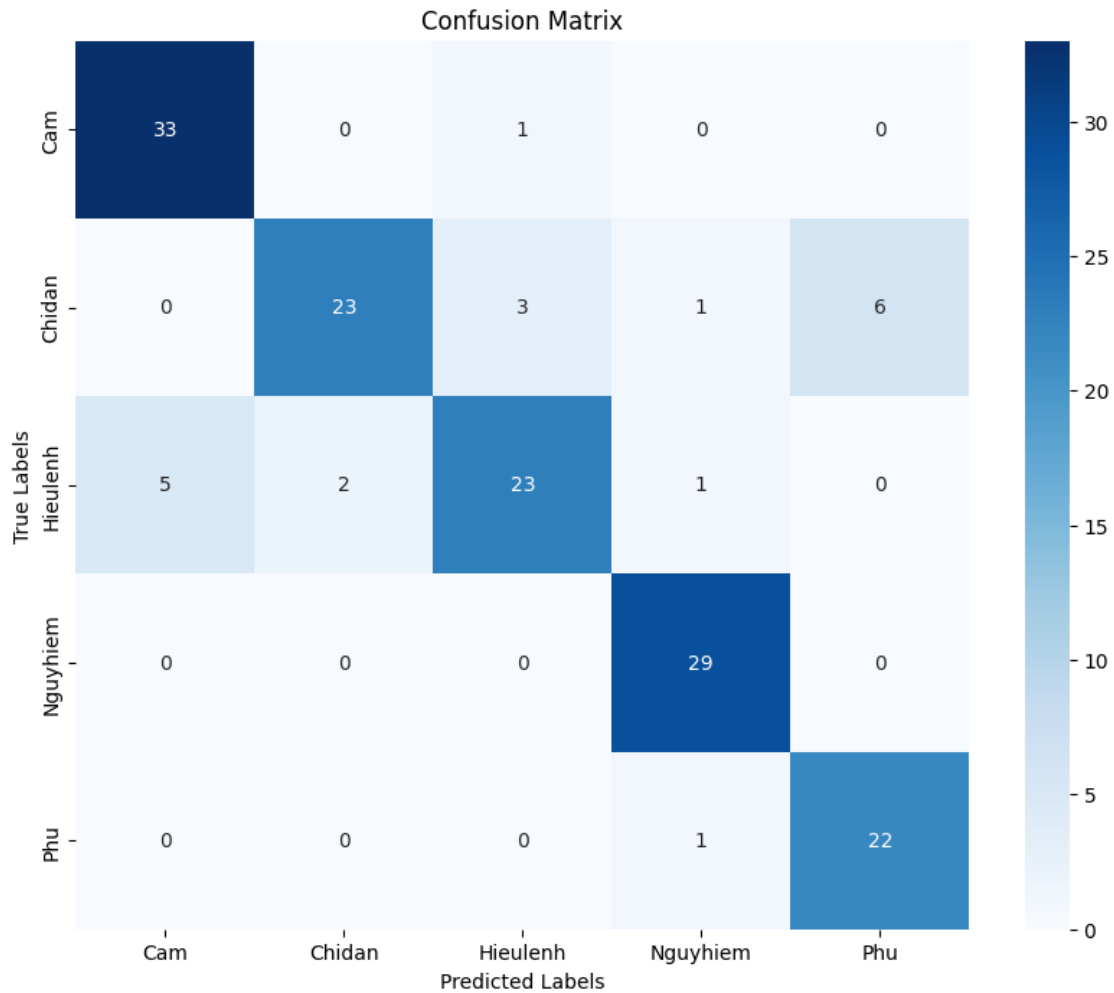

8 Predict on test images for KNN

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

	precision	recall	f1-score	support
Cam	0.87	0.97	0.92	34
Chidan	0.92	0.70	0.79	33
Hieulenh	0.85	0.74	0.79	31
Nguyhiem	0.91	1.00	0.95	29
Phu	0.79	0.96	0.86	23
accuracy			0.87	150
macro avg	0.87	0.87	0.86	150
weighted avg	0.87	0.87	0.86	150

```
heatmap_label_knn = confusion_matrix(test_labels_encoded, y_pred_knn)

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



