Tesina Intelligent and Secure Network

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import matplotlib
import seaborn as sea

# Load dataset
data = 'WirelessWiredData.csv'
df = pd.read_csv(data)
```

Ispezione del dataset

```
print(df.info())
```

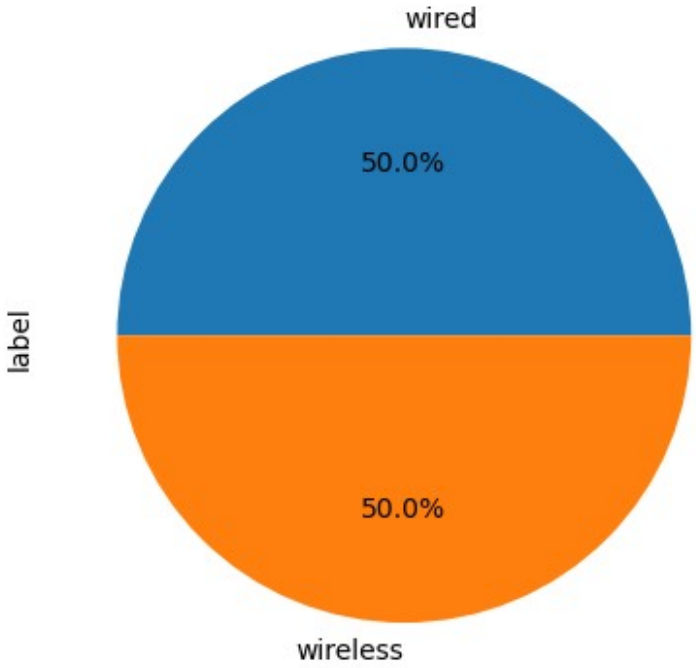
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1202 entries, 0 to 1201
Data columns (total 4 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   latency         1202 non-null   float64
 1   retransmission  1202 non-null   int64  
 2   bandwidth       1202 non-null   int64  
 3   label           1202 non-null   object 
dtypes: float64(1), int64(2), object(1)
memory usage: 37.7+ KB
None
```

```
# Preview the dataset
print(df.head()) # first 5 elements
```

```
    latency  retransmission  bandwidth  label
0  0.000019               0   12526266  wired
1  0.000026               0   12524238  wired
2  0.000017               0   12524730  wired
3  0.000017               0   12524730  wired
4  0.000020               0   12520524  wired
```

```
# Class distribution
print(df["label"].value_counts())
plt.figure()
figure = (df['label'].value_counts()*100.0 /len(df))\
           .plot.pie(autopct='%.1f%%', labels = ['wired', 'wireless'])
plt.show()
```

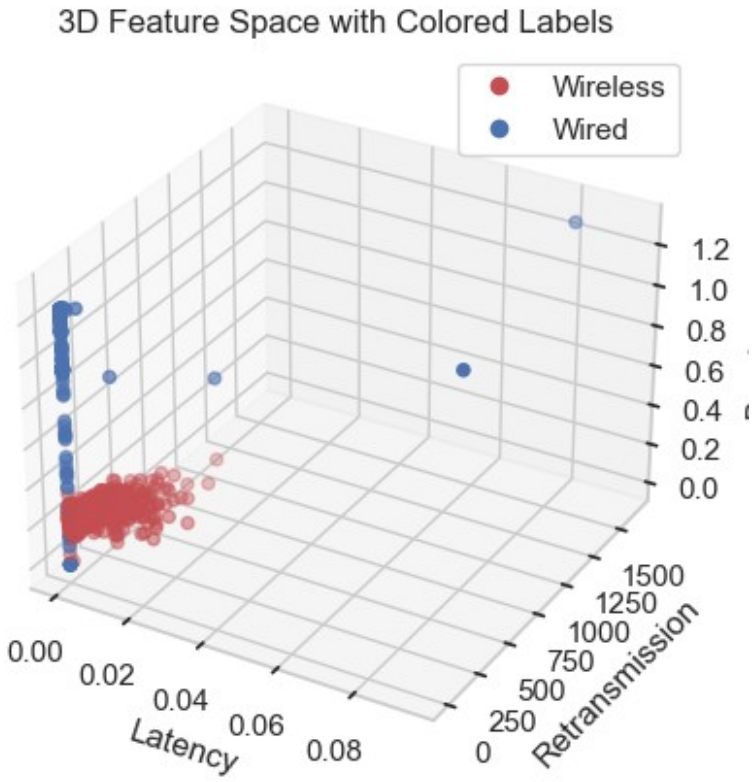
```
wired       601
wireless    601
Name: label, dtype: int64
```



Il dataset è ovviamente bilanciato!

```
# Create a scatter plot with colored labels
sea.set(style="whitegrid")
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

# Define color map for labels
label_colors = {'wireless': 'r', 'wired': 'b'}
label_color_values = df['label'].map(label_colors)

# Scatter plot
scatter = ax.scatter(df['latency'], df['retransmission'],
df['bandwidth'], c=label_color_values, marker='o')

# Set labels and title
ax.set_xlabel('Latency')
ax.set_ylabel('Retransmission')
ax.set_zlabel('Bandwidth')
ax.set_title('3D Feature Space with Colored Labels')

# Create legend
legend_labels = [plt.Line2D([0], [0], marker='o', color='w',
```

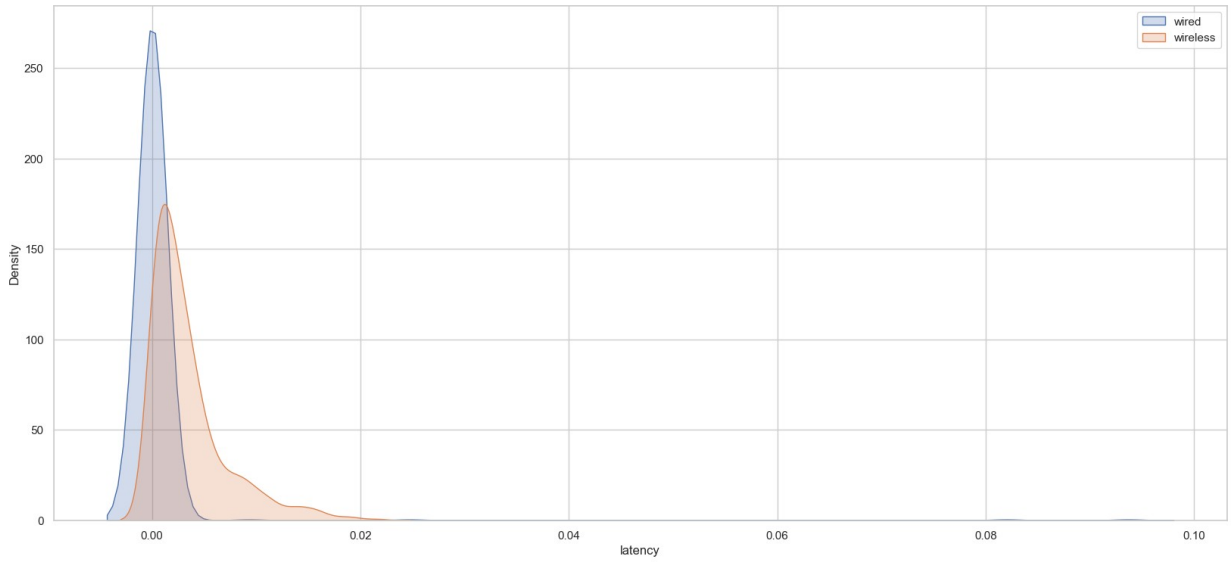
```
label='Wireless', markerfacecolor='r', markersize=8),
                   plt.Line2D([0], [0], marker='o', color='w',
label='Wired', markerfacecolor='b', markersize=8)]
ax.legend(handles=legend_labels)

# Show the plot
plt.show()
```

