

Klasyfikacja gatunków muzyki

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Celem laboratorium jest przeprowadzenie klasyfikacji gatunków muzyki na podstawie wyodrębnionych cech.

- Zastosujemy skalowanie cech
- Porównamy kilka klasyfikatorów
- Zastosujemy ciąg przetwarzania (*pipeline*)

10.1. Pobieramy i wczytujemy dane

```
In [1]: !wget https://dysk.agh.edu.pl/s/foAZjcKxtX2TQj5/download -O gitzan_small_
--2023-05-11 09:16:34-- https://dysk.agh.edu.pl/s/foAZjcKxtX2TQj5/downl
oad
Resolving dysk.agh.edu.pl (dysk.agh.edu.pl)... 149.156.96.4, 2001:6d8:1
0:1060::6004
Connecting to dysk.agh.edu.pl (dysk.agh.edu.pl)|149.156.96.4|:443... con
nected.
HTTP request sent, awaiting response... 200 OK
Length: 150687 (147K) [text/csv]
Saving to: 'gitzan_small_features.csv'

gitzan_small_featur 100%[=====>] 147.16K  429KB/s   in
0.3s

2023-05-11 09:16:35 (429 KB/s) - 'gitzan_small_features.csv' saved [1506
87/150687]
```

```
In [2]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

```
In [3]: df = pd.read_csv('gitzan_small_features.csv').drop(columns = ['Unnamed: 0']
df.head()
```

Out [3]:

	genre	file	audio	sr	zero_crossing_rate_mean	zero_cro
--	-------	------	-------	----	-------------------------	----------

0	classical	classical.00009.wav	[0.01455688 0.02090454 0.01434326 ... -0.03...	22050		0.056318
1	classical	classical.00004.wav	[-0.01077271 -0.02001953 -0.02426147 ... -0.10...	22050		0.113025
2	classical	classical.00002.wav	[-0.04046631 -0.07815552 -0.08737183 ... -0.06...	22050		0.090184
3	classical	classical.00003.wav	[-0.0083313 -0.02258301 -0.04367065 ... 0.00...	22050		0.109106
4	classical	classical.00001.wav	[-0.01138306 -0.00216675 0.01687622 ... -0.02...	22050		0.087911

5 rows × 77 columns

Oprócz wyznaczonych cech zbiór danych zawiera oryginalne surowe dane i ich etykiety

In [4]: `df.columns`

```
Out[4]: Index(['genre', 'file', 'audio', 'sr', 'zero_crossing_rate_mean',
              'zero_crossing_rate_var', 'spectral_centroid_mean',
              'spectral_centroid_var', 'rms_mean', 'rms_var', 'spectral_rolloff_mean',
              'spectral_rolloff_var', 'mfcc01_mean', 'mfcc01_var', 'mfcc02_mean',
              'mfcc02_var', 'mfcc03_mean', 'mfcc03_var', 'mfcc04_mean', 'mfcc04_var',
              'mfcc05_mean', 'mfcc05_var', 'mfcc06_mean', 'mfcc06_var', 'mfcc07_mean',
              'mfcc07_var', 'mfcc08_mean', 'mfcc08_var', 'mfcc09_mean', 'mfcc09_var',
              'mfcc10_mean', 'mfcc10_var', 'mfcc11_mean', 'mfcc11_var', 'mfcc12_mean',
              'mfcc12_var', 'mfcc13_mean', 'mfcc13_var', 'mfcc14_mean', 'mfcc14_var',
              'mfcc15_mean', 'mfcc15_var', 'mfcc16_mean', 'mfcc16_var', 'mfcc17_mean',
              'mfcc17_var', 'mfcc18_mean', 'mfcc18_var', 'mfcc19_mean', 'mfcc19_var',
              'mfcc20_mean', 'mfcc20_var', 'chroma01_mean', 'chroma01_var',
              'chroma02_mean', 'chroma02_var', 'chroma03_mean', 'chroma03_var',
              'chroma04_mean', 'chroma04_var', 'chroma05_mean', 'chroma05_var',
              'chroma06_mean', 'chroma06_var', 'chroma07_mean', 'chroma07_var',
              'chroma08_mean', 'chroma08_var', 'chroma09_mean', 'chroma09_var',
              'chroma10_mean', 'chroma10_var', 'chroma11_mean', 'chroma11_var',
              'chroma12_mean', 'chroma12_var', 'tempo'],
              dtype='object')
```

TODO 10.1.1

- Usunąć zbędne kolumny z DataFrame (te które nie są wyznaczonymi cechami)
- Przekonwertuj do postaci macierzy `numpy` za pomocą metody `to_numpy()`

```
In [11]: from sklearn.model_selection import train_test_split
from sklearn.model_selection import cross_validate
from sklearn.preprocessing import LabelEncoder, StandardScaler

# wyznaczanie etykiet w postaci liczbowej
labels = df['genre']
le = LabelEncoder()
y = le.fit_transform(labels)
print(y)
print(le.classes_)

#usuwanie zbędnych kolumn
X = df.drop(['genre', 'file', 'audio', 'sr'], axis=1)

print(X.shape)

[1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 9 9 9 9 9 9 9 9 9 5 5 5 5 5 5
5
5 5 5 4 4 4 4 4 4 4 4 4 4 4 2 2 2 2 2 2 2 2 2 2 6 6 6 6 6 6 6 6 6 6 3 3 3
3
3 3 3 3 3 3 8 8 8 8 8 8 8 8 8 8 7 7 7 7 7 7 7 7 7 7]
['blues' 'classical' 'country' 'disco' 'hiphop' 'jazz' 'metal' 'pop'
 'reggae' 'rock']
(100, 73)
```

10.2. Klasyfikacja

10.2.1 TODO

- Zastosuj klasyfikator `GaussianNB` i wyznacz przewidywane przez klasyfikator etykiety `y_pred` za pomocą funkcji `cross_val_predict()` z parametrem `cv=10`
- Wyznacz macierz pomyłek za pomocą funkcji `confusion_matrix()`, a następnie wydrukuj ją

```
In [12]: from sklearn.model_selection import cross_val_predict
from sklearn.metrics import confusion_matrix
from sklearn.naive_bayes import GaussianNB

clf = GaussianNB()

y_pred = cross_val_predict(clf, X, y, cv=10)
conf_mat = confusion_matrix(y, y_pred)

print(conf_mat)

import seaborn as sns
```

```
[[4 0 0 0 0 0 0 0 2 4]
 [0 9 0 0 0 1 0 0 0 0]
 [0 0 8 0 0 0 1 1 0 0]
 [0 0 1 8 0 0 0 1 0 0]
 [2 0 0 0 6 0 1 1 0 0]
 [3 0 0 0 0 7 0 0 0 0]
 [0 0 1 2 0 0 7 0 0 0]
 [1 0 1 3 2 1 0 2 0 0]
 [1 0 0 0 1 0 0 0 7 1]
 [1 0 0 0 0 0 1 0 0 8]]
```

Zilustrujemy macierz pomyłek wraz z etykietami

```
In [13]: # Funkcja pobrana z https://github.com/DTrimarchi10/confusion_matrix/blob

import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

def make_confusion_matrix(cf,
                          group_names=None,
                          categories='auto',
                          count=True,
                          percent=True,
                          cbar=True,
                          xyticks=True,
                          xyplotlabels=True,
                          sum_stats=True,
                          figsize=None,
                          cmap='Blues',
                          title=None):
    ...

    This function will make a pretty plot of an sklearn Confusion Matrix
```

Arguments

```

cf:                confusion matrix to be passed in
group_names:       List of strings that represent the labels row by row t
categories:        List of strings containing the categories to be displa
count:            If True, show the raw number in the confusion matrix.
normalize:        If True, show the proportions for each category. Defau
cbar:             If True, show the color bar. The cbar values are based
                  Default is True.
xyticks:          If True, show x and y ticks. Default is True.
xyplotlabels:     If True, show 'True Label' and 'Predicted Label' on th
sum_stats:        If True, display summary statistics below the figure.
figsize:          Tuple representing the figure size. Default will be th
cmap:             Colormap of the values displayed from matplotlib.pyplot
                  See http://matplotlib.org/examples/color/colormaps\_ref

```

```

title:            Title for the heatmap. Default is None.
'''

```

```

# CODE TO GENERATE TEXT INSIDE EACH SQUARE

```

```

blanks = ['' for i in range(cf.size)]

if group_names and len(group_names)==cf.size:
    group_labels = ["{}\n".format(value) for value in group_names]
else:
    group_labels = blanks

if count:
    group_counts = ["{0:0.0f}\n".format(value) for value in cf.flatte
else:
    group_counts = blanks

if percent:
    group_percentages = ["{0:.2%}".format(value) for value in cf.flat
else:
    group_percentages = blanks

box_labels = [f"{v1}{v2}{v3}".strip() for v1, v2, v3 in zip(group_lab
box_labels = np.asarray(box_labels).reshape(cf.shape[0],cf.shape[1])

```

```

# CODE TO GENERATE SUMMARY STATISTICS & TEXT FOR SUMMARY STATS

```

```

if sum_stats:
    #Accuracy is sum of diagonal divided by total observations
    accuracy = np.trace(cf) / float(np.sum(cf))

    #if it is a binary confusion matrix, show some more stats
    if len(cf)==2:
        #Metrics for Binary Confusion Matrices
        precision = cf[1,1] / sum(cf[:,1])
        recall    = cf[1,1] / sum(cf[1,:])
        f1_score  = 2*precision*recall / (precision + recall)
        stats_text = "\n\nAccuracy={:0.3f}\nPrecision={:0.3f}\nRecall
                        accuracy,precision,recall,f1_score)
    else:
        stats_text = "\n\nAccuracy={:0.3f}".format(accuracy)
else:
    stats_text = ""

```

```
# SET FIGURE PARAMETERS ACCORDING TO OTHER ARGUMENTS
if figsize==None:
    #Get default figure size if not set
    figsize = plt.rcParams.get('figure.figsize')

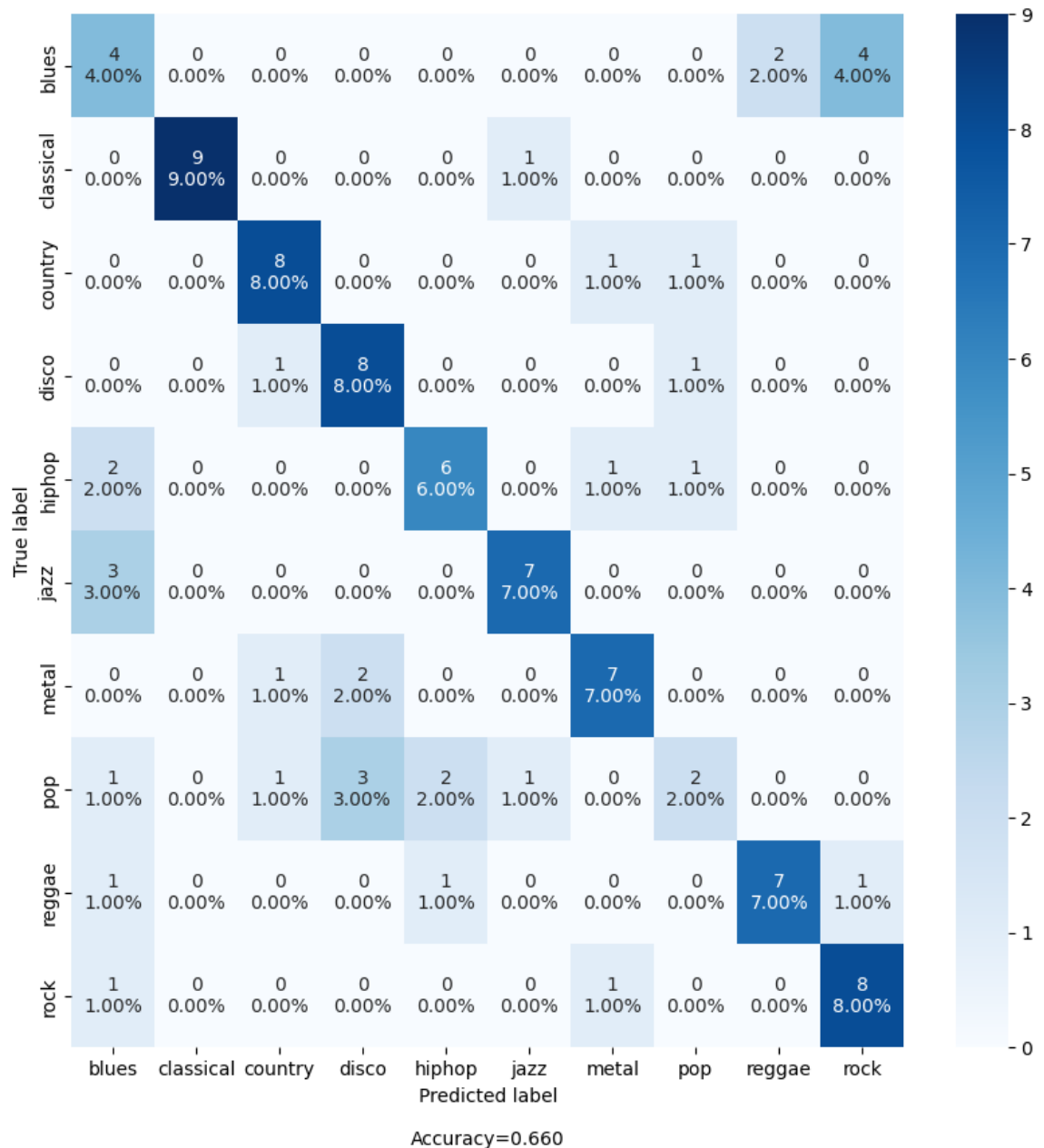
if xyticks==False:
    #Do not show categories if xyticks is False
    categories=False

# MAKE THE HEATMAP VISUALIZATION
plt.figure(figsize=figsize)
sns.heatmap(cf,annot=box_labels,fmt="",cmap=cmap,cbar=cbar,xticklabel

if xyplotlabels:
    plt.ylabel('True label')
    plt.xlabel('Predicted label' + stats_text)
else:
    plt.xlabel(stats_text)

if title:
    plt.title(title)
```

```
In [14]: plt.rcParams["figure.figsize"] = (10,10)
make_confusion_matrix(conf_mat,categories=le.classes_)
```



10.2.1 Skalowanie

Zastosujemy skalowanie cech:

- StandardScaler
- MinMaxScaler

TODO 10.2.2

- Jak przekształca dane StandardScaler?
- Co robi MinMaxScaler?
- Który z nich może zwrócić dane ujemne?

```
In [15]: import numpy as np
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import MinMaxScaler

data = np.asarray([[100, 0.001],
```

```

[8, 0.05],
[50, 0.005],
[88, 0.07],
[4, 0.1]])

print("Przed skalowaniem")
print(data)
# define standard scaler
scaler = StandardScaler()
# transform data
scaled = scaler.fit_transform(data)
print("Po skalowaniu")
print(scaled)

print(f'scaler.mean_={scaler.mean_}')
print(f'scaler.var_={scaler.var_}')

print(f'data.mean(axis=0)={data.mean(axis=0)}')
print(f'data.std(axis=0)**2={data.std(axis=0)**2}')

print(f'scaled.mean(axis=0)={scaled.mean(axis=0)}')
print(f'scaled.std(axis=0)**2={scaled.std(axis=0)**2}')

```

```

Przed skalowaniem
[[1.0e+02 1.0e-03]
 [8.0e+00 5.0e-02]
 [5.0e+01 5.0e-03]
 [8.8e+01 7.0e-02]
 [4.0e+00 1.0e-01]]
Po skalowaniu
[[ 1.26398112 -1.16389967]
 [-1.06174414  0.12639634]
 [ 0.         -1.05856939]
 [ 0.96062565  0.65304778]
 [-1.16286263  1.44302493]]
scaler.mean_=[5.00e+01 4.52e-02]
scaler.var_=[1.56480e+03 1.44216e-03]
data.mean(axis=0)=[5.00e+01 4.52e-02]
data.std(axis=0)**2=[1.56480e+03 1.44216e-03]
scaled.mean(axis=0)=[ 4.4408921e-17 -4.4408921e-17]
scaled.std(axis=0)**2=[1. 1.]

```

StandardScaler to metoda normalizacji danych numerycznych, która przekształca wartości zmiennych w taki sposób, że ich średnia wynosi 0, a odchylenie standardowe wynosi 1.

MinMaxScaler to metoda skalowania danych numerycznych, która przekształca wartości zmiennych w przedział od 0 do 1.

Zarówno StandardScaler, jak i MinMaxScaler są metodami skalowania danych numerycznych i mogą zwrócić wartości ujemne, w zależności od wartości pierwotnych danych wejściowych.