```

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

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

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

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

```

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

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



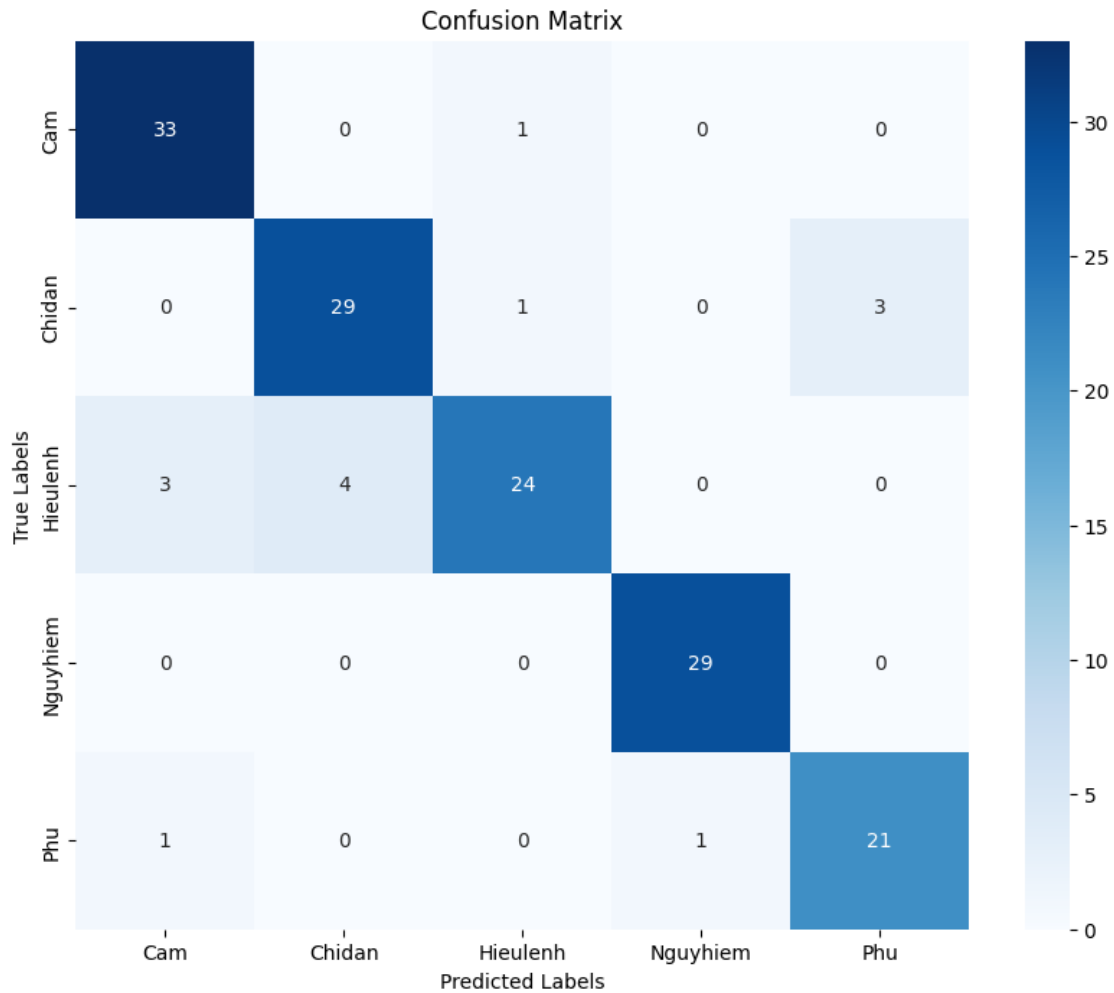
9 Predict on test images for SVM

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

	precision	recall	f1-score	support
Cam	0.89	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()

```

10 Save grid search results

```

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

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

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

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

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

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

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

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

```

```

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

export_notebook_to_pdf(notebook_path, proj_dir)

```

Đã xuất file PDF thành công: d:\ASUS\Deploy-Traffic-Sign-Classification-through-Images\grid_search_results\notebook_export_2024-11-22_12_09_16.pdf

'd:\\ASUS\\Deploy-Traffic-Sign-Classification-through-
Images\\grid_search_results\\notebook_export_2024-11-22_12_09_16.pdf'