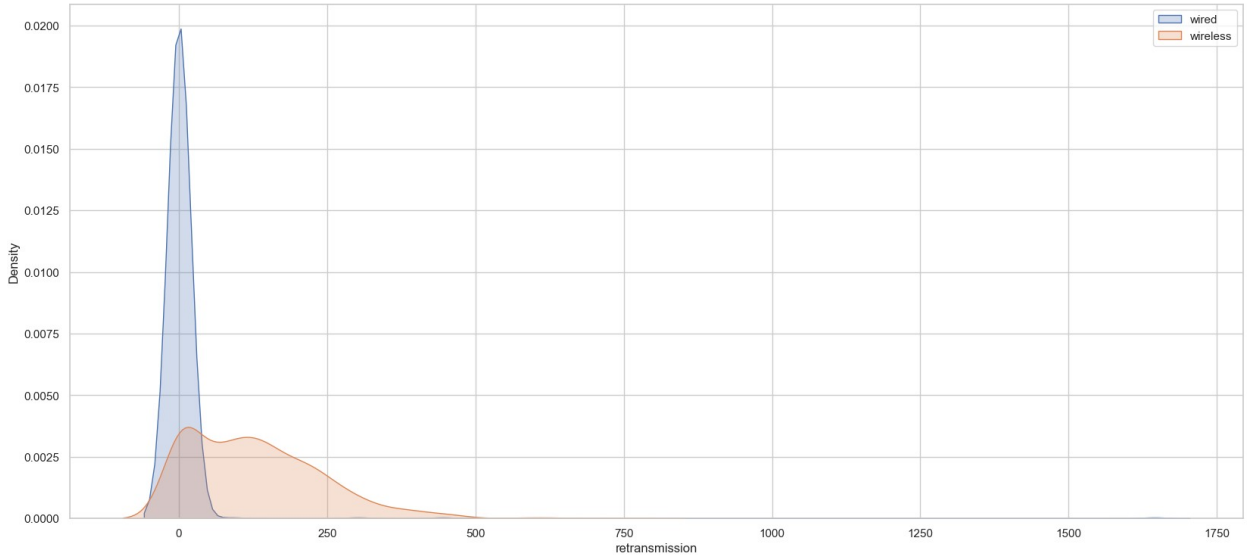


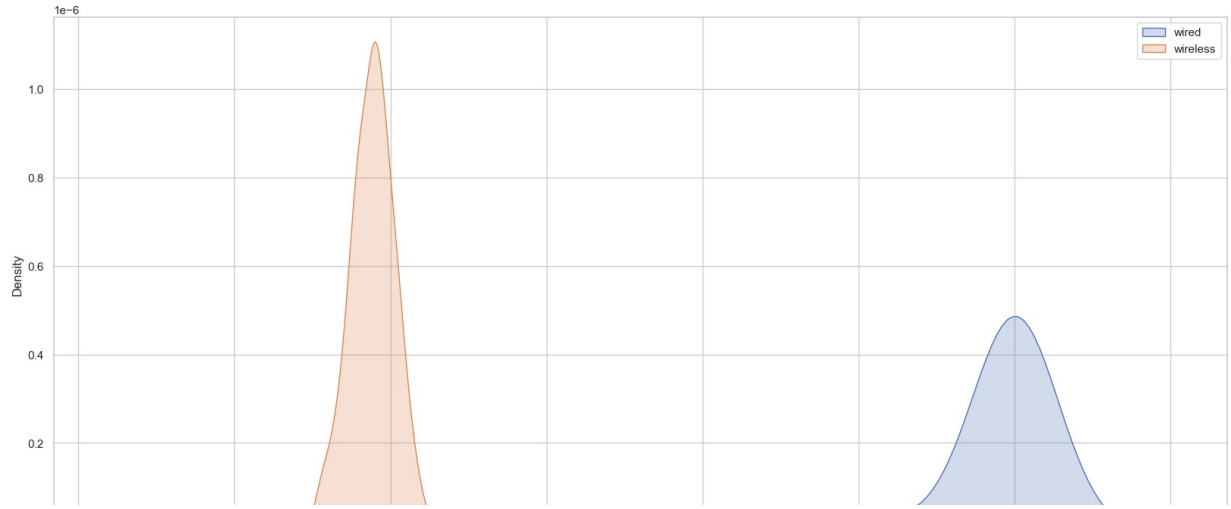

```
# Class numerical conversion
df["label"]=[0 if i == "wired" else 1 for i in df["label"]]

# View summary statistics in numerical variables
print(round(df.describe(),2))
```

	latency	retransmission	bandwidth	label
count	1202.00	1202.00	1202.00	1202.0
mean	0.00	66.78	6932225.38	0.5
std	0.00	113.11	5046342.01	0.5
min	0.00	0.00	0.00	0.0
25%	0.00	0.00	2201455.50	0.0
50%	0.00	0.00	2857770.00	0.5
75%	0.00	116.50	12524722.00	1.0
max	0.09	1645.00	13002582.00	1.0

```
features = list(df.columns)
features.remove('label')
class_ = ['wired', 'wireless']
j=1
plt.figure(figsize=(20,30))
for f in features:
    plt.subplot(3, 1, j)
    for i in range(2):
        sea.kdeplot(data=df[df["label"] == i][f], label = class_[i],
fill = True)
        plt.legend()
    j += 1
```


wired
wireless
Density
250
200
150
100
50
0
0.00
0.02
0.04
0.06
0.08
0.10
latency

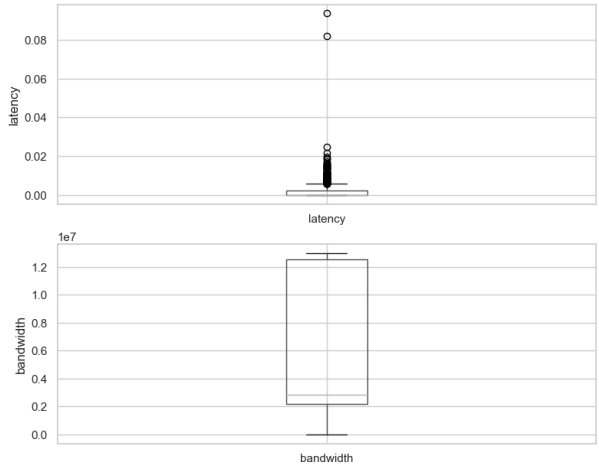

wired
wireless
Density
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0
250
500
750
1000
1250
1500
1750
retransmission

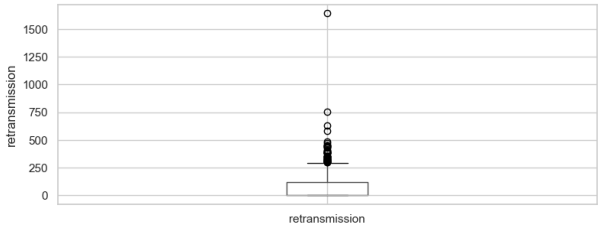

1e−6
wired
wireless
Density
1.0
0.8
0.6
0.4
0.2

Analisi delle features

```
print(features)

plt.figure(figsize=(20,40))

i=1
for f in features:
    plt.subplot(10, 2, i)
    fig = df.boxplot(column=f)
    fig.set_title('')
    fig.set_ylabel(f)
    i += 1
```

```
['latency', 'retransmission', 'bandwidth']
```