```

In [16]: scaler = MinMaxScaler()
# transform data
scaled = scaler.fit_transform(data)
print("Po skalowaniu")
print(scaled)

```


Po skalowaniu

```
[[1.          0.          ]
 [0.04166667 0.49494949]
 [0.47916667 0.04040404]
 [0.875       0.6969697 ]
 [0.          1.          ]]
```

Zobaczmy na wyniki po skalowaniu

TODO 10.2.3

- Przeprowadź skalowanie i klasyfikację używając przeskalowanych cech
- Wyznacz przewidywane etykiety za pomocą `cross_val_predict(..., cv=10)`
- Narysuj macierz pomyłek
- Czy skalowanie miało jakiś wpływ na wyniki?

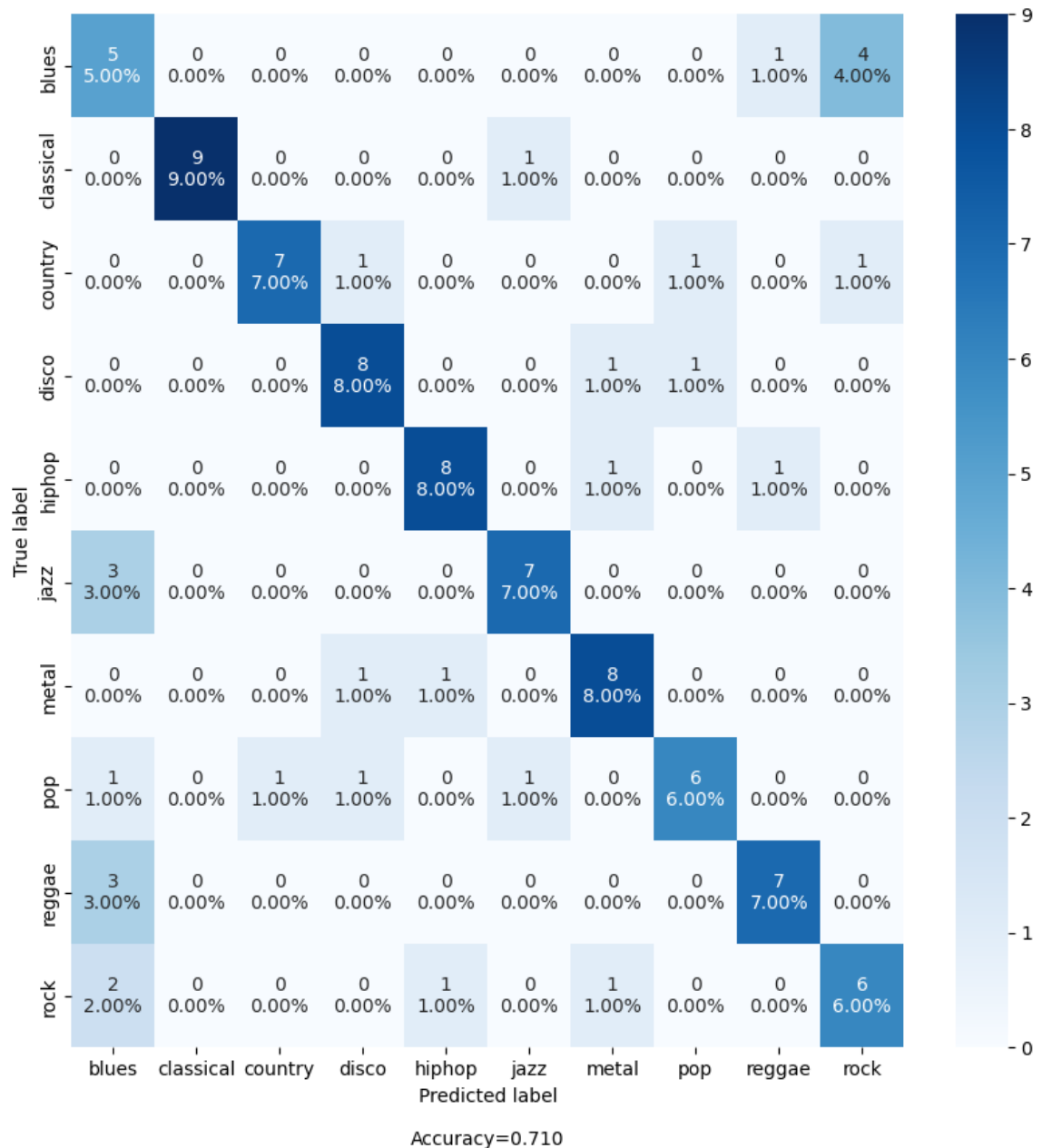
```
In [18]: scl = StandardScaler()
X_scaled=scl.fit_transform(X)
clf = GaussianNB()

y_pred = cross_val_predict(clf, X_scaled, y, cv=10)

conf_mat = confusion_matrix(y, y_pred)
print(conf_mat)

plt.rcParams["figure.figsize"] = (10,10)
make_confusion_matrix(conf_mat, categories=le.classes_)

[[5 0 0 0 0 0 0 1 4]
 [0 9 0 0 0 1 0 0 0]
 [0 0 7 1 0 0 0 1 0]
 [0 0 0 8 0 0 1 1 0]
 [0 0 0 0 8 0 1 0 1]
 [3 0 0 0 0 7 0 0 0]
 [0 0 0 1 1 0 8 0 0]
 [1 0 1 1 0 1 0 6 0]
 [3 0 0 0 0 0 0 7 0]
 [2 0 0 0 1 0 1 0 6]]
```



Tak, skalowanie miało wpływ na wynik o czym świadczą różne wartości w macierzy konfuzji.

10.2.2 Budujemy ciąg przetwarzania (pipeline)

```
In [19]: from sklearn.pipeline import make_pipeline
scl = StandardScaler()
clf = GaussianNB()

pipeline = make_pipeline(scl, clf)
print(pipeline)
```

```
Pipeline(steps=[('standardscaler', StandardScaler()),
                 ('gaussiannb', GaussianNB())])
```

Pipeline ma typowe metody klasyfikatora: `fit()` i `predict()`

```
In [20]: import sklearn
pipeline.fit(X,y)
```

```
y_pred = pipeline.predict(X)
print(f'Accuracy:{sklearn.metrics.accuracy_score(y,y_pred)}')
```

Accuracy:0.92

Oczywiście jest to wynik wyznaczony dla całego zbioru danych. W przypadku podziału na zbiór uczący/testowy rezultat będzie gorszy.

Powinniśmy zastosować określić parametry składowania na podstawie zbioru uczącego, a następnie zastosować je przy transformacji danych zbioru testowego.

10.2.3 Jak wygląda transformacja nieznanych danych?

TODO

- Sprawdź, czy mieszczą się w zakresie dla danych uczących. Pamiętaj, że skalujemy cechy, czyli dane w kolumnach

```
In [21]: data = np.asarray([[100, 0.001],
                           [8, 0.05],
                           [50, 0.005],
                           [88, 0.07],
                           [4, 0.1]])

# scaler = StandardScaler()
# scaler = MinMaxScaler(feature_range=[0,1])
scaler.fit(data)

# print(data)
unobserved_data = np.asarray([[110, -0.1],
                              [-4, 0.12]])

scaled = scaler.transform(unobserved_data)
print(unobserved_data)
print(scaled)
```

```
[[ 1.1e+02 -1.0e-01]
 [-4.0e+00  1.2e-01]]
[[ 1.10416667 -1.02020202]
 [-0.08333333  1.2020202 ]]
```

Testujemy trafność (accuracy) dla różnych losowych podziałów

```
In [22]: from sklearn.model_selection import train_test_split
import sklearn
for i in range(20):
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0
    pipeline.fit(X_train,y_train)
    y_pred = pipeline.predict(X_test)
    print(f'Accuracy:{sklearn.metrics.accuracy_score(y_test,y_pred)}')
```

```

Accuracy:0.7
Accuracy:0.5
Accuracy:0.4
Accuracy:0.9
Accuracy:0.6
Accuracy:0.8
Accuracy:0.7
Accuracy:0.4
Accuracy:0.8
Accuracy:0.8
Accuracy:0.7
Accuracy:0.7
Accuracy:0.8
Accuracy:0.8
Accuracy:0.5
Accuracy:0.8
Accuracy:0.8
Accuracy:0.7
Accuracy:0.7
Accuracy:0.6

```

TODO 10.2.4

- Analogicznie wywołaj `cross_val_predict()` zastępując klasyfikator zdefiniowanym ciągiem przetwarzania `pipeline`
- Następnie, wyświetl macierz pomyłek

```

In [23]: y_pred = cross_val_predict(pipeline, X, y, cv=10)
conf_mat = confusion_matrix(y, y_pred)
print(conf_mat)

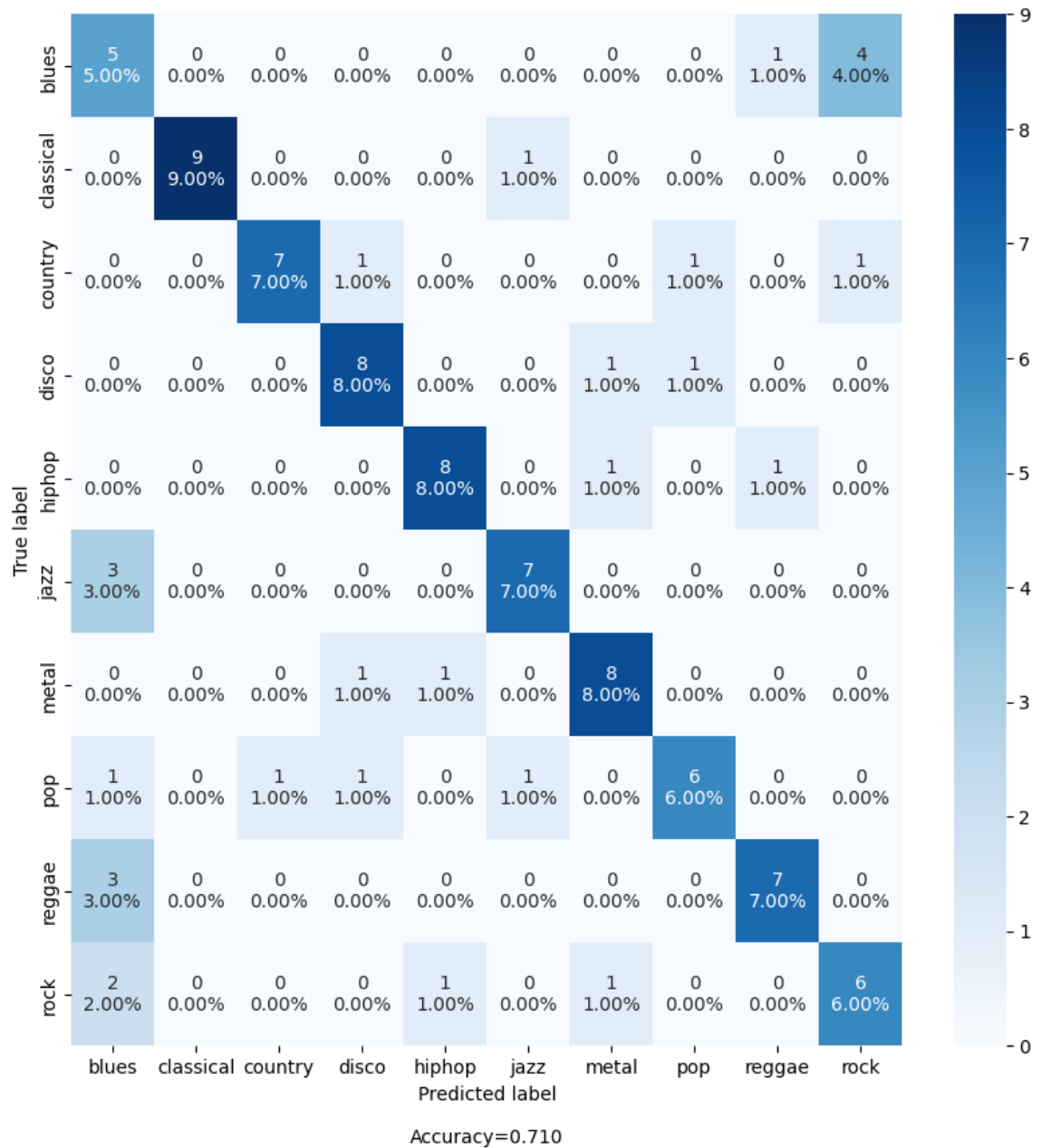
plt.rcParams["figure.figsize"] = (10,10)
make_confusion_matrix(conf_mat, categories=le.classes_)

```

```

[[5 0 0 0 0 0 0 0 1 4]
 [0 9 0 0 0 1 0 0 0 0]
 [0 0 7 1 0 0 0 1 0 1]
 [0 0 0 8 0 0 1 1 0 0]
 [0 0 0 0 8 0 1 0 1 0]
 [3 0 0 0 0 7 0 0 0 0]
 [0 0 0 1 1 0 8 0 0 0]
 [1 0 1 1 0 1 0 6 0 0]
 [3 0 0 0 0 0 0 0 7 0]
 [2 0 0 0 1 0 1 0 0 6]]

```



10.2.4 Zbieramy metryki

Zobaczmy jakie są zdefiniowane...

```
In [24]: import sklearn
sorted(sklearn.metrics.SCORERS.keys())
```

```
Out[24]: ['accuracy',
          'adjusted_mutual_info_score',
          'adjusted_rand_score',
          'average_precision',
          'balanced_accuracy',
          'completeness_score',
          'explained_variance',
          'f1',
          'f1_macro',
          'f1_micro',
          'f1_samples',
          'f1_weighted',
          'fowlkes_mallows_score',
          'homogeneity_score',
          'jaccard',
          'jaccard_macro',
          'jaccard_micro',
          'jaccard_samples',
          'jaccard_weighted',
          'matthews_corrcoef',
          'max_error',
          'mutual_info_score',
          'neg_brier_score',
          'neg_log_loss',
          'neg_mean_absolute_error',
          'neg_mean_absolute_percentage_error',
          'neg_mean_gamma_deviance',
          'neg_mean_poisson_deviance',
          'neg_mean_squared_error',
          'neg_mean_squared_log_error',
          'neg_median_absolute_error',
          'neg_negative_likelihood_ratio',
          'neg_root_mean_squared_error',
          'normalized_mutual_info_score',
          'positive_likelihood_ratio',
          'precision',
          'precision_macro',
          'precision_micro',
          'precision_samples',
          'precision_weighted',
          'r2',
          'rand_score',
          'recall',
          'recall_macro',
          'recall_micro',
          'recall_samples',
          'recall_weighted',
          'roc_auc',
          'roc_auc_ovo',
          'roc_auc_ovo_weighted',
          'roc_auc_ovr',
          'roc_auc_ovr_weighted',
          'top_k_accuracy',
          'v_measure_score']
```

TODO 10.2.5

- Zbierz następujące metryki: accuracy, precision, recall i F1 (trzy ostatnie w wersji makro) stosując walidację krzyżową
- Wyznacz wartości średnie

```
In [26]: scoring = ['accuracy', 'precision_macro', 'recall_macro', 'f1_macro']
cv_results = cross_validate(pipeline, X, y, cv=10, scoring=scoring)
print(cv_results)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
{'fit_time': array([0.01519346, 0.01670837, 0.01243162, 0.02433991, 0.01107931,
                  0.01341152, 0.01729035, 0.01428938, 0.01022911, 0.01066756]), 'score_time': array([0.02889371, 0.01320171, 0.01324248, 0.01284647, 0.0429275 ,
                  0.01306987, 0.02096391, 0.01876974, 0.0123198 , 0.01205492]), 'test_accuracy': array([0.9, 0.6, 0.5, 0.8, 0.6, 0.9, 0.6, 0.8, 0.9, 0.5]),
'test_precision_macro': array([0.85, 0.48333333, 0.43333333, 0.7, 0.55, 0.85, 0.5, 0.7, 0.85, 0.38333333]),
'test_recall_macro': array([0.9, 0.6, 0.5, 0.8, 0.6, 0.9, 0.6, 0.8, 0.9, 0.5]),
'test_f1_macro': array([0.86666667, 0.51666667, 0.45, 0.73333333, 0.56666667, 0.86666667, 0.53333333, 0.73333333, 0.86666667, 0.41666667])}]
```

```

/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
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  _warn_prf(average, modifier, msg_start, len(result))

```

```

In [27]: acc = cv_results['test_accuracy'].mean()
prec = cv_results['test_precision_macro'].mean()
recall = cv_results['test_recall_macro'].mean()
f1 = cv_results['test_f1_macro'].mean()

print(f'acc={acc} prec={prec} recall={recall} f1={f1}')

acc=0.71 prec=0.63 recall=0.71 f1=0.6549999999999999

```

10.3. Testy wielu klasyfikatorów

Dodamy funkcję, która zbuduje pipeline, wywoła `cross_val_predict()`, wyznaczy i wyświetli macierz pomyłek.

TODO 10.3.1.

- Uzupełnij brakujący kod

```

In [28]: from sklearn.pipeline import make_pipeline
from sklearn.model_selection import cross_val_predict
from sklearn.metrics import confusion_matrix
import matplotlib.pyplot as plt