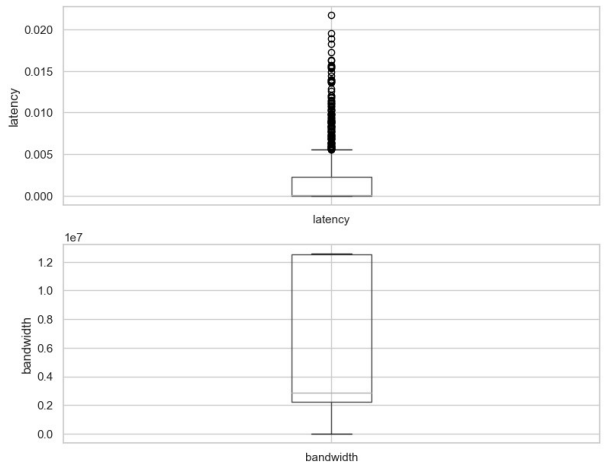


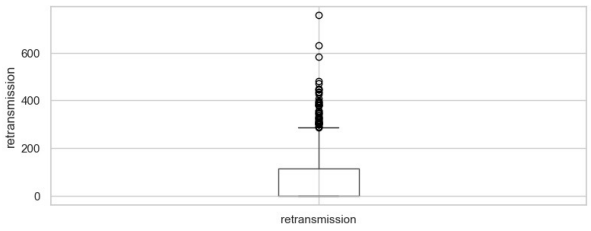
Rimozione outlier

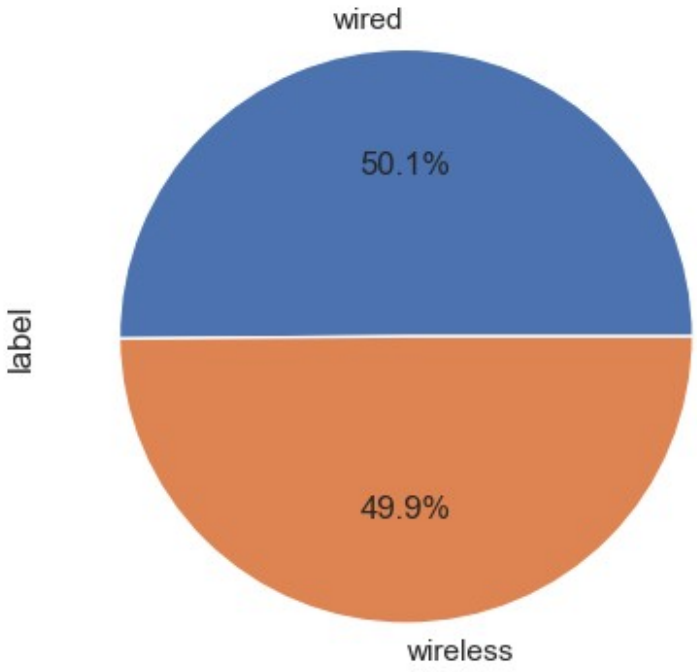
```
# Specify the columns containing the data with outliers
column_names = ['latency', 'retransmission']

# Calculate the interquartile range (IQR) for each column
Q1 = df[column_names].quantile(0.25)
Q3 = df[column_names].quantile(0.75)
IQR = Q3 - Q1

# Define the lower and upper bounds to identify outliers for each
column
lower_bound = Q1 - 10 * IQR
upper_bound = Q3 + 10 * IQR

# Filter out rows that have values outside the bounds for either
column
filtered_data = df[
    (df[column_names[0]] >= lower_bound[column_names[0]]) &
    (df[column_names[0]] <= upper_bound[column_names[0]]) &
```

```
    (df[column_names[1]] >= lower_bound[column_names[1]]) &
    (df[column_names[1]] <= upper_bound[column_names[1]])
]

df = filtered_data

# boxplot
features = list(df.columns)
features.remove('label')
print(features)

plt.figure(figsize=(20,40))

i=1
for f in features:
    plt.subplot(10, 2, i)
    fig = df.boxplot(column=f)
    fig.set_title('')
    fig.set_ylabel(f)
    i += 1

# Class distribution
print(df["label"].value_counts())
plt.figure()
figure = (df['label'].value_counts()*100.0 /len(df))\
          .plot.pie(autopct='%.1f%%', labels = ['wired', 'wireless'])
plt.show()
```

```
['latency', 'retransmission', 'bandwidth']
1    601
0    598
Name: label, dtype: int64
```

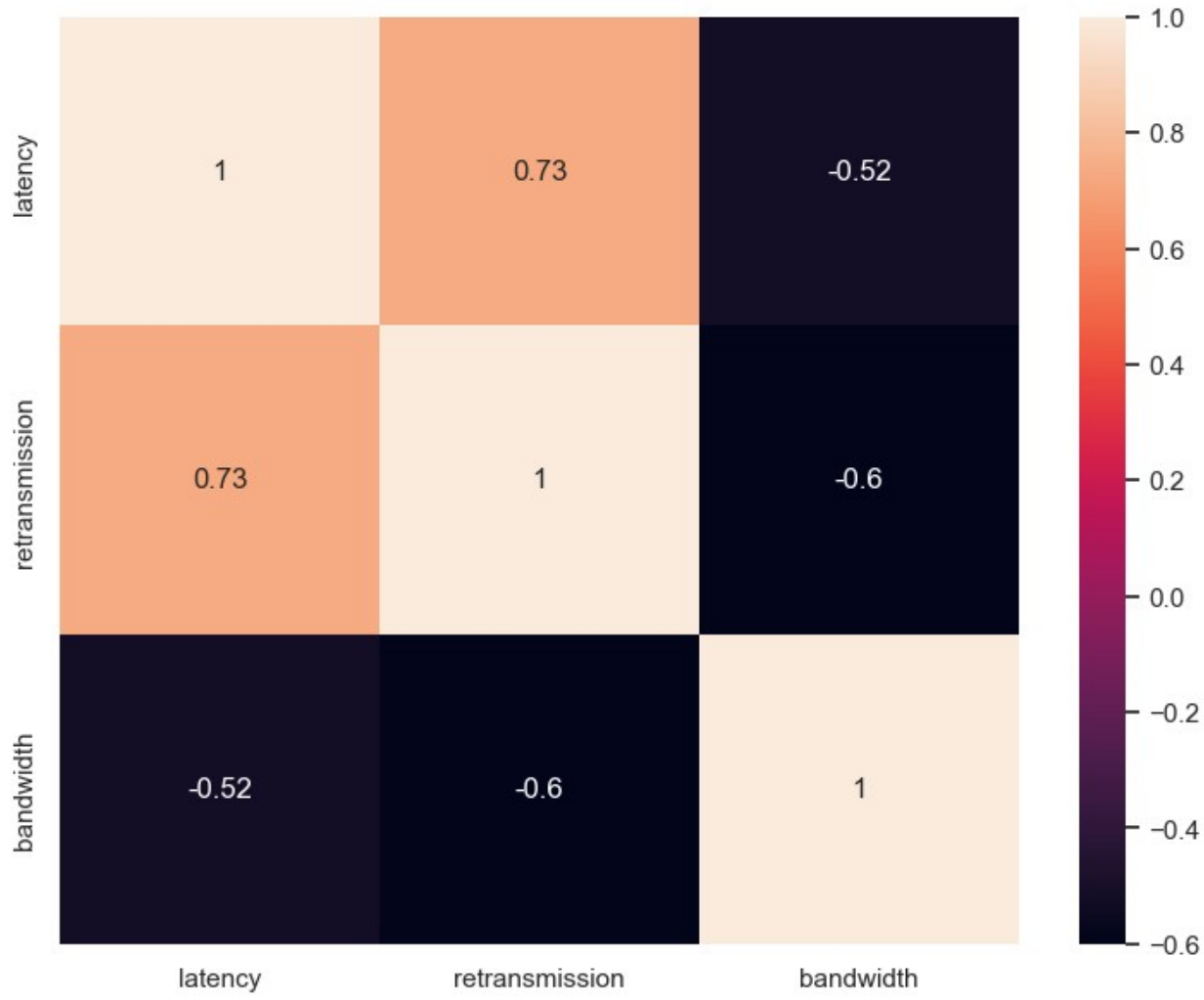




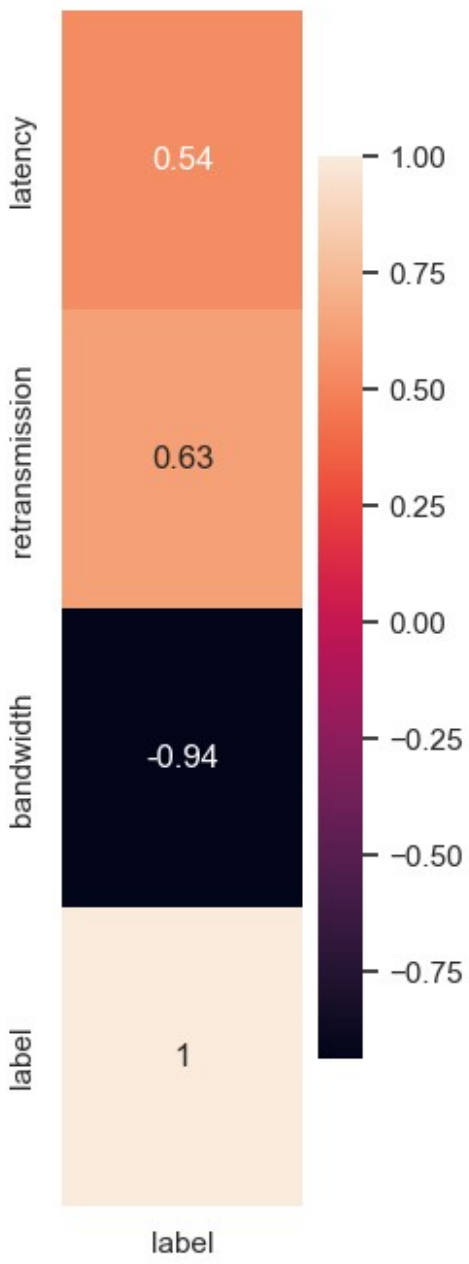


Correlazione

```
features_data = df[features]
plt.figure(figsize = (9,7))
sea.heatmap(features_data.corr(), annot = True)
plt.show()
```




```
plt.figure(figsize=(2,8))
corr_matrix = df.corr()
sea.heatmap(corr_matrix[['label']], annot=True)
plt.show()
```



Data splitting & Normalization

```
# Shuffle the dataset
df = df.sample(frac=1)
# Preview the dataset
print(df.head()) # first 5 elements
```

```
       latency  retransmission  bandwidth  label
1096  0.015468             193    2241656      1
593   0.000014               0   12524782      0
414   0.000013               0   12524784      0
```

```
115   0.000015                0   12524660      0
224   0.000017                0   12524790      0
```

```
# Split data
X = df.drop(['label'], axis=1)
t = df['label']

# Split X and t into training and testing sets
from sklearn.model_selection import train_test_split
X_train, X_test, t_train, t_test = train_test_split(X, t, test_size =
0.3, random_state = 0)

# Check the shape of X_train and X_test
print(X_train.shape)
print(X_test.shape)
```

```
(839, 3)
(360, 3)
```

```
# Normalization
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

# Export the scaler
from joblib import dump
dump(scaler, 'scaler.pkl')

# Check if data is normalized
print(X_train.mean(axis=0))
print(X_train.std(axis=0))
```

```
[2.11723104e-17 8.68064725e-17 4.23446207e-17]
[1. 1. 1.]
```

Training

Logistic Regression

```
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import confusion_matrix, f1_score,
accuracy_score, make_scorer

# Initialize the softmax regression model
logistic_reg = LogisticRegression(solver='lbfgs', C=1, max_iter=1000)
grid = {"C": np.logspace(-5, 10, 30)}

# Perform grid search cross-validation with f1 as the scoring metric
f1 = make_scorer(f1_score)
```

```
logistic_reg_cv = GridSearchCV(logistic_reg, grid, cv=5, scoring=f1)
logistic_reg_cv.fit(X_train, t_train)
```

```
GridSearchCV(cv=5, estimator=LogisticRegression(C=1, max_iter=1000),
             param_grid={'C': array([1.00000000e-05, 3.29034456e-05,
1.08263673e-04, 3.56224789e-04,
       1.17210230e-03, 3.85662042e-03, 1.26896100e-02, 4.17531894e-02,
       1.37382380e-01, 4.52035366e-01, 1.48735211e+00, 4.89390092e+00,
       1.61026203e+01, 5.29831691e+01, 1.74332882e+02, 5.73615251e+02,
       1.88739182e+03, 6.21016942e+03, 2.04335972e+04, 6.72335754e+04,
       2.21221629e+05, 7.27895384e+05, 2.39502662e+06, 7.88046282e+06,
       2.59294380e+07, 8.53167852e+07, 2.80721620e+08, 9.23670857e+08,
       3.03919538e+09, 1.00000000e+10])},
             scoring=make_scorer(f1_score))
```

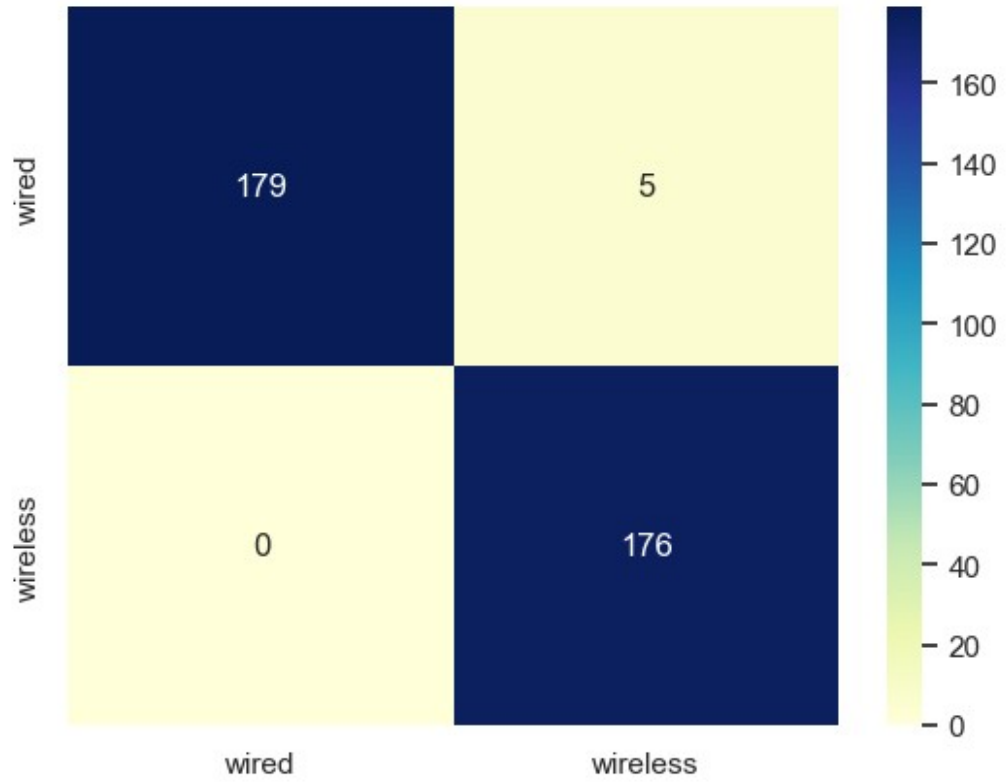
```
# Print the best parameters and accuracy from the grid search
print("Tuned hyperparameters (best parameters): ",
logistic_reg_cv.best_params_)
print("F1: ", logistic_reg_cv.best_score_)
```

```
Tuned hyperparameters (best parameters):  {'C': 0.0011721022975334804}
F1:  0.9793866875025546
```

```
Y_hat_test = logistic_reg_cv.predict(X_test)
print("Accuracy score on the test set: ", accuracy_score(t_test,
Y_hat_test))
print("F1 score on the test set: ", f1_score(t_test, Y_hat_test))
```

```
Accuracy score on the test set:  0.9861111111111112
F1 score on the test set:  0.9859943977591036
```

```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(t_test, Y_hat_test, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()
```



SVM

```
# import SVC classifier
from sklearn.svm import SVC

# import metrics to compute accuracy
from sklearn.metrics import accuracy_score, f1_score,
classification_report

# instantiate classifier with default hyperparameters
svc=SVC()

# import GridSearchCV
from sklearn.model_selection import GridSearchCV

# declare parameters for hyperparameter tuning
parameters = [ {'C':[1, 10, 100, 1000], 'kernel':['linear']},
               {'C':[1, 10, 100, 1000], 'kernel':['rbf'], 'gamma':
[0.1, 0.2, 0.3, 0.4]},
               {'C':[1, 10, 100, 1000], 'kernel':['poly'], 'degree':
[2] ,'gamma':[0.01,0.02]}
              ]

grid_search = GridSearchCV(estimator = svc,
                           param_grid = parameters,
                           scoring = 'f1_weighted',
```

```
                           cv = 5,
                           verbose=10)

grid_search.fit(X_train, t_train)
```

```
Fitting 5 folds for each of 28 candidates, totalling 140 fits
[CV 1/5; 1/28] START C=1,
kernel=linear.....................................
[CV 1/5; 1/28] END .........C=1, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 1/28] START C=1,
kernel=linear.....................................
[CV 2/5; 1/28] END .........C=1, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 1/28] START C=1,
kernel=linear.....................................
[CV 3/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 1/28] START C=1,
kernel=linear.....................................
[CV 4/5; 1/28] END .........C=1, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 1/28] START C=1,
kernel=linear.....................................
[CV 5/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 2/28] START C=10,
kernel=linear.....................................
[CV 1/5; 2/28] END .........C=10, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 2/28] START C=10,
kernel=linear.....................................
[CV 2/5; 2/28] END .........C=10, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 2/28] START C=10,
kernel=linear.....................................
[CV 3/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 2/28] START C=10,
kernel=linear.....................................
[CV 4/5; 2/28] END .........C=10, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 2/28] START C=10,
kernel=linear.....................................
[CV 5/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 3/28] START C=100,
kernel=linear.....................................
[CV 1/5; 3/28] END .........C=100, kernel=linear;, score=0.982 total
time=   0.0s
```

```
[CV 2/5; 3/28] START C=100,
kernel=linear.....................................
[CV 2/5; 3/28] END ........C=100, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 3/28] START C=100,
kernel=linear.....................................
[CV 3/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 3/28] START C=100,
kernel=linear.....................................
[CV 4/5; 3/28] END ........C=100, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 3/28] START C=100,
kernel=linear.....................................
[CV 5/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 1/5; 4/28] END .......C=1000, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 2/5; 4/28] END .......C=1000, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 3/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 4/5; 4/28] END .......C=1000, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 5/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 1/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 2/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 3/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 5/28] START C=1, gamma=0.1,
```

```
kernel=rbf.................................
[CV 4/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 5/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 1/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 2/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 2/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 3/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 4/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 5/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 1/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 2/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 3/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 4/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 5/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
```

```
[CV 1/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 10/28] START C=10, gamma=0.2,
kernel=rbf............................
[CV 1/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 10/28] START C=10, gamma=0.2,
kernel=rbf............................
[CV 2/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 10/28] START C=10, gamma=0.2,
kernel=rbf............................
[CV 3/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.988 total
```

```
time=   0.0s
[CV 4/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................

[CV 4/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 4/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 5/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
```

```
[CV 1/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 5/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 1/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 4/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 15/28] START C=100, gamma=0.3,
```

```
kernel=rbf.............................
[CV 3/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 2/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 4/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 5/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
```

```
[CV 5/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 3/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 4/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 2/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 3/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 4/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 2/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.982 total
```

```
time=   0.0s
[CV 3/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 4/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 1/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 2/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 3/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 4/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 5/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly....................
[CV 1/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.458 total time=   0.0s
[CV 2/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly....................
[CV 2/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.390 total time=   0.0s
[CV 3/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly....................
[CV 3/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.436 total time=   0.0s
[CV 4/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly....................

[CV 4/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.436 total time=   0.0s
```

```
[CV 5/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.433 total time=   0.0s
[CV 1/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 1/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.468 total time=   0.0s
[CV 2/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 2/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.447 total time=   0.0s
[CV 3/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.479 total time=   0.0s
[CV 4/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.454 total time=   0.0s
[CV 5/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 5/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.476 total time=   0.0s
[CV 1/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 1/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.666 total time=   0.0s
[CV 2/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.660 total time=   0.0s
[CV 3/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.733 total time=   0.0s
[CV 4/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 4/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.669 total time=   0.0s
[CV 5/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.677 total time=   0.0s
[CV 1/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly.....................
[CV 1/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.752 total time=   0.0s
[CV 2/5; 25/28] START C=100, degree=2, gamma=0.01,
```