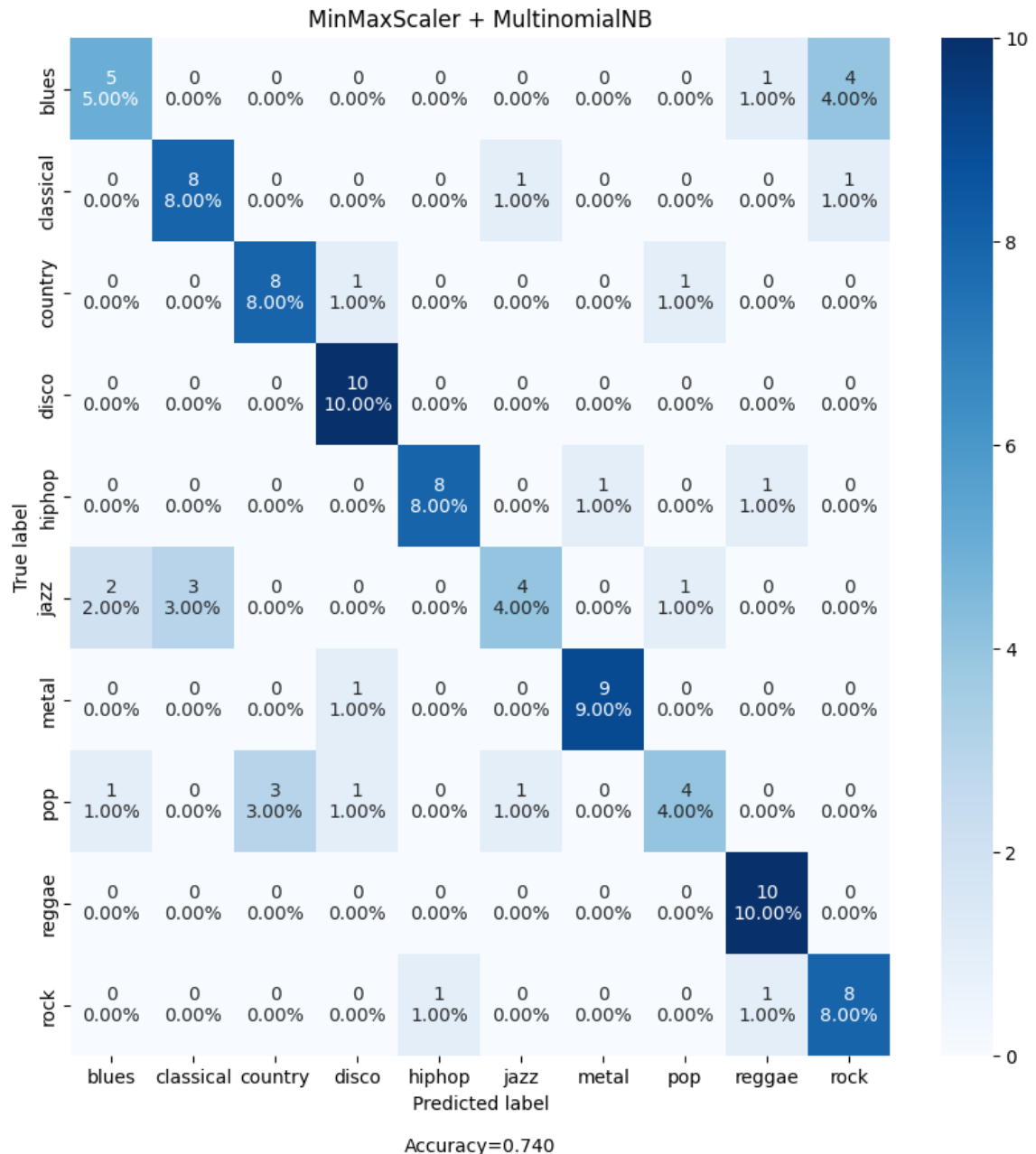
plt.rcParams["figure.figsize"] = (10,10)

def cv_show_confusion_matrix(X, y, labels, scaler, classifier, cv=10, title=None):
    pipeline = make_pipeline(scaler, classifier)
    y_pred = cross_val_predict(pipeline, X, y, cv=cv)
    conf_mat = confusion_matrix(y, y_pred)
    if title is None:
        title = scaler.__class__.__name__ + " + " + classifier.__class__.__name__
    else:
        title = title + ': ' + scaler.__class__.__name__ + " + " + classifier.__class__.__name__
    make_confusion_matrix(conf_mat, categories=labels, title=title)

```


Sprawdzimy, czy działa dla MultinomialNB. Użyjemy parametru `feature_range=[1,2]`, aby przypadkowo nie dostarczać do `MultinomialNB` wartości ujemnych. W nowszej wersji biblioteki jest parametr `clip` (przytnij do zakresu).

```
In [29]: from sklearn.naive_bayes import MultinomialNB
from sklearn.preprocessing import MinMaxScaler
cv_show_confusion_matrix(X,y,labels=le.classes_,scaler=MinMaxScaler(feature_range=[1,2]))
```



10.3.1 Tworzymy listę konfiguracji i wyświetlamy macierze pomyłek

```
In [30]: # Szukamy klasyfikatora
from sklearn.preprocessing import MinMaxScaler
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn.naive_bayes import MultinomialNB
from sklearn.tree import DecisionTreeClassifier
```

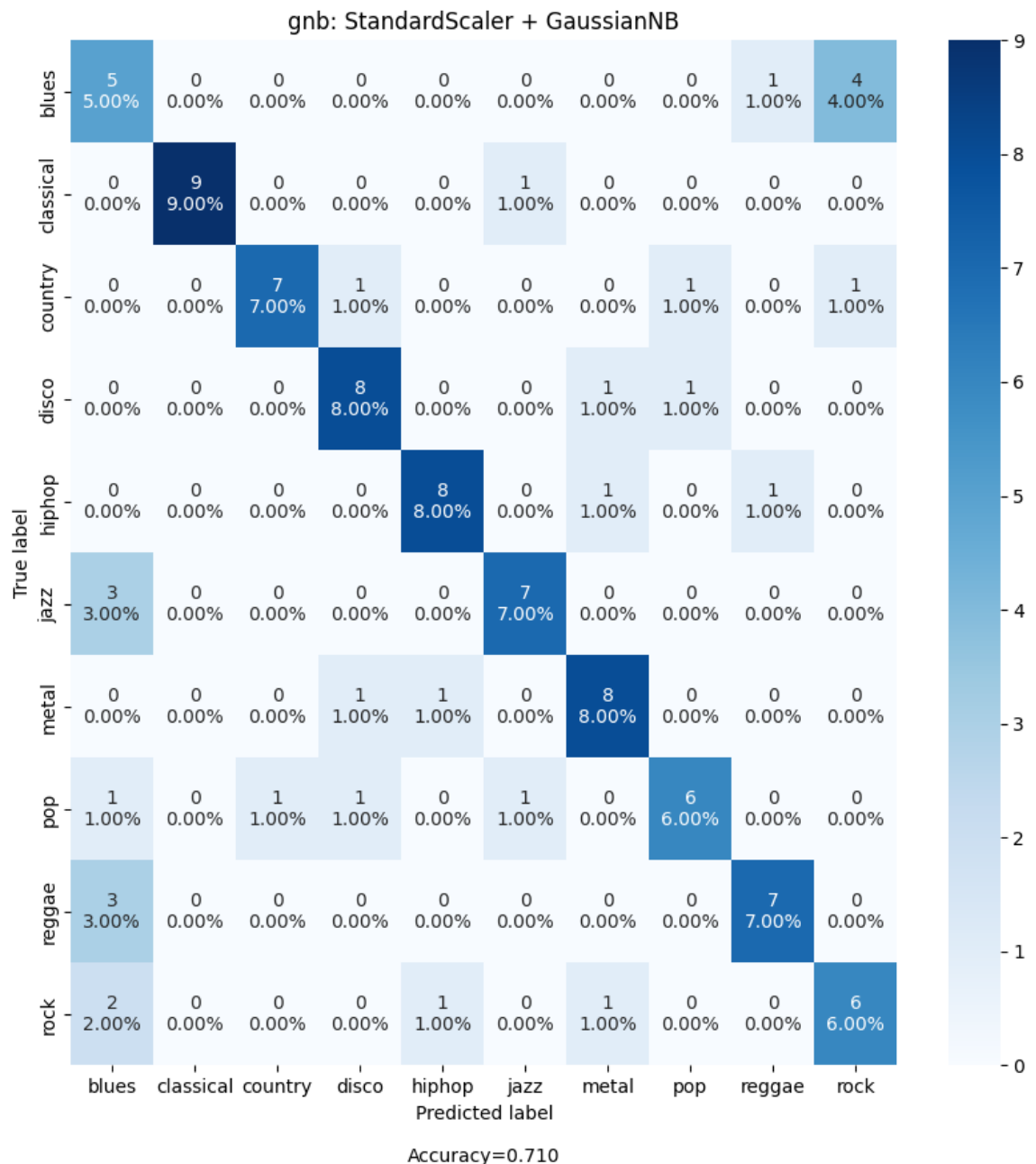
```

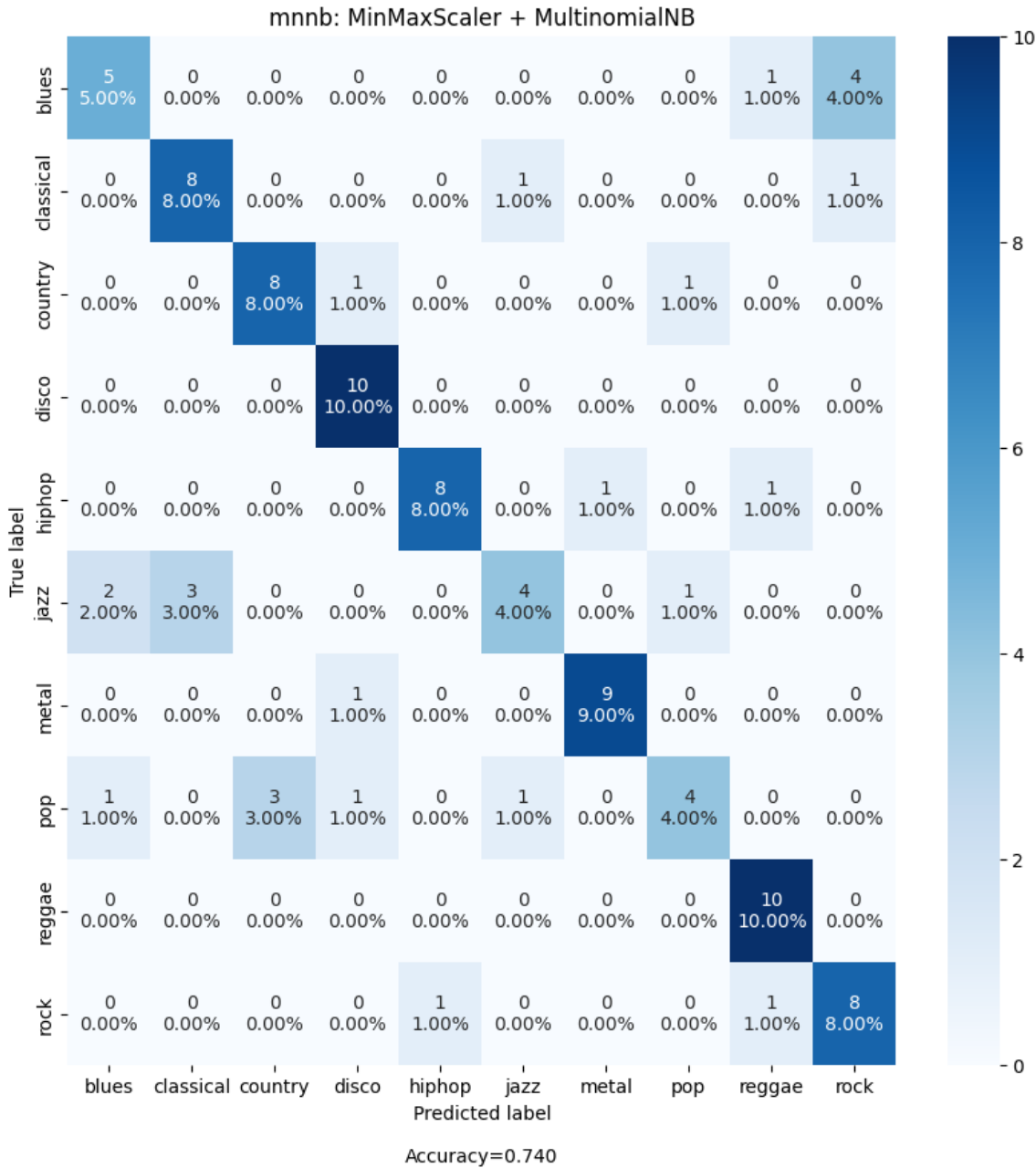
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn.neighbors import KNeighborsClassifier

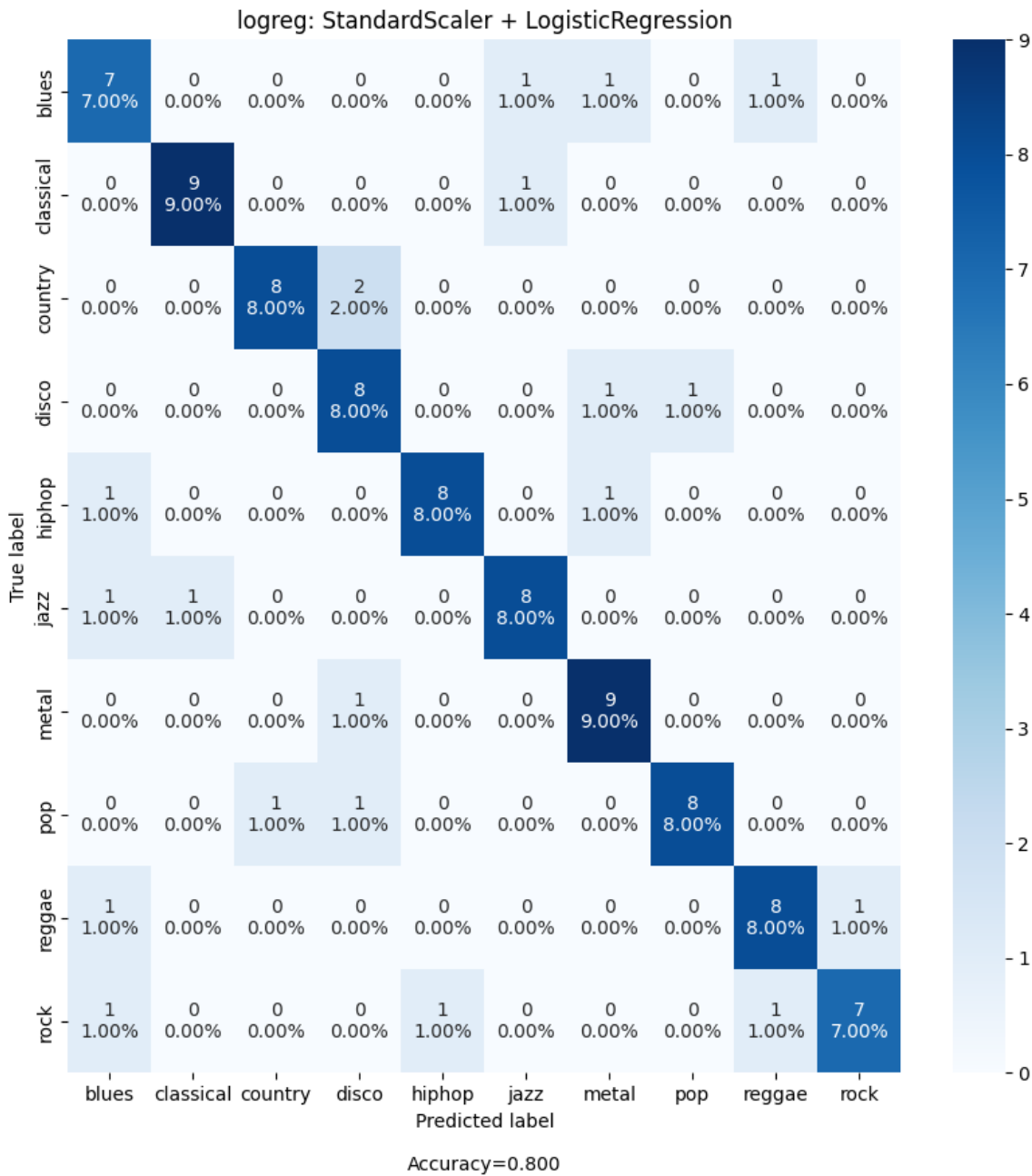
configs={'gnb':[StandardScaler(),GaussianNB()],
        'mnnb':[MinMaxScaler(feature_range=(1,2)),MultinomialNB(alpha=0.1)],
        'logreg':[StandardScaler(),LogisticRegression()],
        'dt-gini':[StandardScaler(),DecisionTreeClassifier(criterion='gini')],
        'dt-ent':[StandardScaler(),DecisionTreeClassifier(criterion='entropy')],
        'rf':[StandardScaler(),RandomForestClassifier(criterion='entropy')],
        'svc-rbf':[StandardScaler(),SVC()],
        'svc-poly':[StandardScaler(),SVC(kernel='poly',degree=2,C=1e5)],
        '1nn':[StandardScaler(),KNeighborsClassifier(n_neighbors=1)],
        '3nn':[StandardScaler(),KNeighborsClassifier(n_neighbors=3)],
        '5nn':[StandardScaler(),KNeighborsClassifier(n_neighbors=5)],
        }

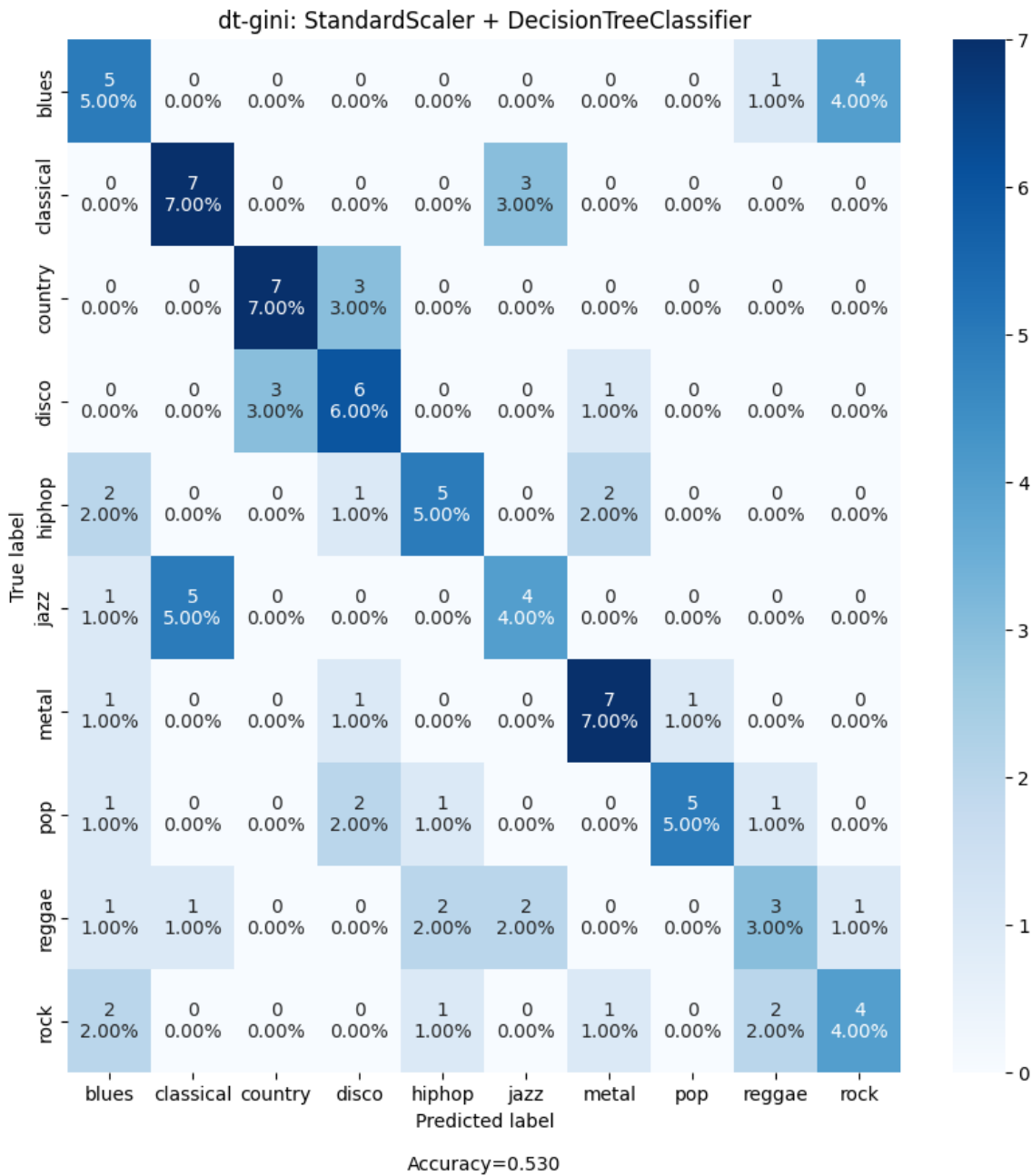
for k in configs:
    cv_show_confusion_matrix(X,y,labels=le.classes_,scaler=configs[k][0],clf=configs[k][1])