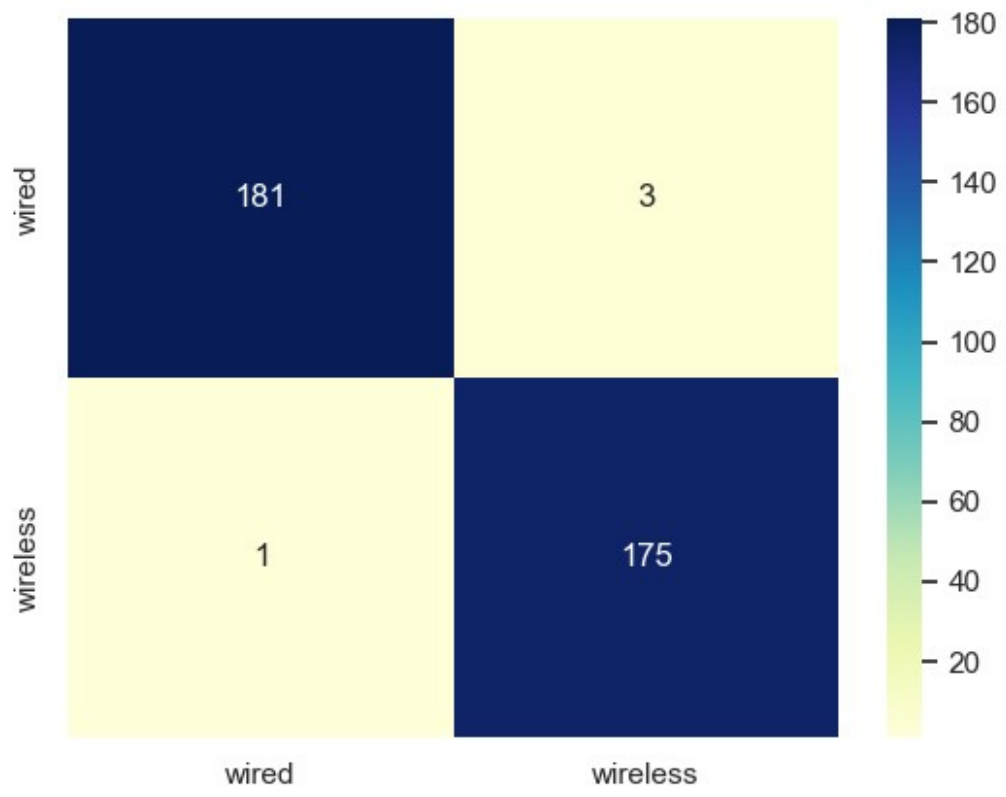
```
kernel=poly..................
[CV 2/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.719 total time=   0.0s
[CV 3/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 3/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.826 total time=   0.0s
[CV 4/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 4/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.765 total time=   0.0s
[CV 5/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 5/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.728 total time=   0.0s
[CV 1/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 1/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.863 total time=   0.0s
[CV 2/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 2/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.803 total time=   0.0s
[CV 3/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 3/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.911 total time=   0.0s
[CV 4/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 4/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.851 total time=   0.0s
[CV 5/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 5/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.874 total time=   0.0s
[CV 1/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly..................
[CV 1/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.875 total time=   0.0s
[CV 2/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly..................
[CV 2/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.832 total time=   0.0s
[CV 3/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly..................
[CV 3/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.929 total time=   0.0s
[CV 4/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly..................
```

```
[CV 4/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.893 total time=   0.0s
[CV 5/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 5/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.898 total time=   0.0s
[CV 1/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.922 total time=   0.0s
[CV 2/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.844 total time=   0.0s
[CV 3/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.934 total time=   0.0s
[CV 4/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.916 total time=   0.0s
[CV 5/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.922 total time=   0.0s

GridSearchCV(cv=5, estimator=SVC(),
             param_grid=[{'C': [1, 10, 100, 1000], 'kernel':
['linear']},
                         {'C': [1, 10, 100, 1000],
                          'gamma': [0.1, 0.2, 0.3, 0.4], 'kernel':
['rbf']},
                         {'C': [1, 10, 100, 1000], 'degree': [2],
                          'gamma': [0.01, 0.02], 'kernel': ['poly']}],
             scoring='f1_weighted', verbose=10)

# examine the best model

# best score achieved during the GridSearchCV
print('GridSearch CV best score : {:.4f}\n\
n'.format(grid_search.best_score_))

# print parameters that give the best results
print('Parameters that give the best results :','\n\n',
(grid_search.best_params_))

# print estimator that was chosen by the GridSearch
print('\n\nEstimator that was chosen by the search :','\n\n',
(grid_search.best_estimator_))
```

```
estimator = grid_search.best_estimator_

from joblib import dump
dump(estimator, "bestModelSVM.joblib")

# calculate GridSearch CV score on test set
t_pred = estimator.predict(X_test)

print('Model classification report with GridSearch CV: \n',
classification_report(t_test, t_pred))
```

```
GridSearch CV best score : 0.9893


Parameters that give the best results :

 {'C': 100, 'gamma': 0.4, 'kernel': 'rbf'}


Estimator that was chosen by the search :

 SVC(C=100, gamma=0.4)
Model classification report with GridSearch CV:
              precision    recall  f1-score   support

           0       0.99      0.98      0.99       184
           1       0.98      0.99      0.99       176

    accuracy                           0.99       360
   macro avg       0.99      0.99      0.99       360
weighted avg       0.99      0.99      0.99       360
```

```
cm = confusion_matrix(t_test, t_pred, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()
```



Impatto delle singole features

```
X_train_latency = np.delete(X_train, [1,2], axis=1)
X_test_latency = np.delete(X_test, [1,2], axis=1)
X_train_retransmission = np.delete(X_train, [0,2], axis=1)
X_test_retransmission = np.delete(X_test, [0,2], axis=1)
X_train_bandwidth = np.delete(X_train, [0,1], axis=1)
X_test_bandwidth = np.delete(X_test, [0,1], axis=1)

X_train_lat_ret = np.delete(X_train, [2], axis=1)
X_test_lat_ret = np.delete(X_test, [2], axis=1)

X_train_lat_ban = np.delete(X_train, [1], axis=1)
X_test_lat_ban = np.delete(X_test, [1], axis=1)

X_train_ret_ban = np.delete(X_train, [0], axis=1)
X_test_ret_ban = np.delete(X_test, [0], axis=1)
```

Latenza

```
svc=SVC()
parameters = [ {'C':[1, 10, 100, 1000], 'kernel':['linear']},
               {'C':[1, 10, 100, 1000], 'kernel':['rbf'], 'gamma':
[0.1, 0.2, 0.3, 0.4]},
               {'C':[1, 10, 100, 1000], 'kernel':['poly'], 'degree':
```

```
[2] ,'gamma':[0.01,0.02]}
              ]

grid_search = GridSearchCV(estimator = svc,
                           param_grid = parameters,
                           scoring = 'f1_weighted',
                           cv = 5,
                           verbose=10)


grid_search.fit(X_train_latency, t_train)
# examine the best model

# best score achieved during the GridSearchCV
print('GridSearch CV best score : {:.4f}\n\
n'.format(grid_search.best_score_))

# print parameters that give the best results
print('Parameters that give the best results :','\n\n',
(grid_search.best_params_))

# print estimator that was chosen by the GridSearch
print('\n\nEstimator that was chosen by the search :','\n\n',
(grid_search.best_estimator_))

estimator = grid_search.best_estimator_

# calculate GridSearch CV score on test set
t_pred = estimator.predict(X_test_latency)

print('Model classification report with GridSearch CV: \n',
classification_report(t_test, t_pred))
cm = confusion_matrix(t_test, t_pred, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()
```

```
Fitting 5 folds for each of 28 candidates, totalling 140 fits
[CV 1/5; 1/28] START C=1,
kernel=linear.....................................
[CV 1/5; 1/28] END .........C=1, kernel=linear;, score=0.940 total
time=   0.0s
[CV 2/5; 1/28] START C=1,
kernel=linear.....................................
[CV 2/5; 1/28] END .........C=1, kernel=linear;, score=0.928 total
time=   0.0s
[CV 3/5; 1/28] START C=1,
kernel=linear.....................................
```

```
[CV 3/5; 1/28] END .........C=1, kernel=linear;, score=0.904 total
time=   0.0s
[CV 4/5; 1/28] START C=1,
kernel=linear.....................................
[CV 4/5; 1/28] END .........C=1, kernel=linear;, score=0.898 total
time=   0.0s
[CV 5/5; 1/28] START C=1,
kernel=linear.....................................
[CV 5/5; 1/28] END .........C=1, kernel=linear;, score=0.897 total
time=   0.0s
[CV 1/5; 2/28] START C=10,
kernel=linear.....................................
[CV 1/5; 2/28] END .........C=10, kernel=linear;, score=0.952 total
time=   0.0s
[CV 2/5; 2/28] START C=10,
kernel=linear.....................................
[CV 2/5; 2/28] END .........C=10, kernel=linear;, score=0.928 total
time=   0.0s
[CV 3/5; 2/28] START C=10,
kernel=linear.....................................
[CV 3/5; 2/28] END .........C=10, kernel=linear;, score=0.928 total
time=   0.0s
[CV 4/5; 2/28] START C=10,
kernel=linear.....................................
[CV 4/5; 2/28] END .........C=10, kernel=linear;, score=0.934 total
time=   0.0s
[CV 5/5; 2/28] START C=10,
kernel=linear.....................................
[CV 5/5; 2/28] END .........C=10, kernel=linear;, score=0.916 total
time=   0.0s
[CV 1/5; 3/28] START C=100,
kernel=linear.....................................
[CV 1/5; 3/28] END ........C=100, kernel=linear;, score=0.952 total
time=   0.0s
[CV 2/5; 3/28] START C=100,
kernel=linear.....................................
[CV 2/5; 3/28] END ........C=100, kernel=linear;, score=0.928 total
time=   0.0s
[CV 3/5; 3/28] START C=100,
kernel=linear.....................................
[CV 3/5; 3/28] END ........C=100, kernel=linear;, score=0.928 total
time=   0.0s
[CV 4/5; 3/28] START C=100,
kernel=linear.....................................
[CV 4/5; 3/28] END ........C=100, kernel=linear;, score=0.946 total
time=   0.0s
[CV 5/5; 3/28] START C=100,
kernel=linear.....................................
[CV 5/5; 3/28] END ........C=100, kernel=linear;, score=0.922 total
```

```
time=   0.0s
[CV 1/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 1/5; 4/28] END .......C=1000, kernel=linear;, score=0.952 total
time=   0.0s
[CV 2/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 2/5; 4/28] END .......C=1000, kernel=linear;, score=0.928 total
time=   0.0s
[CV 3/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 3/5; 4/28] END .......C=1000, kernel=linear;, score=0.928 total
time=   0.0s
[CV 4/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 4/5; 4/28] END .......C=1000, kernel=linear;, score=0.952 total
time=   0.0s
[CV 5/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 5/5; 4/28] END .......C=1000, kernel=linear;, score=0.922 total
time=   0.0s
[CV 1/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 1/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 2/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 2/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 3/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 3/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.854 total
time=   0.0s
[CV 4/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 4/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 5/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 5/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.885 total
time=   0.0s
[CV 1/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 1/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 2/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 2/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.910 total
time=   0.0s
```

```
[CV 3/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.873 total
time=   0.0s
[CV 4/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.880 total
time=   0.0s
[CV 5/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 2/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.916 total
time=   0.0s
[CV 3/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 4/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 5/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.897 total
time=   0.0s
[CV 1/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.904 total
time=   0.0s
[CV 4/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 5/5; 8/28] START C=1, gamma=0.4,
```

```
kernel=rbf.................................
[CV 5/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.903 total
time=   0.0s
[CV 1/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.................................
[CV 1/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.................................
[CV 2/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.................................
[CV 3/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.916 total
time=   0.0s
[CV 4/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.................................
[CV 4/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 5/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.................................
[CV 5/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 1/5; 10/28] START C=10, gamma=0.2,
kernel=rbf................................
[CV 1/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 10/28] START C=10, gamma=0.2,
kernel=rbf................................
[CV 2/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 10/28] START C=10, gamma=0.2,
kernel=rbf................................
[CV 3/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 4/5; 10/28] START C=10, gamma=0.2,
kernel=rbf................................
[CV 4/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 5/5; 10/28] START C=10, gamma=0.2,
kernel=rbf................................
[CV 5/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.916 total
time=   0.0s
[CV 1/5; 11/28] START C=10, gamma=0.3,
kernel=rbf................................
[CV 1/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 11/28] START C=10, gamma=0.3,
kernel=rbf................................
```

```
[CV 2/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 4/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 5/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................

[CV 5/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 1/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 4/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 5/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 1/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 4/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.928 total
```

```
time=   0.0s
[CV 5/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 1/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 4/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 5/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 1/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 4/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 5/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 1/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
```

```
[CV 2/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 3/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 4/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 5/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 3/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 4/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 5/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 1/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 3/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 4/5; 18/28] START C=1000, gamma=0.2,
```

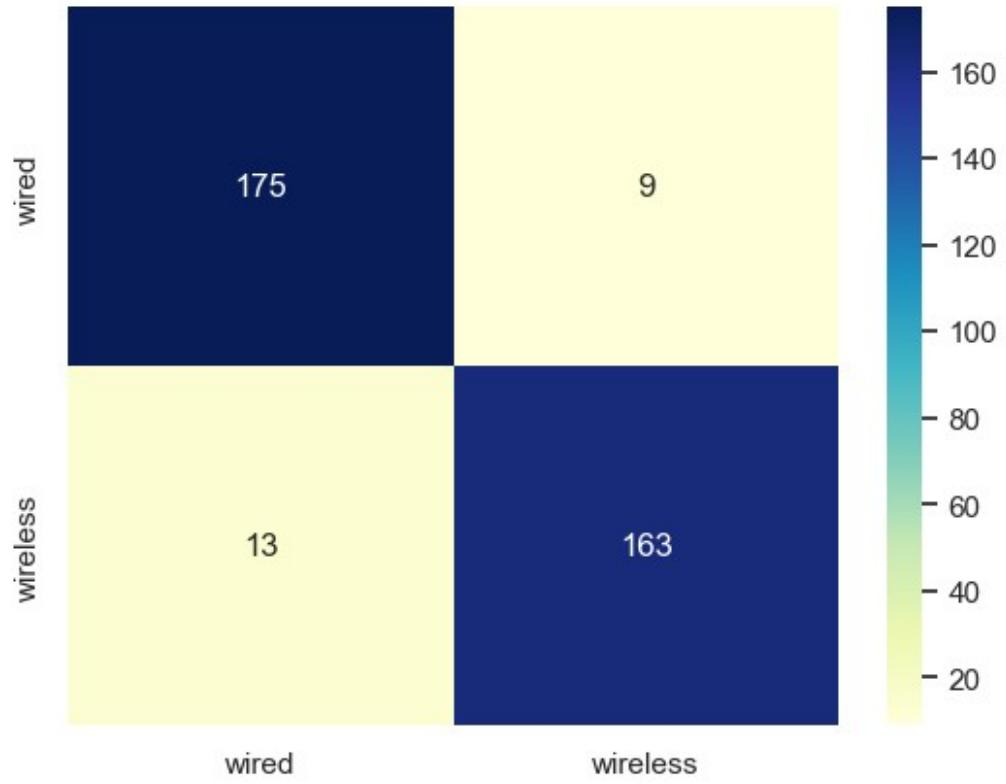
```
kernel=rbf.............................
[CV 4/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 5/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 1/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 2/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 3/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 4/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 5/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 1/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 3/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 4/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 5/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 1/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
```

```
[CV 1/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 2/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 5/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 1/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.390 total time=   0.0s
[CV 2/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.401 total time=   0.0s
[CV 3/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.447 total time=   0.0s
[CV 4/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 4/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.378 total time=   0.0s
[CV 5/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.387 total time=   0.0s
[CV 1/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 1/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.413 total time=   0.0s
[CV 2/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................

[CV 2/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.413 total time=   0.0s
[CV 3/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
```

```
score=0.436 total time=   0.0s
[CV 4/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly...................
[CV 4/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.410 total time=   0.0s
[CV 5/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly...................
[CV 5/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.422 total time=   0.0s
[CV 1/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly...................
[CV 1/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.468 total time=   0.0s
[CV 2/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly...................
[CV 2/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.447 total time=   0.0s
[CV 3/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly...................
[CV 3/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.479 total time=   0.0s
[CV 4/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly...................
[CV 4/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.454 total time=   0.0s
[CV 5/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly...................
[CV 5/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.507 total time=   0.0s
[CV 1/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 1/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.499 total time=   0.0s
[CV 2/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 2/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.447 total time=   0.0s
[CV 3/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 3/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.489 total time=   0.0s
[CV 4/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 4/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.454 total time=   0.0s
[CV 5/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 5/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.517 total time=   0.0s
```

```
[CV 1/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.509 total time=   0.0s
[CV 2/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.447 total time=   0.0s
[CV 3/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.499 total time=   0.0s
[CV 4/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.475 total time=   0.0s
[CV 5/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.526 total time=   0.0s
[CV 1/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 1/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.509 total time=   0.0s
[CV 2/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 2/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.468 total time=   0.0s
[CV 3/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 3/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.509 total time=   0.0s
[CV 4/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 4/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.475 total time=   0.0s
[CV 5/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 5/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.536 total time=   0.0s
[CV 1/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.509 total time=   0.0s
[CV 2/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.468 total time=   0.0s
[CV 3/5; 28/28] START C=1000, degree=2, gamma=0.02,
```

```
kernel=poly.................
[CV 3/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.509 total time=   0.0s
[CV 4/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.475 total time=   0.0s
[CV 5/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.536 total time=   0.0s
GridSearch CV best score : 0.9511


Parameters that give the best results :

 {'C': 1000, 'gamma': 0.2, 'kernel': 'rbf'}


Estimator that was chosen by the search :

 SVC(C=1000, gamma=0.2)
Model classification report with GridSearch CV:
              precision    recall  f1-score   support

           0       0.93      0.95      0.94       184
           1       0.95      0.93      0.94       176

    accuracy                           0.94       360
   macro avg       0.94      0.94      0.94       360
weighted avg       0.94      0.94      0.94       360
```