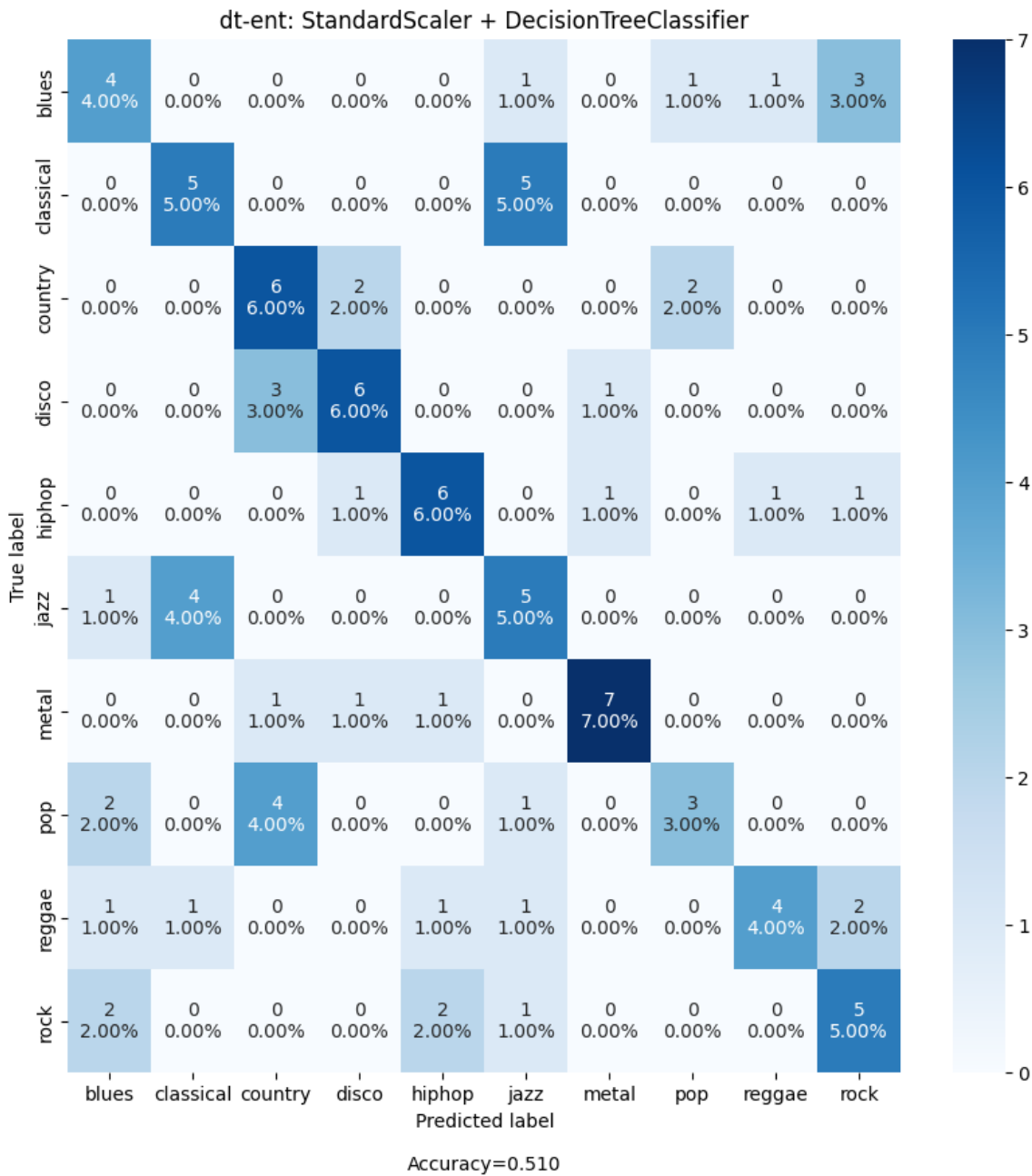
```

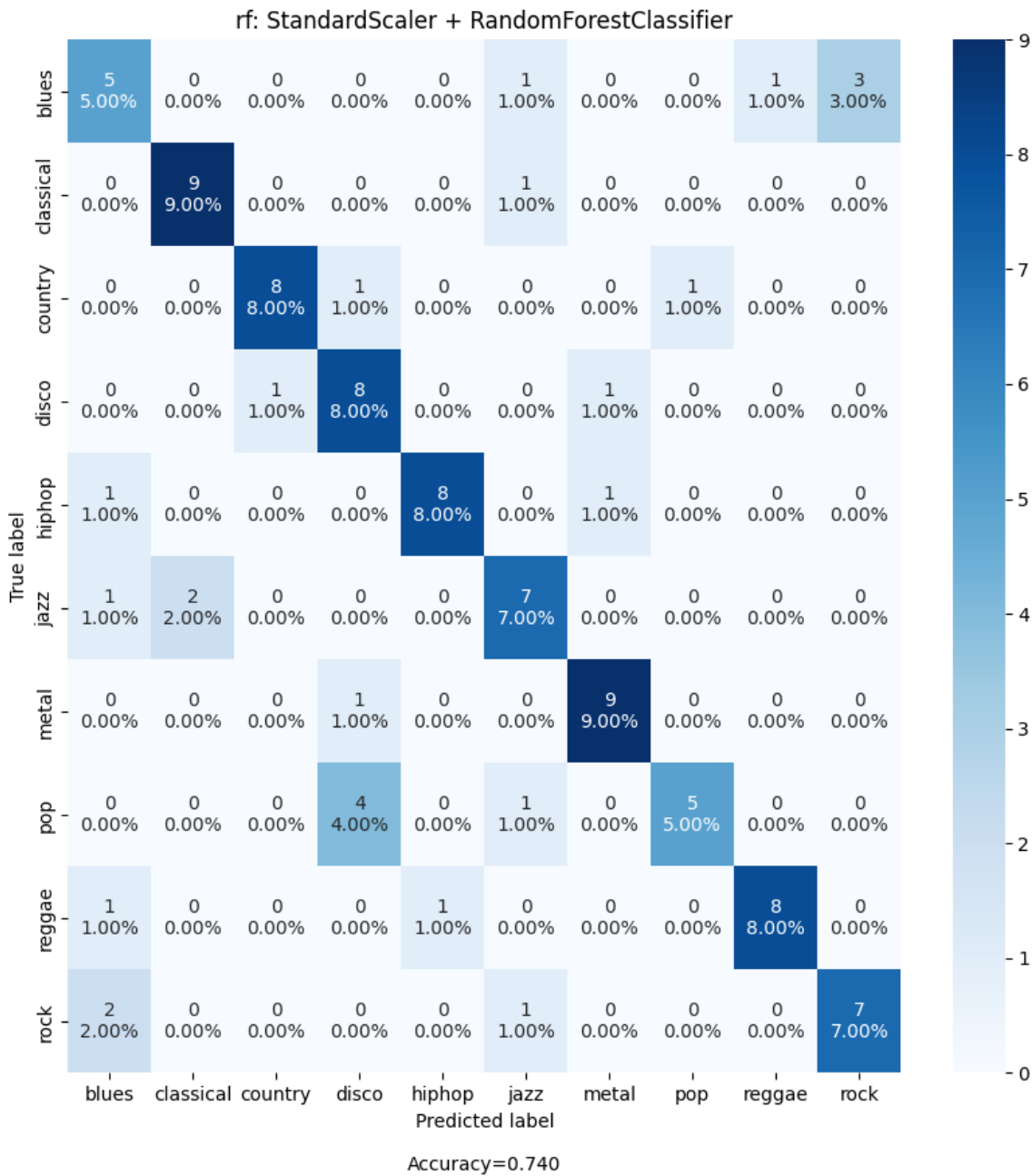


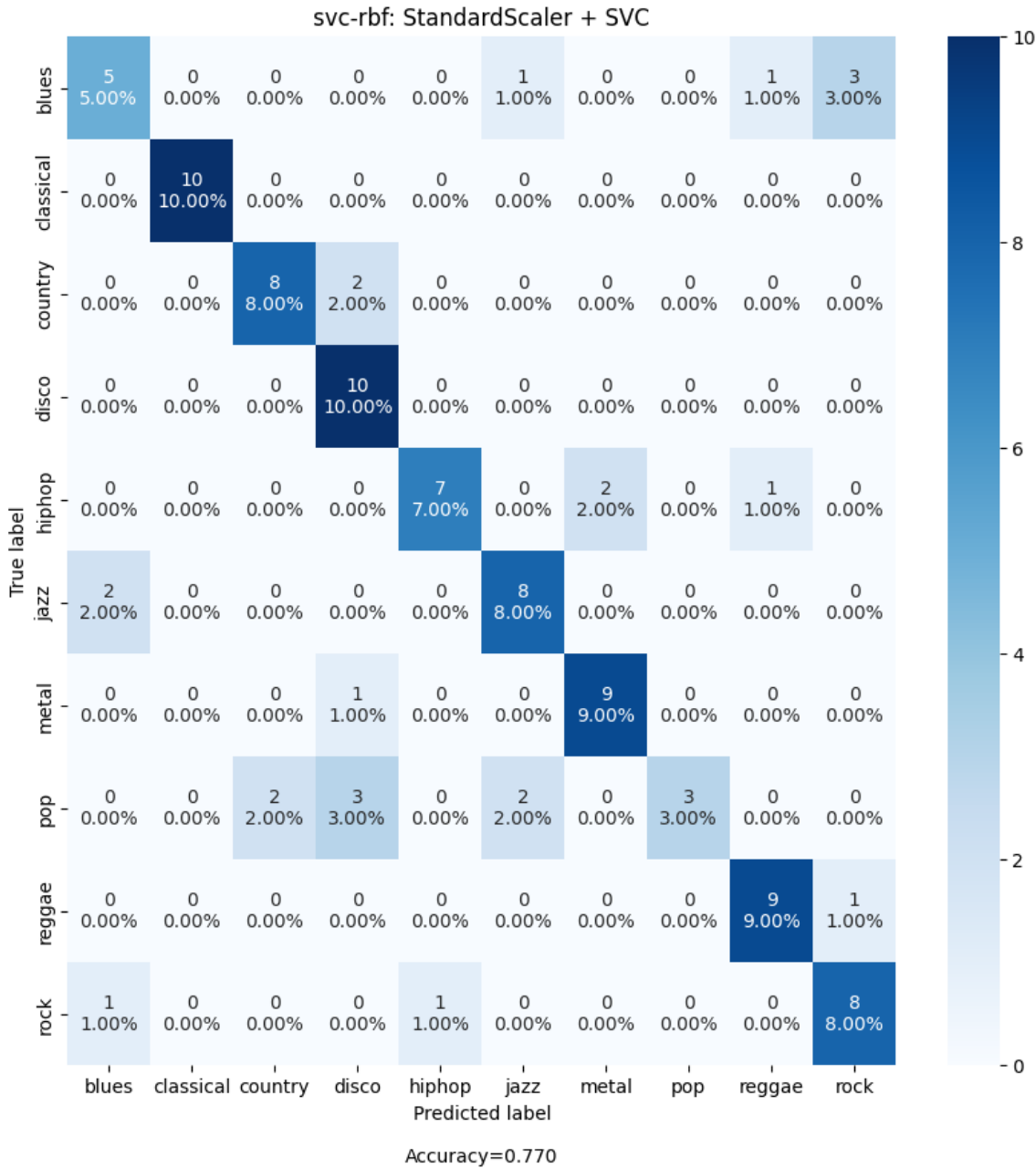


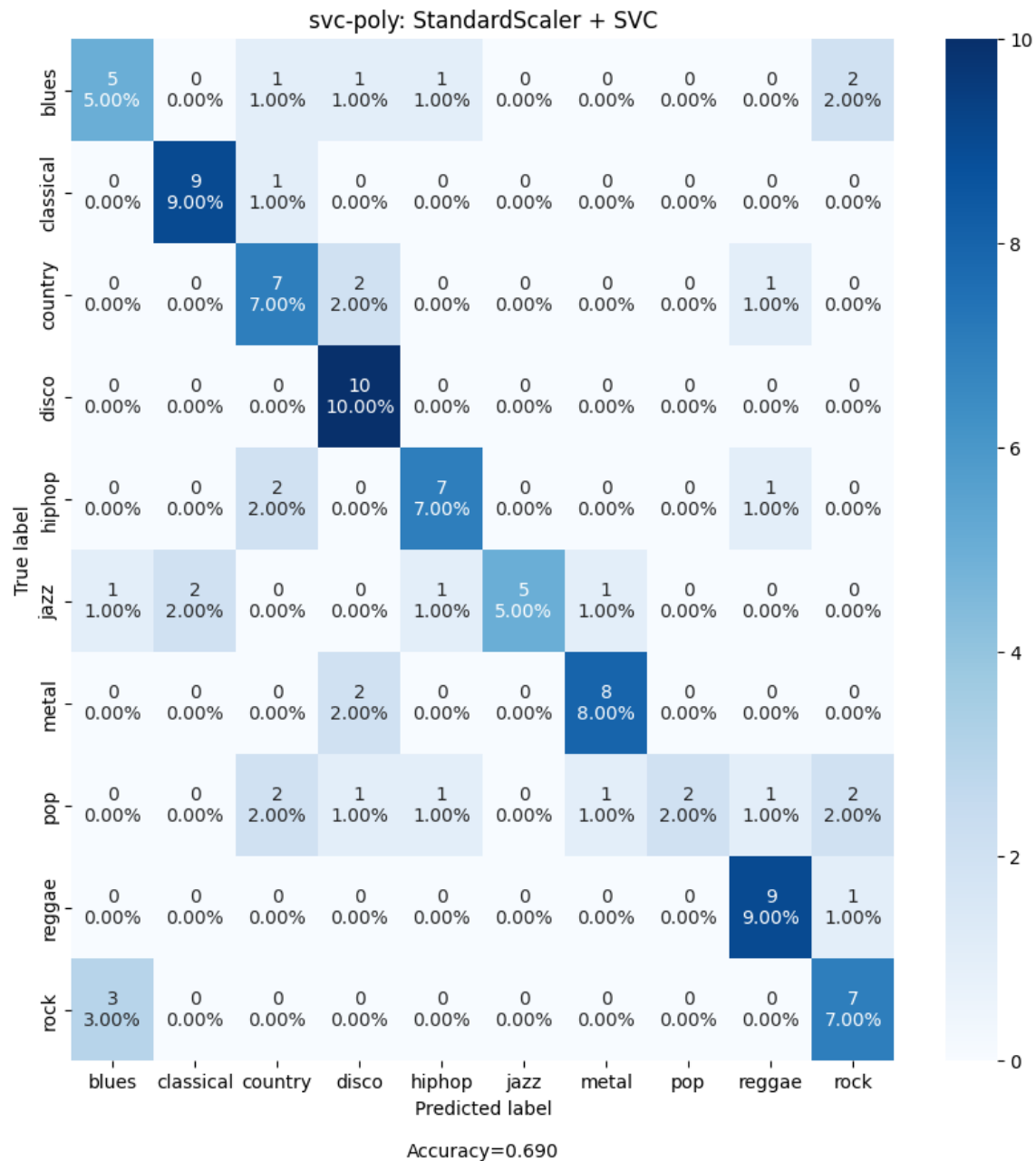


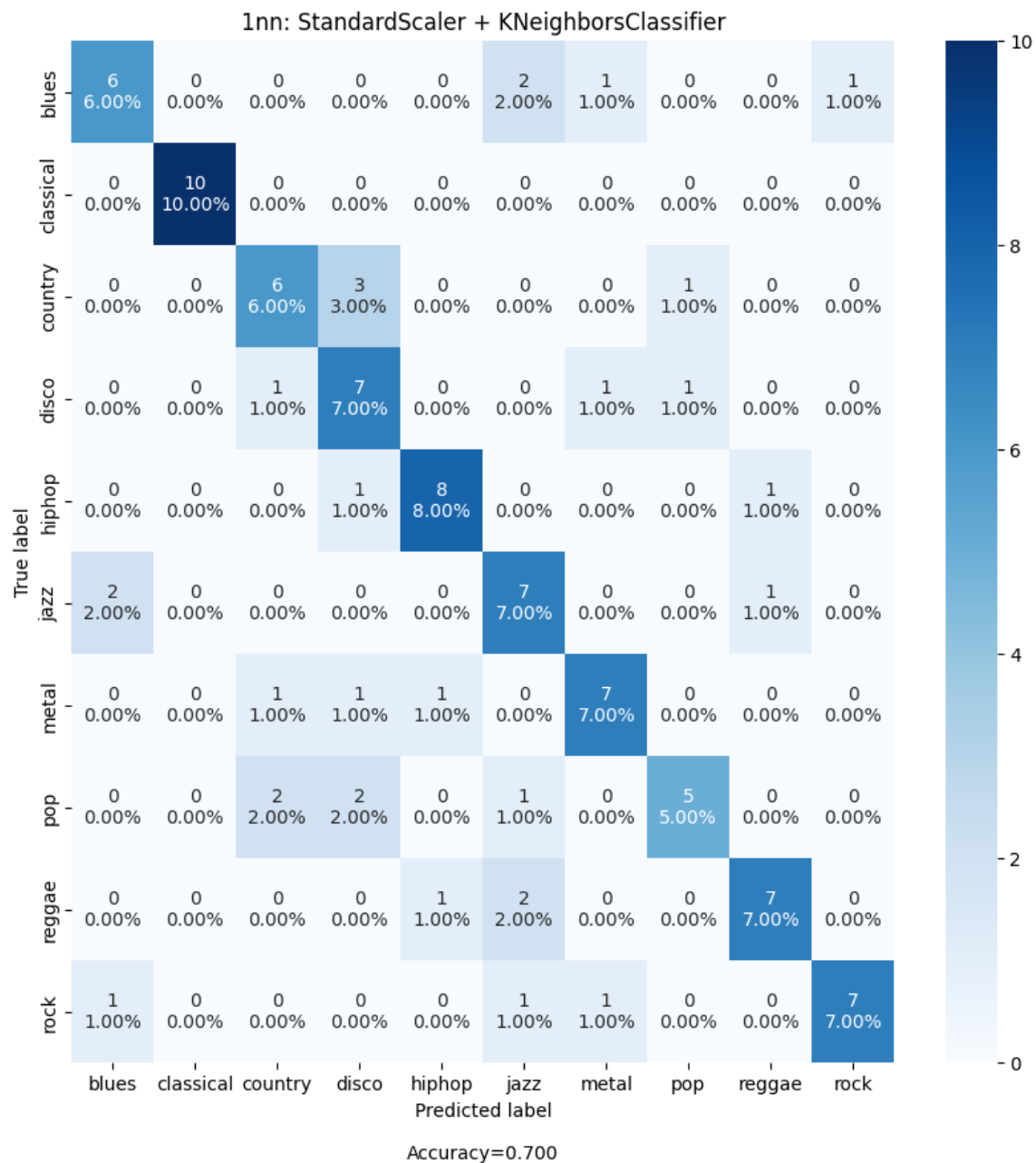


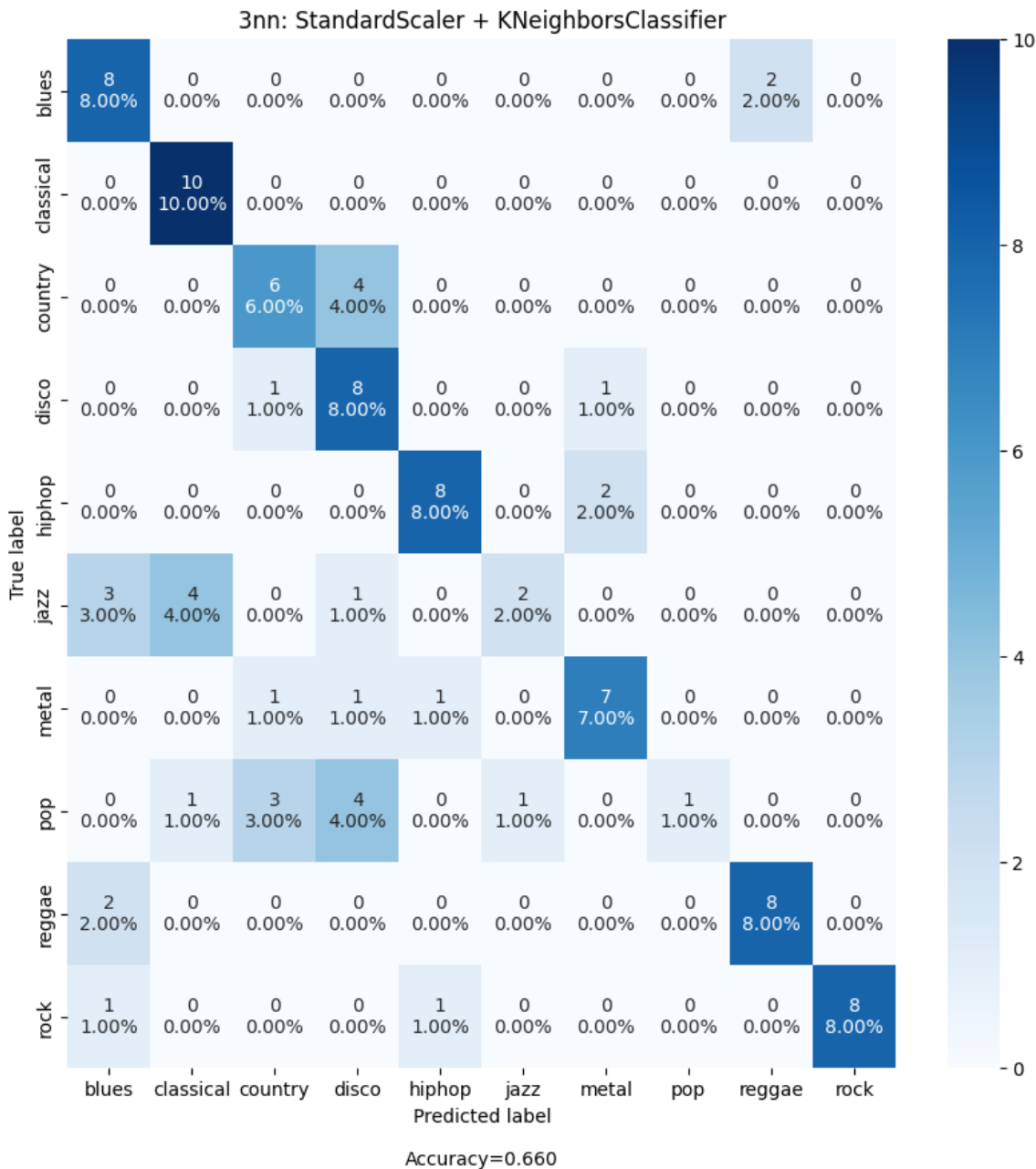


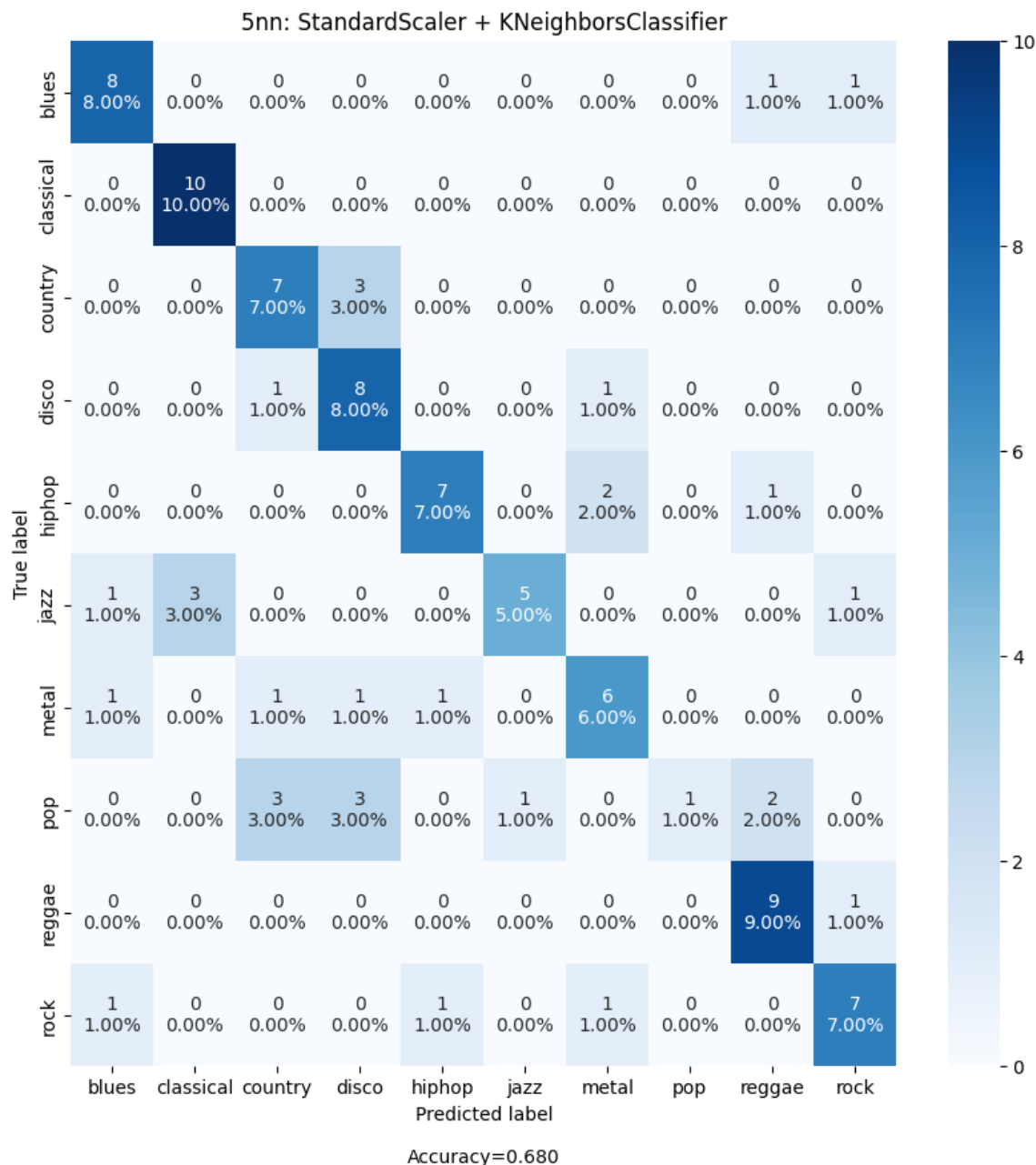












10.3.2 Testujemy wszystkie klasyfikatory stosując walidację krzyżową