Retransmission

```
svc=SVC()
parameters = [ {'C':[1, 10, 100, 1000], 'kernel':['linear']},
               {'C':[1, 10, 100, 1000], 'kernel':['rbf'], 'gamma':
[0.1, 0.2, 0.3, 0.4]},
               {'C':[1, 10, 100, 1000], 'kernel':['poly'], 'degree':
[2] ,'gamma':[0.01,0.02]}
              ]

grid_search = GridSearchCV(estimator = svc,
                           param_grid = parameters,
                           scoring = 'f1_weighted',
                           cv = 5,
                           verbose=10)


grid_search.fit(X_train_retransmission, t_train)
# examine the best model

# best score achieved during the GridSearchCV
print('GridSearch CV best score : {:.4f}\n\
n'.format(grid_search.best_score_))

# print parameters that give the best results
print('Parameters that give the best results :','\n\n',
```

```
(grid_search.best_params_))

# print estimator that was chosen by the GridSearch
print('\n\nEstimator that was chosen by the search :','\n\n',
(grid_search.best_estimator_))

estimator = grid_search.best_estimator_

# calculate GridSearch CV score on test set
t_pred = estimator.predict(X_test_retransmission)

print('Model classification report with GridSearch CV: \n',
classification_report(t_test, t_pred))
cm = confusion_matrix(t_test, t_pred, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()
```

```
Fitting 5 folds for each of 28 candidates, totalling 140 fits
[CV 1/5; 1/28] START C=1,
kernel=linear.....................................
[CV 1/5; 1/28] END .........C=1, kernel=linear;, score=0.892 total
time=   0.0s
[CV 2/5; 1/28] START C=1,
kernel=linear.....................................
[CV 2/5; 1/28] END .........C=1, kernel=linear;, score=0.904 total
time=   0.0s
[CV 3/5; 1/28] START C=1,
kernel=linear.....................................
[CV 3/5; 1/28] END .........C=1, kernel=linear;, score=0.848 total
time=   0.0s
[CV 4/5; 1/28] START C=1,
kernel=linear.....................................
[CV 4/5; 1/28] END .........C=1, kernel=linear;, score=0.880 total
time=   0.0s
[CV 5/5; 1/28] START C=1,
kernel=linear.....................................
[CV 5/5; 1/28] END .........C=1, kernel=linear;, score=0.891 total
time=   0.0s
[CV 1/5; 2/28] START C=10,
kernel=linear.....................................
[CV 1/5; 2/28] END .........C=10, kernel=linear;, score=0.886 total
time=   0.0s
[CV 2/5; 2/28] START C=10,
kernel=linear.....................................
[CV 2/5; 2/28] END .........C=10, kernel=linear;, score=0.910 total
time=   0.0s
[CV 3/5; 2/28] START C=10,
```

```
kernel=linear.....................................
[CV 3/5; 2/28] END .........C=10, kernel=linear;, score=0.861 total
time=   0.0s
[CV 4/5; 2/28] START C=10,
kernel=linear.....................................
[CV 4/5; 2/28] END .........C=10, kernel=linear;, score=0.892 total
time=   0.0s
[CV 5/5; 2/28] START C=10,
kernel=linear.....................................
[CV 5/5; 2/28] END .........C=10, kernel=linear;, score=0.891 total
time=   0.0s
[CV 1/5; 3/28] START C=100,
kernel=linear.....................................
[CV 1/5; 3/28] END ........C=100, kernel=linear;, score=0.886 total
time=   0.0s
[CV 2/5; 3/28] START C=100,
kernel=linear.....................................
[CV 2/5; 3/28] END ........C=100, kernel=linear;, score=0.922 total
time=   0.0s
[CV 3/5; 3/28] START C=100,
kernel=linear.....................................
[CV 3/5; 3/28] END ........C=100, kernel=linear;, score=0.861 total
time=   0.0s
[CV 4/5; 3/28] START C=100,
kernel=linear.....................................
[CV 4/5; 3/28] END ........C=100, kernel=linear;, score=0.904 total
time=   0.0s
[CV 5/5; 3/28] START C=100,
kernel=linear.....................................
[CV 5/5; 3/28] END ........C=100, kernel=linear;, score=0.891 total
time=   0.0s
[CV 1/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 1/5; 4/28] END .......C=1000, kernel=linear;, score=0.886 total
time=   0.0s
[CV 2/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 2/5; 4/28] END .......C=1000, kernel=linear;, score=0.922 total
time=   0.0s
[CV 3/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 3/5; 4/28] END .......C=1000, kernel=linear;, score=0.861 total
time=   0.0s
[CV 4/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 4/5; 4/28] END .......C=1000, kernel=linear;, score=0.910 total
time=   0.0s
[CV 5/5; 4/28] START C=1000,
kernel=linear.....................................
```

```
[CV 5/5; 4/28] END .......C=1000, kernel=linear;, score=0.891 total
time=   0.0s
[CV 1/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 1/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 2/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 3/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 3/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.822 total
time=   0.0s
[CV 4/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 4/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 5/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 5/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.885 total
time=   0.0s
[CV 1/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 1/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 2/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 2/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.898 total
time=   0.0s
[CV 3/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 3/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.835 total
time=   0.0s
[CV 4/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 4/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 5/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 5/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.885 total
time=   0.0s
[CV 1/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 1/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 2/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 2/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.898 total
```

```
time=   0.0s
[CV 3/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.842 total
time=   0.0s
[CV 4/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.874 total
time=   0.0s
[CV 5/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 2/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.904 total
time=   0.0s
[CV 3/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.848 total
time=   0.0s
[CV 4/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.874 total
time=   0.0s
[CV 5/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 3/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.848 total
time=   0.0s
[CV 4/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.892 total
time=   0.0s
```

```
[CV 5/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 3/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 4/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 5/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 3/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 4/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................

[CV 4/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 5/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 12/28] START C=10, gamma=0.4,
```

```
kernel=rbf.............................
[CV 2/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.916 total
time=   0.0s
[CV 3/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 4/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 5/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.922 total
time=   0.0s
[CV 3/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 4/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.898 total
time=   0.0s
[CV 5/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.922 total
time=   0.0s
[CV 3/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 4/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
```

```
[CV 4/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.904 total
time=   0.0s
[CV 5/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.886 total
time=   0.0s
[CV 2/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.922 total
time=   0.0s
[CV 3/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.867 total
time=   0.0s
[CV 4/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.904 total
time=   0.0s
[CV 5/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 2/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.922 total
time=   0.0s
[CV 3/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.867 total
time=   0.0s
[CV 4/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.904 total
time=   0.0s
[CV 5/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.892 total
```

```
time=   0.0s
[CV 2/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.922 total
time=   0.0s
[CV 3/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.867 total
time=   0.0s
[CV 4/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 5/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.891 total
time=   0.0s
[CV 1/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 2/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.916 total
time=   0.0s
[CV 3/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 4/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 5/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.885 total
time=   0.0s
[CV 1/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.898 total
time=   0.0s
[CV 2/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.922 total
time=   0.0s
[CV 3/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.867 total
time=   0.0s
```