```
In [31]: from sklearn.model_selection import cross_validate
from sklearn.utils import Bunch

scoring = ['accuracy', 'precision_macro', 'recall_macro', 'f1_macro']
results = Bunch()
for k in configs:
    pipeline = make_pipeline(configs[k][0], configs[k][1])
    results[k] = cross_validate(pipeline, X, y, cv=10, scoring=scoring)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.  
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set  
to 0.0 in labels with no predicted samples. Use `zero_division` paramete  
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_warn_prf(average, modifier, msg_start, len(result))  
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```

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```



```

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```



```

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```

```
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.  
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set  
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.  
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.  
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set  
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    _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
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    _warn_prf(average, modifier, msg_start, len(result))

```

```
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.  
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.  
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_warn_prf(average, modifier, msg_start, len(result))
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.  
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to 0.0 in labels with no predicted samples. Use `zero_division` paramete  
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to 0.0 in labels with no predicted samples. Use `zero_division` paramete  
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py:1344: UndefinedMetricWarning: Precision is ill-defined and being set  
to 0.0 in labels with no predicted samples. Use `zero_division` paramete  
r to control this behavior.  
_warn_prf(average, modifier, msg_start, len(result))
```

Tym razem results jest słownikiem, który nazwie konfiguracji przypisuje wyniki walidacji krzyżowej. A wyniki to odwzorowanie metryka->lista rezultatów.

```
In [32]: # print(results)
for k in results:
    print(k)
    print(results[k])

rdf = pd.DataFrame(results)
rdf.head(10)
```


rf	svc-rbf	svc-poly	1nn	
828186035, 396850586, 0.2...	[0.019768714904785156, 0.012266397476196289, 0...	[0.011017560958862305, 0.011648416519165039, 0...	[0.008373260498046875, 0.00721287727355957, 0....	[0.0161061286 0.0068564414
308642578, 278442383, 0....	[0.015492677688598633, 0.013662099838256836, 0...	[0.011869668960571289, 0.010558366775512695, 0...	[0.010952949523925781, 0.019799470901489258, 0...	[0.0252254009 0.018881082
0.8, 0.7, 0.8, 7, 0.9, 0.9, ...	[0.7, 0.7, 0.8, 0.8, 0.7, 0.8, 0.9, 0.9, 0.7, ...	[0.7, 0.6, 0.5, 0.8, 0.8, 0.7, 0.7, 0.8, 0.7, ...	[0.5, 0.7, 0.7, 0.7, 0.7, 0.8, 1.0, 0.7, 0.7, ...	[0.5, 0.6, 0.7, 0.7, 0.7,
[0.85, 333333333, 0.7, 0.6, 0.7...	[0.6, 0.6, 0.7, 0.7, 0.55, 0.7333333333333333,...	[0.65, 0.45, 0.3333333333333333, 0.7, 0.7, 0.5...	[0.45, 0.65, 0.6333333333333333, 0.55, 0.6, 0....	0.433333333 0.55, 0.55, ...
0.8, 0.7, 0.8, 7, 0.9, 0.9, ...	[0.7, 0.7, 0.8, 0.8, 0.7, 0.8, 0.9, 0.9, 0.7, ...	[0.7, 0.6, 0.5, 0.8, 0.8, 0.7, 0.7, 0.8, 0.7, ...	[0.5, 0.7, 0.7, 0.7, 0.7, 0.8, 1.0, 0.7, 0.7, ...	[0.5, 0.6, 0.7, 0.7, 0.7,
366666668, 0.65, 99999997...	[0.6333333333333333, 0.6333333333333333, 0.733...	[0.6666666666666666, 0.5, 0.3833333333333333, ...	[0.4666666666666666, 0.6666666666666666, 0.65,...	[0.433333333 0.483333333

TODO 10.3.2

- Rozpakujmy te wyniki, tak aby w tabeli summary znalazły się wiersze podające średnie wartości metryk dla poszczególnych klasyfikatorów.

```
In [33]: summary = pd.DataFrame(columns=['classifier', 'acc', 'prec', 'recall', 'f1'])
for k in results:
    acc = results[k]['test_accuracy'].mean()
    prec = results[k]['test_precision_macro'].mean()
    recall = results[k]['test_recall_macro'].mean()
    f1 = results[k]['test_f1_macro'].mean()
    row = [k, acc, prec, recall, f1]
    summary.loc[len(summary), :] = row
summary.head(20)
```

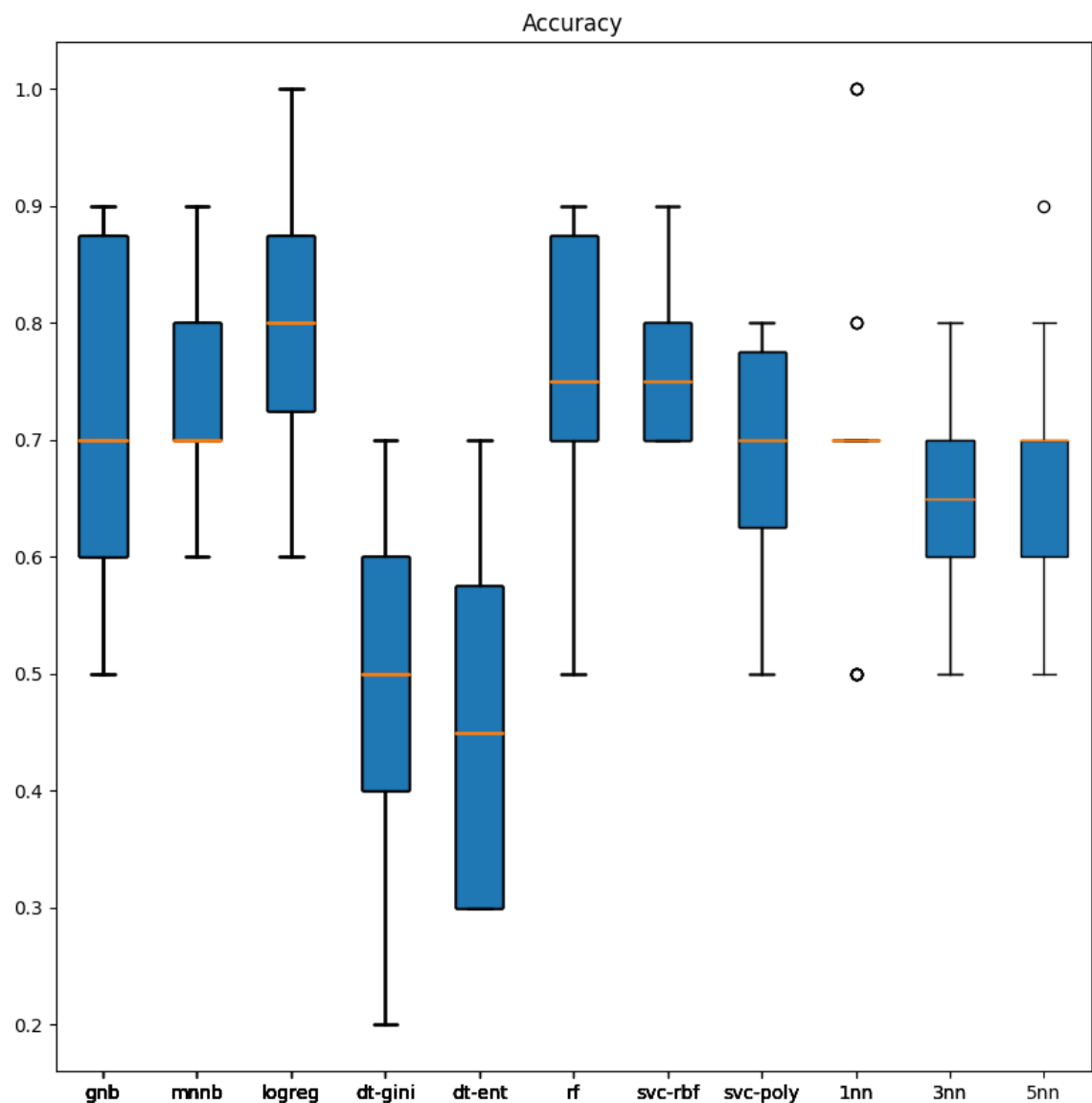
```
Out [33]:
```

	classifier	acc	prec	recall	f1
0	gnb	0.71	0.63	0.71	0.655
1	mnnb	0.74	0.651667	0.74	0.68
2	logreg	0.8	0.713333	0.8	0.741667
3	dt-gini	0.48	0.335	0.48	0.38
4	dt-ent	0.45	0.346667	0.45	0.38
5	rf	0.75	0.661667	0.75	0.69
6	svc-rbf	0.77	0.673333	0.77	0.705
7	svc-poly	0.69	0.57	0.69	0.608333
8	1nn	0.7	0.618333	0.7	0.643333
9	3nn	0.66	0.53	0.66	0.571667
10	5nn	0.68	0.576667	0.68	0.608333

10.3.3 Boxplots

Rysujemy wykres *boxplots*. Przeczytaj, jak należy go interpretować [Wikipedia](#)

```
In [34]: labels=[]
data=[]
for k in results:
    labels.append(k)
    data.append(results[k]['test_accuracy'])
plt.boxplot(data,vert=True, # vertical box alignment
            patch_artist=True, # fill with color
            labels=labels)
plt.title('Accuracy')
```



TODO 10.3.3

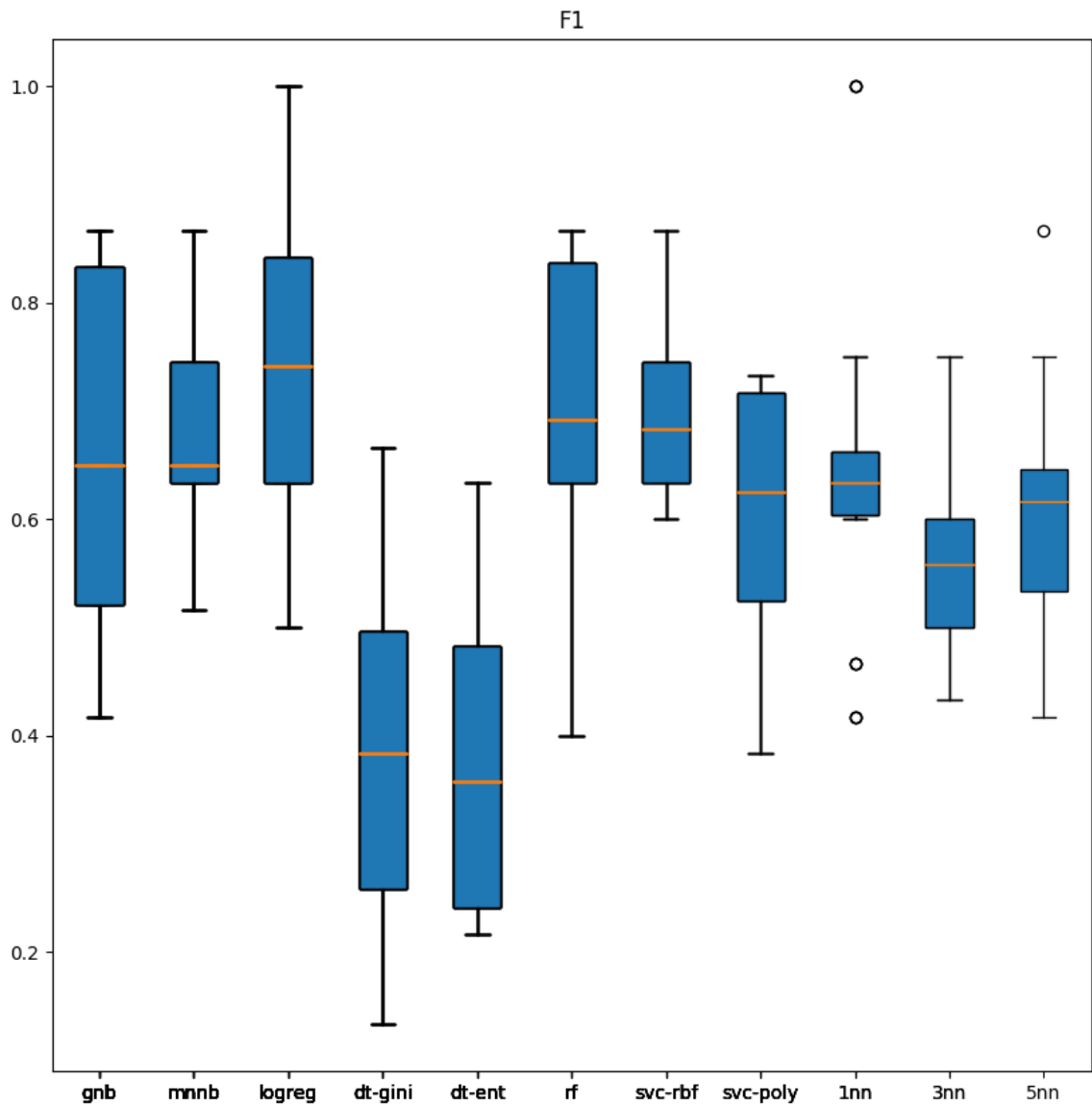
- Obserwując wartości F1, który klasyfikator wydaje się najlepszy (dla tego zbioru danych)
- Czy 1nn jest "lepszy" niż 3nn?

```
In [35]: labels=[]
data=[]
```

```

for k in results:
    labels.append(k)
    data.append(results[k]['test_f1_macro'])
    plt.boxplot(data,vert=True, # vertical box alignment
                patch_artist=True, # fill with color
                labels=labels)
plt.title('F1')

```



Najlepszy wydaje się klasyfikator logreg.

1nn jest lepszy niż 3nn.

10.4. Optymalizacja parametrów

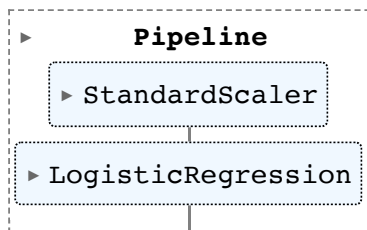
Zakładając, że mamy zbiory parametrów A, B, C, \dots, Z procedura *grid search* bada wszystkie kombinacje ze zbioru $A \times B \times C \times \dots \times Z$, natomiast *random search* losowo wybiera określoną liczbę kombinacji.

10.4.1 Grid search

Zastosujemy do regresji logistycznej. W rzeczywistości będziemy dobierali tylko jeden parameter.

```
In [36]: from sklearn.model_selection import GridSearchCV
pipeline = make_pipeline(configs['logreg'][0], configs['logreg'][1])
pipeline
```

Out [36]:



StandardScaler nie ma zbyt wielu parametrów, ale LogisticRegression można dobierać stałą regularyzacji C.

Sprawdźmy, jakie nazwy mają parametry dla pipeline...

```
In [37]: pipeline.get_params().keys()
```

```
Out [37]: dict_keys(['memory', 'steps', 'verbose', 'standardscaler', 'logisticregression', 'standardscaler__copy', 'standardscaler__with_mean', 'standardscaler__with_std', 'logisticregression__C', 'logisticregression__class_weight', 'logisticregression__dual', 'logisticregression__fit_intercept', 'logisticregression__intercept_scaling', 'logisticregression__l1_ratio', 'logisticregression__max_iter', 'logisticregression__multi_class', 'logisticregression__n_jobs', 'logisticregression__penalty', 'logisticregression__random_state', 'logisticregression__solver', 'logisticregression__tol', 'logisticregression__verbose', 'logisticregression__warm_start'])
```

```
In [38]: C=[100,50,20,10,8,5,3,2,1.0,0.8,0.5,0.2,0.1,0.05]
print(C)
params={'logisticregression__C':C}
grid = GridSearchCV(pipeline, params, scoring="f1_macro", cv=10, verbose=3)
grid.fit(X, y)
grid.best_params_
```

```
[100, 50, 20, 10, 8, 5, 3, 2, 1.0, 0.8, 0.5, 0.2, 0.1, 0.05]
Fitting 10 folds for each of 14 candidates, totalling 140 fits
[CV 1/10] END .....logisticregression__C=100;; score=1.000 total time
= 0.0s
[CV 2/10] END .....logisticregression__C=100;; score=0.767 total time
= 0.0s
[CV 3/10] END .....logisticregression__C=100;; score=0.600 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=100;; score=0.600 total time
= 0.0s
[CV 5/10] END .....logisticregression__C=100;; score=0.767 total time
= 0.0s
[CV 6/10] END .....logisticregression__C=100;; score=0.617 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=100;; score=0.750 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=100;; score=0.867 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=100;; score=0.867 total time
= 0.0s
[CV 10/10] END .....logisticregression__C=100;; score=0.733 total time
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[CV 1/10] END .....logisticregression__C=50;; score=1.000 total time
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[CV 2/10] END .....logisticregression__C=50;; score=0.767 total time
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[CV 3/10] END .....logisticregression__C=50;; score=0.600 total time
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[CV 5/10] END .....logisticregression__C=50;; score=0.767 total time
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[CV 6/10] END .....logisticregression__C=50;; score=0.617 total time
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[CV 1/10] END .....logisticregression__C=20;; score=1.000 total time
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[CV 2/10] END .....logisticregression__C=20;; score=0.767 total time
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[CV 3/10] END .....logisticregression__C=20;; score=0.600 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=20;; score=0.600 total time
= 0.0s
[CV 5/10] END .....logisticregression__C=20;; score=0.767 total time
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[CV 6/10] END .....logisticregression__C=20;; score=0.617 total time
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[CV 7/10] END .....logisticregression__C=20;; score=0.867 total time
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[CV 8/10] END .....logisticregression__C=20;; score=0.867 total time
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[CV 9/10] END .....logisticregression__C=20;; score=0.867 total time
= 0.0s
```

```
[CV 10/10] END .....logisticregression__C=20;; score=0.733 total time
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[CV 1/10] END .....logisticregression__C=10;; score=1.000 total time
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[CV 3/10] END .....logisticregression__C=10;; score=0.600 total time
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[CV 4/10] END .....logisticregression__C=10;; score=0.600 total time
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[CV 5/10] END .....logisticregression__C=10;; score=0.767 total time
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[CV 10/10] END .....logisticregression__C=10;; score=0.733 total time
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[CV 2/10] END .....logisticregression__C=8;; score=0.767 total time
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[CV 3/10] END .....logisticregression__C=8;; score=0.600 total time
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[CV 4/10] END .....logisticregression__C=8;; score=0.600 total time
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[CV 5/10] END .....logisticregression__C=8;; score=0.767 total time
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[CV 8/10] END .....logisticregression__C=8;; score=0.867 total time
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[CV 9/10] END .....logisticregression__C=8;; score=0.867 total time
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[CV 1/10] END .....logisticregression__C=5;; score=1.000 total time
= 0.0s
[CV 2/10] END .....logisticregression__C=5;; score=0.767 total time
= 0.0s
[CV 3/10] END .....logisticregression__C=5;; score=0.600 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=5;; score=0.600 total time
= 0.0s
[CV 5/10] END .....logisticregression__C=5;; score=0.767 total time
= 0.0s
[CV 6/10] END .....logisticregression__C=5;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=5;; score=0.867 total time
= 0.1s
[CV 8/10] END .....logisticregression__C=5;; score=0.733 total time
= 0.1s
[CV 9/10] END .....logisticregression__C=5;; score=0.867 total time
= 0.2s
```

```
[CV 10/10] END .....logisticregression__C=5;; score=0.733 total time
= 0.2s
[CV 1/10] END .....logisticregression__C=3;; score=1.000 total time
= 0.1s
[CV 2/10] END .....logisticregression__C=3;; score=0.733 total time
= 0.1s
[CV 3/10] END .....logisticregression__C=3;; score=0.600 total time
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[CV 4/10] END .....logisticregression__C=3;; score=0.600 total time
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[CV 5/10] END .....logisticregression__C=3;; score=0.767 total time
= 0.0s
[CV 6/10] END .....logisticregression__C=3;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=3;; score=0.867 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=3;; score=0.733 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=3;; score=0.867 total time
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[CV 10/10] END .....logisticregression__C=3;; score=0.733 total time
= 0.0s
[CV 1/10] END .....logisticregression__C=2;; score=1.000 total time
= 0.0s
[CV 2/10] END .....logisticregression__C=2;; score=0.733 total time
= 0.0s
[CV 3/10] END .....logisticregression__C=2;; score=0.600 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=2;; score=0.600 total time
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[CV 5/10] END .....logisticregression__C=2;; score=0.767 total time
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[CV 6/10] END .....logisticregression__C=2;; score=0.750 total time
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[CV 7/10] END .....logisticregression__C=2;; score=0.867 total time
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[CV 8/10] END .....logisticregression__C=2;; score=0.733 total time
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[CV 3/10] END .....logisticregression__C=1.0;; score=0.600 total time
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[CV 4/10] END .....logisticregression__C=1.0;; score=0.600 total time
= 0.0s
[CV 5/10] END .....logisticregression__C=1.0;; score=0.767 total time
= 0.0s
[CV 6/10] END .....logisticregression__C=1.0;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=1.0;; score=0.867 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=1.0;; score=0.733 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=1.0;; score=0.867 total time
= 0.0s
```



```
[CV 10/10] END .....logisticregression__C=1.0;; score=0.500 total time
= 0.0s
[CV 1/10] END .....logisticregression__C=0.8;; score=1.000 total time
= 0.0s
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= 0.0s
[CV 3/10] END .....logisticregression__C=0.8;; score=0.600 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=0.8;; score=0.600 total time
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= 0.0s
[CV 6/10] END .....logisticregression__C=0.8;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=0.8;; score=0.867 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=0.8;; score=0.733 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=0.8;; score=0.867 total time
= 0.0s
[CV 10/10] END .....logisticregression__C=0.8;; score=0.500 total time
= 0.0s
[CV 1/10] END .....logisticregression__C=0.5;; score=1.000 total time
= 0.0s
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= 0.0s
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= 0.0s
[CV 4/10] END .....logisticregression__C=0.5;; score=0.600 total time
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[CV 5/10] END .....logisticregression__C=0.5;; score=0.767 total time
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[CV 6/10] END .....logisticregression__C=0.5;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=0.5;; score=0.867 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=0.5;; score=0.733 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=0.5;; score=0.867 total time
= 0.0s
[CV 10/10] END .....logisticregression__C=0.5;; score=0.500 total time
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[CV 3/10] END .....logisticregression__C=0.2;; score=0.600 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=0.2;; score=0.600 total time
= 0.0s
[CV 5/10] END .....logisticregression__C=0.2;; score=0.667 total time
= 0.0s
[CV 6/10] END .....logisticregression__C=0.2;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=0.2;; score=0.867 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=0.2;; score=0.733 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=0.2;; score=0.867 total time
= 0.0s
```

```
[CV 10/10] END .....logisticregression__C=0.2;; score=0.300 total time
= 0.0s
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= 0.0s
[CV 2/10] END .....logisticregression__C=0.1;; score=0.733 total time
= 0.0s
[CV 3/10] END .....logisticregression__C=0.1;; score=0.600 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=0.1;; score=0.600 total time
= 0.0s
[CV 5/10] END .....logisticregression__C=0.1;; score=0.733 total time
= 0.0s
[CV 6/10] END .....logisticregression__C=0.1;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=0.1;; score=0.867 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=0.1;; score=0.733 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=0.1;; score=0.867 total time
= 0.0s
[CV 10/10] END .....logisticregression__C=0.1;; score=0.400 total time
= 0.0s
[CV 1/10] END .....logisticregression__C=0.05;; score=0.733 total time
= 0.0s
[CV 2/10] END .....logisticregression__C=0.05;; score=0.733 total time
= 0.0s
[CV 3/10] END .....logisticregression__C=0.05;; score=0.500 total time
= 0.0s
[CV 4/10] END .....logisticregression__C=0.05;; score=0.600 total time
= 0.0s
[CV 5/10] END .....logisticregression__C=0.05;; score=0.600 total time
= 0.0s
[CV 6/10] END .....logisticregression__C=0.05;; score=0.750 total time
= 0.0s
[CV 7/10] END .....logisticregression__C=0.05;; score=0.733 total time
= 0.0s
[CV 8/10] END .....logisticregression__C=0.05;; score=0.667 total time
= 0.0s
[CV 9/10] END .....logisticregression__C=0.05;; score=0.867 total time
= 0.0s
[CV 10/10] END .....logisticregression__C=0.05;; score=0.600 total time
= 0.0s
```

```
Out[38]: {'logisticregression__C': 50}
```

```
In [39]: pipeline=make_pipeline(StandardScaler(), LogisticRegression(C=grid.best_p
scoring = ['accuracy','precision_macro','recall_macro','f1_macro']
# scoring = scoring=['accuracy','f1_macro']
cv_results = cross_validate(pipeline, X, y, cv=10,scoring=scoring)
for k in cv_results:
    print(f'{k}={cv_results[k].mean()}')
```

```

/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))
fit_time=0.029514074325561523
score_time=0.008321714401245118
test_accuracy=0.8200000000000001
test_precision_macro=0.7433333333333333
test_recall_macro=0.8200000000000001
test_f1_macro=0.7683333333333333

/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.
py:1344: UndefinedMetricWarning: Precision is ill-defined and being set
to 0.0 in labels with no predicted samples. Use `zero_division` paramete
r to control this behavior.
    _warn_prf(average, modifier, msg_start, len(result))

```

10.4.2 Random search

Zastosujemy do SVM z kernelem RBF.

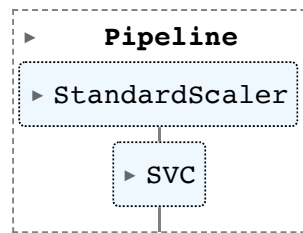
```

In [40]: from sklearn.model_selection import RandomizedSearchCV
pipeline = make_pipeline(configs['svc-rbf'][0], configs['svc-rbf'][1])

```

pipeline

Out [40]:



Użyjemy klasy `RandomizedSearchCV`. Parametr `n_iter` określa, ile konfiguracji będzie testowane. Zdefiniujemy 10000 konfiguracji.

Wypróbujemy dwa parametry C oraz gamma.

TODO 10.4.1

- Zdefiniuj C jako listę/wektor 100 wartości od 0 do 2
- Zdefiniuj gamma jako listę/wektor 100 wartości od 0.01 do 2

```

In [41]: C = np.linspace(0, 2, 100)
gamma = np.linspace(0.01, 2, 100)
params={'svc__C':C,'svc__gamma':gamma}
grid = RandomizedSearchCV(pipeline, params, scoring="f1_macro",cv=10, n_i
grid.fit(X, y)
grid.best_params_
  
```

Fitting 10 folds for each of 100 candidates, totalling 1000 fits

[CV 1/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.325 total time= 0.1s

[CV 2/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.300 total time= 0.1s

[CV 3/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.295 total time= 0.1s

[CV 4/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.022 total time= 0.0s

[CV 5/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.075 total time= 0.1s

[CV 6/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.200 total time= 0.1s

[CV 7/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.222 total time= 0.1s

[CV 8/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.125 total time= 0.0s

[CV 9/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.429 total time= 0.0s

[CV 10/10] END svc__C=0.3838383838383837, svc__gamma=0.41202020202020206;; score=0.100 total time= 0.0s

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[CV 2/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.300 total time= 0.0s

[CV 3/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.222 total time= 0.0s

[CV 4/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.020 total time= 0.0s

[CV 5/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.075 total time= 0.0s

[CV 6/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.195 total time= 0.0s

[CV 7/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.222 total time= 0.0s

[CV 8/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.125 total time= 0.0s

[CV 9/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.429 total time= 0.1s

[CV 10/10] END svc__C=0.16161616161616163, svc__gamma=0.592929292929293;; score=0.100 total time= 0.0s

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[CV 2/10] END svc__C=0.48484848484848486, svc__gamma=0.29141414141414146;; score=0.300 total time= 0.0s

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[CV 4/10] END svc__C=0.48484848484848486, svc__gamma=0.29141414141414146;; score=0.122 total time= 0.0s

[CV 5/10] END svc__C=0.48484848484848486, svc__gamma=0.29141414141414146;; score=0.025 total time= 0.0s

[CV 6/10] END svc__C=0.48484848484848486, svc__gamma=0.29141414141414146;; score=0.192 total time= 0.0s

[CV 7/10] END svc__C=0.48484848484848486, svc__gamma=0.29141414141414146;; score=0.225 total time= 0.0s

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```
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score=0.222 total time= 0.0s
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[CV 10/10] END svc__C=1.7575757575757578, svc__gamma=1.055252525252525
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```

```
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[CV 7/10] END svc__C=0.36363636363636365, svc__gamma=0.5326262626262627;; score=0.222 total time= 0.0s
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[CV 9/10] END svc__C=0.36363636363636365, svc__gamma=0.5326262626262627;; score=0.429 total time= 0.0s
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[CV 7/10] END svc__C=1.8989898989898992, svc__gamma=0.6934343434343435;; score=0.225 total time= 0.0s
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[CV 8/10] END svc__C=1.7575757575757578, svc__gamma=0.8542424242424242;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.7575757575757578, svc__gamma=0.8542424242424242;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.7575757575757578, svc__gamma=0.8542424242424242
```

```
2;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.222 total time= 0.0s
[CV 5/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.092 total time= 0.0s
[CV 6/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.090909090909091, svc__gamma=0.4723232323232327;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.090909090909091, svc__gamma=0.472323232323232
7;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.325 total time= 0.0s
[CV 4/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.022 total time= 0.0s
[CV 5/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.8181818181818183, svc__gamma=0.6733333333333333;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.8181818181818183, svc__gamma=0.673333333333333
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.8484848484848485, svc__gamma=0.5527272727272727;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.8484848484848485, svc__gamma=0.552727272727272
```



```
7;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.022 total time= 0.0s
[CV 5/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.025 total time= 0.0s
[CV 6/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.200 total time= 0.0s
[CV 7/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.225 total time= 0.0s
[CV 8/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.08080808080808081, svc__gamma=0.3517171717171717
6;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.42424242424242425, svc__gamma=0.4924242424242424
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.333 total time= 0.0s
[CV 3/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.283 total time= 0.0s
[CV 4/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.092 total time= 0.0s
[CV 5/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.140 total time= 0.0s
[CV 6/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.295 total time= 0.0s
[CV 7/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.295 total time= 0.0s
[CV 8/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.225 total time= 0.0s
[CV 9/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454546;;
score=0.417 total time= 0.0s
[CV 10/10] END svc__C=0.8484848484848485, svc__gamma=0.9145454545454545
```

```
6;; score=0.067 total time= 0.0s
[CV 1/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.325 total time= 0.0s
[CV 4/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.022 total time= 0.0s
[CV 5/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.878787878787879, svc__gamma=0.6532323232323233;;,
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;, s
core=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.676767676767677, svc__gamma=1.396969696969697;;,
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.617 total time= 0.0s
[CV 2/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.500 total time= 0.0s
[CV 3/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.295 total time= 0.0s
[CV 5/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.483 total time= 0.0s
[CV 6/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.617 total time= 0.0s
[CV 7/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.517 total time= 0.0s
[CV 8/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.750 total time= 0.0s
[CV 9/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
6;;, score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.6262626262626263, svc__gamma=0.05020202020202020
```

```
6;; score=0.317 total time= 0.0s
[CV 1/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.667 total time= 0.0s
[CV 3/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.650 total time= 0.0s
[CV 4/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.600 total time= 0.0s
[CV 5/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.633 total time= 0.0s
[CV 6/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.750 total time= 0.0s
[CV 7/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=1.000 total time= 0.0s
[CV 8/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.633 total time= 0.0s
[CV 9/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.2828282828282829, svc__gamma=1.819090909090909;;
score=0.417 total time= 0.0s
[CV 1/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.676767676767677, svc__gamma=0.8542424242424242;;
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.2323232323232325, svc__gamma=1.2361616161616162
```

```
2;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.3131313131313131, svc__gamma=1.597979797979798;;
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.283 total time= 0.0s
[CV 4/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.069 total time= 0.0s
[CV 6/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.325 total time= 0.0s
[CV 8/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.225 total time= 0.0s
[CV 9/10] END svc__C=0.42424242424242425, svc__gamma=0.79393939393939394;;
score=0.440 total time= 0.0s
[CV 10/10] END svc__C=0.42424242424242425, svc__gamma=0.7939393939393939
4;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.325 to
tal time= 0.0s
[CV 2/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.300 to
tal time= 0.0s
[CV 3/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.222 to
tal time= 0.0s
[CV 4/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.022 to
tal time= 0.0s
[CV 5/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.025 to
tal time= 0.0s
[CV 6/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.195 to
tal time= 0.0s
[CV 7/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.222 to
tal time= 0.0s
[CV 8/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.125 to
tal time= 0.0s
[CV 9/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.429 to
tal time= 0.0s
[CV 10/10] END svc__C=2.0, svc__gamma=0.914545454545454546;; score=0.100 t
```

```
total time= 0.0s
[CV 1/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.325 total time= 0.0s
[CV 4/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.022 total time= 0.0s
[CV 5/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.7979797979797982, svc__gamma=0.6331313131313132;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.7979797979797982, svc__gamma=0.633131313131313
2;, score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.329 total time= 0.0s
[CV 2/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.400 total time= 0.0s
[CV 3/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.225 total time= 0.0s
[CV 5/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.407 total time= 0.0s
[CV 6/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.133 total time= 0.0s
[CV 7/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.329 total time= 0.0s
[CV 9/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.494949494949495, svc__gamma=0.3115151515151515;,
score=0.200 total time= 0.0s
[CV 1/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
3;, score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.48484848484848486, svc__gamma=0.673333333333333
```

```
3;;, score=0.100 total time= 0.0s
[CV 1/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.325 tot
al time= 0.0s
[CV 2/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.300 tot
al time= 0.0s
[CV 3/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.329 tot
al time= 0.0s
[CV 4/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.122 tot
al time= 0.0s
[CV 5/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.025 tot
al time= 0.0s
[CV 6/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.200 tot
al time= 0.0s
[CV 7/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.225 tot
al time= 0.0s
[CV 8/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.125 tot
al time= 0.0s
[CV 9/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.429 tot
al time= 0.0s
[CV 10/10] END svc__C=2.0, svc__gamma=0.592929292929293;;, score=0.100 to
tal time= 0.0s
[CV 1/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.192 total time= 0.0s
[CV 2/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.440 total time= 0.0s
[CV 3/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.507 total time= 0.0s
[CV 4/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.200 total time= 0.0s
[CV 5/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.373 total time= 0.0s
[CV 6/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.550 total time= 0.0s
[CV 10/10] END svc__C=0.9696969696969697, svc__gamma=1.216060606060606;;,
score=0.150 total time= 0.0s
[CV 1/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545;;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.0505050505050506, svc__gamma=1.095454545454545
```

```
5;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.069 total time= 0.0s
[CV 6/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.16161616161616163, svc__gamma=0.7135353535353535
6;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.5454545454545455, svc__gamma=0.7336363636363636
6;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.533 total time= 0.0s
[CV 3/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.517 total time= 0.0s
[CV 4/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.383 total time= 0.0s
[CV 5/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.500 total time= 0.0s
[CV 6/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.733 total time= 0.0s
[CV 7/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.617 total time= 0.0s
[CV 8/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.567 total time= 0.0s
[CV 9/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
5;; score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.22222222222222224, svc__gamma=1.296464646464646
```

```
5;; score=0.383 total time= 0.0s
[CV 1/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.373 total time= 0.0s
[CV 2/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.417 total time= 0.0s
[CV 3/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.407 total time= 0.0s
[CV 4/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.200 total time= 0.0s
[CV 5/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.373 total time= 0.0s
[CV 6/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.407 total time= 0.0s
[CV 9/10] END svc__C=0.8080808080808082, svc__gamma=1.2562626262626264;;
score=0.517 total time= 0.0s
[CV 10/10] END svc__C=0.8080808080808082, svc__gamma=1.256262626262626
4;; score=0.150 total time= 0.0s
[CV 1/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.433 total time= 0.0s
[CV 2/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.325 total time= 0.0s
[CV 5/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.283 total time= 0.0s
[CV 6/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.229 total time= 0.0s
[CV 7/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.400 total time= 0.0s
[CV 8/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.433 total time= 0.0s
[CV 9/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.4040404040404041, svc__gamma=0.1105050505050505
1;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.333 total time= 0.0s
[CV 3/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.283 total time= 0.0s
[CV 4/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.092 total time= 0.0s
[CV 5/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.140 total time= 0.0s
[CV 6/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.295 total time= 0.0s
[CV 7/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.295 total time= 0.0s
[CV 8/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.6666666666666667, svc__gamma=0.9547474747474748;;
score=0.417 total time= 0.0s
[CV 10/10] END svc__C=0.6666666666666667, svc__gamma=0.954747474747474
```



```
8;;, score=0.067 total time= 0.0s
[CV 1/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.440 total time= 0.0s
[CV 3/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.507 total time= 0.0s
[CV 4/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.200 total time= 0.0s
[CV 5/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.373 total time= 0.0s
[CV 6/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.550 total time= 0.0s
[CV 10/10] END svc__C=0.14141414141414144, svc__gamma=1.035151515151515
2;;, score=0.150 total time= 0.0s
[CV 1/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.500 total time= 0.0s
[CV 2/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.500 total time= 0.0s
[CV 3/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.483 total time= 0.0s
[CV 4/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.373 total time= 0.0s
[CV 5/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.617 total time= 0.0s
[CV 6/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.617 total time= 0.0s
[CV 7/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.417 total time= 0.0s
[CV 8/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.617 total time= 0.0s
[CV 9/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.507 total time= 0.0s
[CV 10/10] END svc__C=1.494949494949495, svc__gamma=0.0904040404040404;;,
score=0.400 total time= 0.0s
[CV 1/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233;;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.9090909090909092, svc__gamma=0.6532323232323233
```

```
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.0505050505050506, svc__gamma=1.5778787878787879;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.0505050505050506, svc__gamma=1.577878787878787
9;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.122 total time= 0.0s
[CV 5/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.9393939393939394, svc__gamma=0.5527272727272727;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.9393939393939394, svc__gamma=0.552727272727272
7;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.333 total time= 0.0s
[CV 3/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.283 total time= 0.0s
[CV 4/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.092 total time= 0.0s
[CV 5/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.140 total time= 0.0s
[CV 6/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.295 total time= 0.0s
[CV 7/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.295 total time= 0.0s
[CV 8/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.225 total time= 0.0s
[CV 9/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
score=0.417 total time= 0.0s
[CV 10/10] END svc__C=0.7878787878787878, svc__gamma=0.9346464646464647;;
```

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score=0.067 total time= 0.0s
[CV 1/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.667 total time= 0.0s
[CV 3/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.650 total time= 0.0s
[CV 4/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.600 total time= 0.0s
[CV 5/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.633 total time= 0.0s
[CV 6/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.750 total time= 0.0s
[CV 7/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=1.000 total time= 0.0s
[CV 8/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.633 total time= 0.0s
[CV 9/10] END svc__C=0.6262626262626263, svc__gamma=1.8391919191919193;,
score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.6262626262626263, svc__gamma=1.839191919191919
3;, score=0.417 total time= 0.0s
[CV 1/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.7676767676767677, svc__gamma=0.7135353535353536;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.7676767676767677, svc__gamma=0.713535353535353
6;, score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 2/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 3/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 4/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 5/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 6/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 7/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 8/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 9/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tota
l time= 0.0s
[CV 10/10] END svc__C=0.0, svc__gamma=0.6331313131313132;, score=nan tot
```

```
al time= 0.0s
[CV 1/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.222 total time= 0.0s
[CV 5/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.092 total time= 0.0s
[CV 6/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.3131313131313131, svc__gamma=0.4321212121212121
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.3939393939393939, svc__gamma=1.7386868686868688;;
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.022 total time= 0.0s
[CV 5/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.200 total time= 0.0s
[CV 7/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.6868686868686867, svc__gamma=0.3718181818181818;;
```

```
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.225 total time= 0.0s
[CV 5/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.195 total time= 0.0s
[CV 6/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.8989898989898992, svc__gamma=0.4120202020202020
6;;, score=0.200 total time= 0.0s
[CV 1/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.567 total time= 0.0s
[CV 2/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.667 total time= 0.0s
[CV 3/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.650 total time= 0.0s
[CV 4/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.600 total time= 0.0s
[CV 5/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.550 total time= 0.0s
[CV 6/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.867 total time= 0.0s
[CV 7/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.867 total time= 0.0s
[CV 8/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.633 total time= 0.0s
[CV 9/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.686868686868687, svc__gamma=1.7587878787878788;;,
score=0.417 total time= 0.0s
[CV 1/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.2323232323232325, svc__gamma=1.8391919191919193;;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.2323232323232325, svc__gamma=1.839191919191919
```

```
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.440 total time= 0.0s
[CV 3/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.507 total time= 0.0s
[CV 4/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.200 total time= 0.0s
[CV 5/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.373 total time= 0.0s
[CV 6/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.6464646464646465, svc__gamma=1.0150505050505052;;
score=0.550 total time= 0.0s
[CV 10/10] END svc__C=0.6464646464646465, svc__gamma=1.015050505050505
2;; score=0.150 total time= 0.0s
[CV 1/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.333 total time= 0.0s
[CV 3/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.507 total time= 0.0s
[CV 4/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.092 total time= 0.0s
[CV 5/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.140 total time= 0.0s
[CV 6/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.550 total time= 0.0s
[CV 10/10] END svc__C=0.26262626262626265, svc__gamma=0.934646464646464
7;; score=0.067 total time= 0.0s
[CV 1/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.022 total time= 0.0s
[CV 5/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.0101010101010102, svc__gamma=0.7537373737373738;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.0101010101010102, svc__gamma=0.753737373737373
```

```
8;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.022 total time= 0.0s
[CV 5/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.200 total time= 0.0s
[CV 7/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
6;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.0202020202020204, svc__gamma=0.4120202020202020
06;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.272727272727273, svc__gamma=1.6180808080808082;;
score=0.100 total time= 0.0s
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score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949496;;
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score=0.650 total time= 0.0s
[CV 4/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949496;;
score=0.600 total time= 0.0s
[CV 5/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949496;;
score=0.633 total time= 0.0s
[CV 6/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949496;;
score=0.750 total time= 0.0s
[CV 7/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949496;;
score=1.000 total time= 0.0s
[CV 8/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949496;;
score=0.633 total time= 0.0s
[CV 9/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949496;;
score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.8484848484848485, svc__gamma=1.8994949494949494
```

```
6;; score=0.417 total time= 0.0s
[CV 1/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.633 t
otal time= 0.0s
[CV 2/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.633 t
otal time= 0.0s
[CV 3/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.733 t
otal time= 0.0s
[CV 4/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.733 t
otal time= 0.0s
[CV 5/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.533 t
otal time= 0.0s
[CV 6/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.750 t
otal time= 0.0s
[CV 7/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.867 t
otal time= 0.0s
[CV 8/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.867 t
otal time= 0.0s
[CV 9/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.733 t
otal time= 0.0s
[CV 10/10] END svc__C=1.9595959595959598, svc__gamma=0.01;; score=0.600
total time= 0.0s
[CV 1/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.440 total time= 0.0s
[CV 3/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.507 total time= 0.0s
[CV 4/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.200 total time= 0.0s
[CV 5/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.373 total time= 0.0s
[CV 6/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.9090909090909092, svc__gamma=1.1356565656565658;;
score=0.550 total time= 0.0s
[CV 10/10] END svc__C=0.9090909090909092, svc__gamma=1.135656565656565
8;; score=0.150 total time= 0.0s
[CV 1/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.329 total time= 0.0s
[CV 2/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.225 total time= 0.0s
[CV 5/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.407 total time= 0.0s
[CV 6/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.329 total time= 0.0s
[CV 9/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
4;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.0303030303030305, svc__gamma=0.3316161616161616
```



```
4;; score=0.200 total time= 0.0s
[CV 1/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.433 total time= 0.0s
[CV 2/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.500 total time= 0.0s
[CV 3/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.325 total time= 0.0s
[CV 5/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.283 total time= 0.0s
[CV 6/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.417 total time= 0.0s
[CV 7/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.400 total time= 0.0s
[CV 8/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.507 total time= 0.0s
[CV 9/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.020202020202020204, svc__gamma=0.090404040404040
4;; score=0.250 total time= 0.0s
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3;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.222 total time= 0.0s
[CV 5/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.092 total time= 0.0s
[CV 6/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.8585858585858588, svc__gamma=0.4321212121212121
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.1111111111111112, svc__gamma=1.5577777777777778;;
```

```
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505051;,
score=0.433 total time= 0.0s
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score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505051;,
score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505051;,
score=0.325 total time= 0.0s
[CV 5/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505051;,
score=0.283 total time= 0.0s
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score=0.229 total time= 0.0s
[CV 7/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505051;,
score=0.400 total time= 0.0s
[CV 8/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505051;,
score=0.433 total time= 0.0s
[CV 9/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505051;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.888888888888889, svc__gamma=0.110505050505050
1;, score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
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[CV 2/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.500 total time= 0.0s
[CV 3/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.483 total time= 0.0s
[CV 4/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.633 total time= 0.0s
[CV 5/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.533 total time= 0.0s
[CV 6/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.750 total time= 0.0s
[CV 7/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.633 total time= 0.0s
[CV 8/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.617 total time= 0.0s
[CV 9/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.617 total time= 0.0s
[CV 10/10] END svc__C=1.0303030303030305, svc__gamma=0.050202020202020
6;, score=0.400 total time= 0.0s
[CV 1/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
5;, score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
5;, score=0.533 total time= 0.0s
[CV 3/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
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[CV 4/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
5;, score=0.383 total time= 0.0s
[CV 5/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
5;, score=0.500 total time= 0.0s
[CV 6/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
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[CV 7/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
5;, score=0.617 total time= 0.0s
[CV 8/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
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[CV 9/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
5;, score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.20202020202020204, svc__gamma=1.296464646464646
```

```
5;; score=0.383 total time= 0.0s
[CV 1/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.225 total time= 0.0s
[CV 4/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.125 total time= 0.0s
[CV 5/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.025 total time= 0.0s
[CV 6/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.192 total time= 0.0s
[CV 7/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.225 total time= 0.0s
[CV 8/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.48484848484848486, svc__gamma=0.2713131313131313
4;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.5757575757575756, svc__gamma=1.0351515151515152;;
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.292929292929293, svc__gamma=1.3567676767676768;;
```

```
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.295 total time= 0.0s
[CV 4/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.022 total time= 0.0s
[CV 5/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.200 total time= 0.0s
[CV 7/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.6262626262626263, svc__gamma=0.4321212121212121
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.533 total time= 0.0s
[CV 3/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.650 total time= 0.0s
[CV 4/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.383 total time= 0.0s
[CV 5/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.500 total time= 0.0s
[CV 6/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.733 total time= 0.0s
[CV 7/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.617 total time= 0.0s
[CV 8/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.567 total time= 0.0s
[CV 9/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.18181818181818182, svc__gamma=1.296464646464646
5;; score=0.383 total time= 0.0s
[CV 1/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.329 total time= 0.0s
[CV 2/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.225 total time= 0.0s
[CV 5/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.300 total time= 0.0s
[CV 6/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.329 total time= 0.0s
[CV 9/10] END svc__C=1.292929292929293, svc__gamma=0.35171717171717176;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.292929292929293, svc__gamma=0.3517171717171717
```

```
6;; score=0.200 total time= 0.0s
[CV 1/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.567 total time= 0.0s
[CV 2/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.533 total time= 0.0s
[CV 3/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.650 total time= 0.0s
[CV 4/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.483 total time= 0.0s
[CV 5/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.500 total time= 0.0s
[CV 6/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.867 total time= 0.0s
[CV 7/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.750 total time= 0.0s
[CV 8/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.567 total time= 0.0s
[CV 9/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.483 total time= 0.0s
[CV 10/10] END svc__C=0.5454545454545455, svc__gamma=1.396969696969697;;
score=0.417 total time= 0.0s
[CV 1/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.595959595959596, svc__gamma=1.3567676767676768;;
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.329 total time= 0.0s
[CV 2/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.400 total time= 0.0s
[CV 3/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.225 total time= 0.0s
[CV 5/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.407 total time= 0.0s
[CV 6/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.133 total time= 0.0s
[CV 7/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.329 total time= 0.0s
[CV 9/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.6161616161616164, svc__gamma=0.3115151515151515
```

```
5;; score=0.200 total time= 0.0s
[CV 1/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.400 total time= 0.0s
[CV 2/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.500 total time= 0.0s
[CV 3/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.373 total time= 0.0s
[CV 4/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.267 total time= 0.0s
[CV 5/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.617 total time= 0.0s
[CV 6/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.440 total time= 0.0s
[CV 7/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.517 total time= 0.0s
[CV 8/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.617 total time= 0.0s
[CV 9/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.507 total time= 0.0s
[CV 10/10] END svc__C=1.6161616161616164, svc__gamma=0.1306060606060606
1;; score=0.333 total time= 0.0s
[CV 1/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.222 total time= 0.0s
[CV 5/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.092 total time= 0.0s
[CV 6/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.200 total time= 0.0s
[CV 7/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.5555555555555556, svc__gamma=0.4321212121212121
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.329 total time= 0.0s
[CV 4/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.173 total time= 0.0s
[CV 5/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.129 total time= 0.0s
[CV 6/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.192 total time= 0.0s
[CV 7/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.225 total time= 0.0s
[CV 8/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.225 total time= 0.0s
[CV 9/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
3;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.8686868686868687, svc__gamma=0.1708080808080808
```

```
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343435;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.70707070707072, svc__gamma=0.69343434343434
5;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.35353535353536, svc__gamma=1.31656565656566
7;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.325 total time= 0.0s
[CV 4/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.022 total time= 0.0s
[CV 5/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353536;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.85858585858588, svc__gamma=0.71353535353535
```

```
6;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.567 total time= 0.0s
[CV 2/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.667 total time= 0.0s
[CV 3/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.650 total time= 0.0s
[CV 4/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.600 total time= 0.0s
[CV 5/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.550 total time= 0.0s
[CV 6/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.867 total time= 0.0s
[CV 7/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.867 total time= 0.0s
[CV 8/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.567 total time= 0.0s
[CV 9/10] END svc__C=0.424242424242425, svc__gamma=1.597979797979798;;
score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.424242424242425, svc__gamma=1.59797979797979
8;; score=0.417 total time= 0.0s
[CV 1/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.283 total time= 0.0s
[CV 4/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.069 total time= 0.0s
[CV 6/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.295 total time= 0.0s
[CV 7/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.325 total time= 0.0s
[CV 8/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.225 total time= 0.0s
[CV 9/10] END svc__C=0.121212121212122, svc__gamma=0.793939393939394;;
score=0.417 total time= 0.0s
[CV 10/10] END svc__C=0.121212121212122, svc__gamma=0.79393939393939
4;; score=0.067 total time= 0.0s
[CV 1/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.533 total time= 0.0s
[CV 3/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.517 total time= 0.0s
[CV 4/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.283 total time= 0.0s
[CV 5/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.507 total time= 0.0s
[CV 6/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.600 total time= 0.0s
[CV 7/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.617 total time= 0.0s
[CV 8/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.617 total time= 0.0s
[CV 9/10] END svc__C=0.666666666666667, svc__gamma=1.2763636363636364;;
score=0.517 total time= 0.0s
[CV 10/10] END svc__C=0.666666666666667, svc__gamma=1.276363636363636
```



```
4;; score=0.283 total time= 0.0s
[CV 1/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.329 total time= 0.0s
[CV 2/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.500 total time= 0.0s
[CV 3/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.373 total time= 0.0s
[CV 4/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.225 total time= 0.0s
[CV 5/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.383 total time= 0.0s
[CV 6/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.233 total time= 0.0s
[CV 7/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.433 total time= 0.0s
[CV 8/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.517 total time= 0.0s
[CV 9/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.533 total time= 0.0s
[CV 10/10] END svc__C=1.0707070707070707, svc__gamma=0.2110101010101010
4;; score=0.300 total time= 0.0s
[CV 1/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.467 total time= 0.0s
[CV 2/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.533 total time= 0.0s
[CV 3/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.517 total time= 0.0s
[CV 4/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.383 total time= 0.0s
[CV 5/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.500 total time= 0.0s
[CV 6/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.733 total time= 0.0s
[CV 7/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.617 total time= 0.0s
[CV 8/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.617 total time= 0.0s
[CV 9/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.617 total time= 0.0s
[CV 10/10] END svc__C=0.24242424242424243, svc__gamma=1.256262626262626
4;; score=0.383 total time= 0.0s
[CV 1/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727273;;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.0101010101010102, svc__gamma=1.4572727272727272
```

```
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.6363636363636365, svc__gamma=1.7788888888888889;;
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.440 total time= 0.0s
[CV 3/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.507 total time= 0.0s
[CV 4/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.200 total time= 0.0s
[CV 5/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.373 total time= 0.0s
[CV 6/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.4444444444444445, svc__gamma=1.0150505050505052;;
score=0.550 total time= 0.0s
[CV 10/10] END svc__C=0.4444444444444445, svc__gamma=1.015050505050505
2;; score=0.150 total time= 0.0s
[CV 1/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.8383838383838385, svc__gamma=1.5376767676767678;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.8383838383838385, svc__gamma=1.537676767676767
```

```
8;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.08080808080808081, svc__gamma=0.633131313131313
2;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.5555555555555556, svc__gamma=1.0552525252525253;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.5555555555555556, svc__gamma=1.055252525252525
3;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.120 total time= 0.0s
[CV 7/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.0505050505050506, svc__gamma=1.819090909090909;;
```

```
score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.325 total time= 0.0s
[CV 4/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.022 total time= 0.0s
[CV 5/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=1.8383838383838385, svc__gamma=0.6331313131313132;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.8383838383838385, svc__gamma=0.633131313131313
2;, score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.1717171717171717, svc__gamma=1.3567676767676768;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.1717171717171717, svc__gamma=1.356767676767676
8;, score=0.100 total time= 0.0s
[CV 1/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.295 total time= 0.0s
[CV 2/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.440 total time= 0.0s
[CV 3/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.507 total time= 0.0s
[CV 4/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.200 total time= 0.0s
[CV 5/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.373 total time= 0.0s
[CV 6/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.483 total time= 0.0s
[CV 7/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.500 total time= 0.0s
[CV 8/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.300 total time= 0.0s
[CV 9/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
2;, score=0.550 total time= 0.0s
[CV 10/10] END svc__C=0.42424242424242425, svc__gamma=1.035151515151515
```

```
2;; score=0.150 total time= 0.0s
[CV 1/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.325 to
tal time= 0.0s
[CV 2/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.300 to
tal time= 0.0s
[CV 3/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.222 to
tal time= 0.0s
[CV 4/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.022 to
tal time= 0.0s
[CV 5/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.025 to
tal time= 0.0s
[CV 6/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.195 to
tal time= 0.0s
[CV 7/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.222 to
tal time= 0.0s
[CV 8/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.122 to
tal time= 0.0s
[CV 9/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.429 to
tal time= 0.0s
[CV 10/10] END svc__C=2.0, svc__gamma=0.9547474747474748;; score=0.100 t
otal time= 0.0s
[CV 1/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.075 total time= 0.0s
[CV 6/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.195 total time= 0.0s
[CV 7/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.125 total time= 0.0s
[CV 9/10] END svc__C=0.9696969696969697, svc__gamma=0.5527272727272727;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=0.9696969696969697, svc__gamma=0.552727272727272
7;; score=0.100 total time= 0.0s
[CV 1/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.329 total time= 0.0s
[CV 2/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.400 total time= 0.0s
[CV 3/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.400 total time= 0.0s
[CV 4/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.225 total time= 0.0s
[CV 5/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.407 total time= 0.0s
[CV 6/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.133 total time= 0.0s
[CV 7/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.225 total time= 0.0s
[CV 8/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.329 total time= 0.0s
[CV 9/10] END svc__C=1.0707070707070707, svc__gamma=0.3115151515151515;;
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.0707070707070707, svc__gamma=0.311515151515151
```

```
5;; score=0.200 total time= 0.0s
[CV 1/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.325 total time= 0.0s
[CV 2/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.300 total time= 0.0s
[CV 3/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.222 total time= 0.0s
[CV 4/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.020 total time= 0.0s
[CV 5/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.025 total time= 0.0s
[CV 6/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.192 total time= 0.0s
[CV 7/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.222 total time= 0.0s
[CV 8/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.122 total time= 0.0s
[CV 9/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.429 total time= 0.0s
[CV 10/10] END svc__C=1.77777777777778, svc__gamma=1.1959595959595961;,
score=0.100 total time= 0.0s
```

```

/usr/local/lib/python3.10/dist-packages/sklearn/model_selection/_validation.py:378: FitFailedWarning:
10 fits failed out of a total of 1000.
The score on these train-test partitions for these parameters will be set to nan.
If these failures are not expected, you can try to debug them by setting error_score='raise'.

```

Below are more details about the failures:

```

-----
10 fits failed with the following error:
Traceback (most recent call last):
  File "/usr/local/lib/python3.10/dist-packages/sklearn/model_selection/_validation.py", line 686, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/usr/local/lib/python3.10/dist-packages/sklearn/pipeline.py", line 405, in fit
    self._final_estimator.fit(Xt, y, **fit_params_last_step)
  File "/usr/local/lib/python3.10/dist-packages/sklearn/svm/_base.py", line 180, in fit
    self._validate_params()
  File "/usr/local/lib/python3.10/dist-packages/sklearn/base.py", line 600, in _validate_params
    validate_parameter_constraints(
  File "/usr/local/lib/python3.10/dist-packages/sklearn/utils/_param_validation.py", line 97, in validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'C' parameter of SVC must be a float in the range (0.0, inf). Got 0.0 instead.

```

```

warnings.warn(some_fits_failed_message, FitFailedWarning)
/usr/local/lib/python3.10/dist-packages/sklearn/model_selection/_search.py:952: UserWarning: One or more of the test scores are non-finite: [0.2093254 0.2013254 0.21376984 0.19569048 0.19604762 0.37985714 0.2013254 0.20710317 0.19660317 0.24174603 0.20710317 0.2013254 0.20460317 0.2013254 0.2442381 0.20710317 0.18852381 0.48190476 0.64333333 0.19660317 0.19569048 0.18852381 0.22785714 0.19654762 0.20710317 0.30757143 0.2013254 0.21793651 0.3695 0.19569048 0.20068254 0.20096825 0.53166667 0.38266667 0.3227381 0.2517381 0.37985714 0.503 0.2013254 0.18852381 0.22507937 0.2442381 0.64333333 0.20096825 nan 0.24174603 0.18852381 0.20960317 0.26238095 0.64333333 0.18852381 0.37985714 0.32669048 0.1968254 0.2093254 0.18852381 0.64333333 0.70833333 0.37985714 0.3042381 0.38388095 0.24174603 0.18852381 0.3227381 0.57 0.53166667 0.20702381 0.19569048 0.19569048 0.2093254 0.545 0.29357143 0.58166667 0.19569048 0.30757143 0.457 0.24174603 0.24257143 0.2013254 0.19569048 0.20710317 0.63666667 0.23254762 0.494 0.38269048 0.53666667 0.18852381 0.18852381 0.37985714 0.18852381 0.2013254 0.19569048 0.18852381 0.20710317 0.19569048 0.37985714 0.19626984 0.2013254 0.30757143 0.19569048]
warnings.warn(

```

```
Out[41]: {'svc__gamma': 0.01, 'svc__C': 1.9595959595959598}
```

```

In [42]: pipeline = make_pipeline(configs['svc-rbf'][0], SVC(kernel='rbf', C=grid.b
scoring = ['accuracy', 'precision_macro', 'recall_macro', 'f1_macro'])

cv_results = cross_validate(pipeline, X, y, cv=10, scoring=scoring)

```

```
for k in cv_results:
    print(f'{k}={cv_results[k].mean()}')
```

```
fit_time=0.01092994213104248
score_time=0.009673094749450684
test_accuracy=0.77
test_precision_macro=0.6783333333333333
test_recall_macro=0.77
test_f1_macro=0.7083333333333333
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
```

```
    _warn_prf(average, modifier, msg_start, len(result))
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
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```

```
    _warn_prf(average, modifier, msg_start, len(result))
```