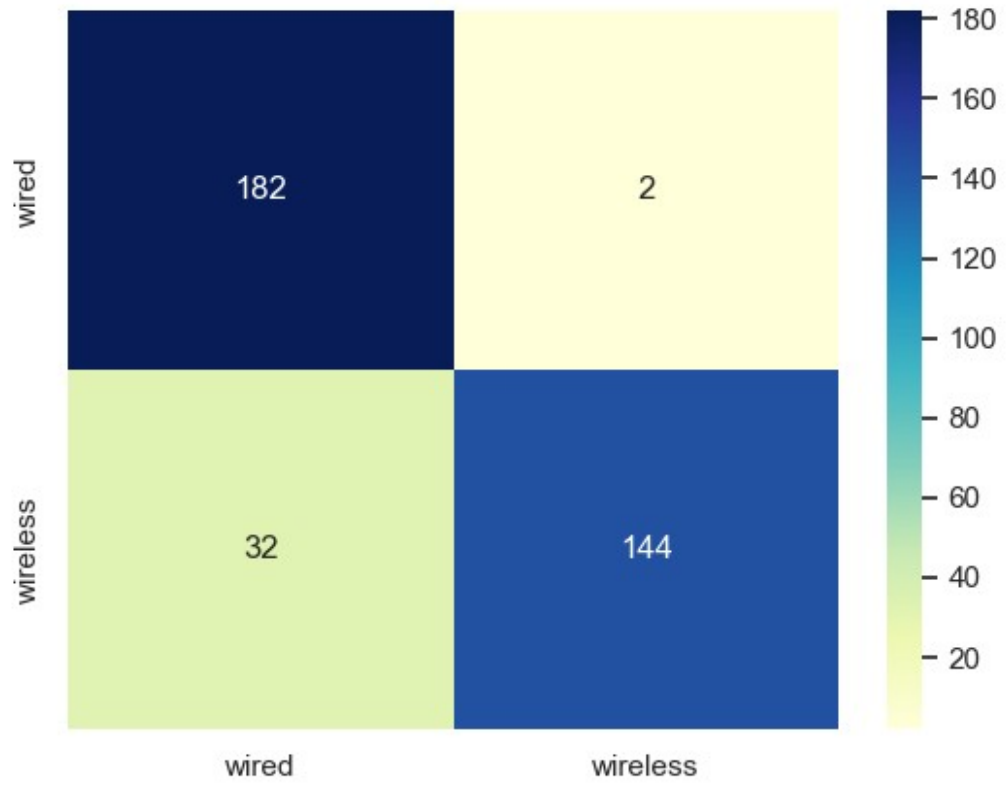
```
[CV 4/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 5/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.885 total
time=   0.0s
[CV 1/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.892 total
time=   0.0s
[CV 2/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 3/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.880 total
time=   0.0s
[CV 4/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 5/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.885 total
time=   0.0s
[CV 1/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 1/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 2/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 3/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 4/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................

[CV 5/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 22/28] START C=1, degree=2, gamma=0.02,
```

```
kernel=poly.....................
[CV 1/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.575 total time=   0.0s
[CV 3/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.566 total time=   0.0s
[CV 4/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 4/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.610 total time=   0.0s
[CV 5/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.600 total time=   0.0s
[CV 1/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 1/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.436 total time=   0.0s
[CV 2/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 2/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.390 total time=   0.0s
[CV 3/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.401 total time=   0.0s
[CV 4/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.436 total time=   0.0s
[CV 5/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 5/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.410 total time=   0.0s
[CV 1/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 1/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.509 total time=   0.0s
[CV 2/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.489 total time=   0.0s
[CV 3/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
```

```
[CV 3/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.529 total time=   0.0s
[CV 4/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 4/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.519 total time=   0.0s
[CV 5/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 5/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.517 total time=   0.0s
[CV 1/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 1/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.566 total time=   0.0s
[CV 2/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 2/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.529 total time=   0.0s
[CV 3/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 3/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.566 total time=   0.0s
[CV 4/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 4/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.548 total time=   0.0s
[CV 5/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 5/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.555 total time=   0.0s
[CV 1/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 1/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.593 total time=   0.0s
[CV 2/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 2/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.548 total time=   0.0s
[CV 3/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 3/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.602 total time=   0.0s
[CV 4/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 4/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.602 total time=   0.0s
[CV 5/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 5/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
```

```
score=0.564 total time=   0.0s
[CV 1/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 1/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.610 total time=   0.0s
[CV 2/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 2/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.575 total time=   0.0s
[CV 3/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 3/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.619 total time=   0.0s
[CV 4/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 4/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.619 total time=   0.0s
[CV 5/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 5/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.582 total time=   0.0s
[CV 1/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.627 total time=   0.0s
[CV 2/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.575 total time=   0.0s
[CV 3/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.619 total time=   0.0s
[CV 4/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.619 total time=   0.0s
[CV 5/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.591 total time=   0.0s
GridSearch CV best score : 0.8991


Parameters that give the best results :

 {'C': 1000, 'gamma': 0.4, 'kernel': 'rbf'}


Estimator that was chosen by the search :
```

```
 SVC(C=1000, gamma=0.4)
Model classification report with GridSearch CV:
              precision    recall  f1-score   support

           0       0.85      0.99      0.91       184
           1       0.99      0.82      0.89       176

    accuracy                           0.91       360
   macro avg       0.92      0.90      0.90       360
weighted avg       0.92      0.91      0.90       360
```



Bandwidth

```
svc=SVC()
parameters = [ {'C':[1, 10, 100, 1000], 'kernel':['linear']},
               {'C':[1, 10, 100, 1000], 'kernel':['rbf'], 'gamma':
[0.1, 0.2, 0.3, 0.4]},
               {'C':[1, 10, 100, 1000], 'kernel':['poly'], 'degree':
[2] ,'gamma':[0.01,0.02]}
              ]

grid_search = GridSearchCV(estimator = svc,
                           param_grid = parameters,
```

```
                            scoring = 'f1_weighted',
                            cv = 5,
                            verbose=10)


grid_search.fit(X_train_bandwidth, t_train)
# examine the best model

# best score achieved during the GridSearchCV
print('GridSearch CV best score : {:.4f}\n\
n'.format(grid_search.best_score_))

# print parameters that give the best results
print('Parameters that give the best results :','\n\n',
(grid_search.best_params_))

# print estimator that was chosen by the GridSearch
print('\n\nEstimator that was chosen by the search :','\n\n',
(grid_search.best_estimator_))

estimator = grid_search.best_estimator_

# calculate GridSearch CV score on test set
t_pred = estimator.predict(X_test_bandwidth)

print('Model classification report with GridSearch CV: \n',
classification_report(t_test, t_pred))
cm = confusion_matrix(t_test, t_pred, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()
```

```
Fitting 5 folds for each of 28 candidates, totalling 140 fits
[CV 1/5; 1/28] START C=1,
kernel=linear.....................................
[CV 1/5; 1/28] END .........C=1, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 1/28] START C=1,
kernel=linear.....................................
[CV 2/5; 1/28] END .........C=1, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 1/28] START C=1,
kernel=linear.....................................
[CV 3/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 1/28] START C=1,
kernel=linear.....................................
[CV 4/5; 1/28] END .........C=1, kernel=linear;, score=0.964 total
```

```
time=   0.0s
[CV 5/5; 1/28] START C=1,
kernel=linear.....................................
[CV 5/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 2/28] START C=10,
kernel=linear.....................................
[CV 1/5; 2/28] END .........C=10, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 2/28] START C=10,
kernel=linear.....................................
[CV 2/5; 2/28] END .........C=10, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 2/28] START C=10,
kernel=linear.....................................
[CV 3/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 2/28] START C=10,
kernel=linear.....................................
[CV 4/5; 2/28] END .........C=10, kernel=linear;, score=0.964 total
time=   0.0s
[CV 5/5; 2/28] START C=10,
kernel=linear.....................................
[CV 5/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 3/28] START C=100,
kernel=linear.....................................
[CV 1/5; 3/28] END ........C=100, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 3/28] START C=100,
kernel=linear.....................................
[CV 2/5; 3/28] END ........C=100, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 3/28] START C=100,
kernel=linear.....................................
[CV 3/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 3/28] START C=100,
kernel=linear.....................................
[CV 4/5; 3/28] END ........C=100, kernel=linear;, score=0.964 total
time=   0.0s
[CV 5/5; 3/28] START C=100,
kernel=linear.....................................
[CV 5/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 1/5; 4/28] END .......C=1000, kernel=linear;, score=0.982 total
time=   0.0s
```

```
[CV 2/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 2/5; 4/28] END .......C=1000, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 3/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 4/5; 4/28] END .......C=1000, kernel=linear;, score=0.964 total
time=   0.0s
[CV 5/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 5/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 1/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 2/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 2/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 3/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 4/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 5/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 1/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 2/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 2/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 3/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 3/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 6/28] START C=1, gamma=0.2,
```

```
kernel=rbf.................................
[CV 4/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 5/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 1/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 1/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 2/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 2/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 3/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 4/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 5/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 1/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 2/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 3/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 4/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 5/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.................................
```

```
[CV 1/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 2/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.988 total
```

```
time=   0.0s
[CV 4/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 1/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
```

```
[CV 1/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................

[CV 5/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 16/28] START C=100, gamma=0.4,
```

```
kernel=rbf.............................
[CV 3/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
```

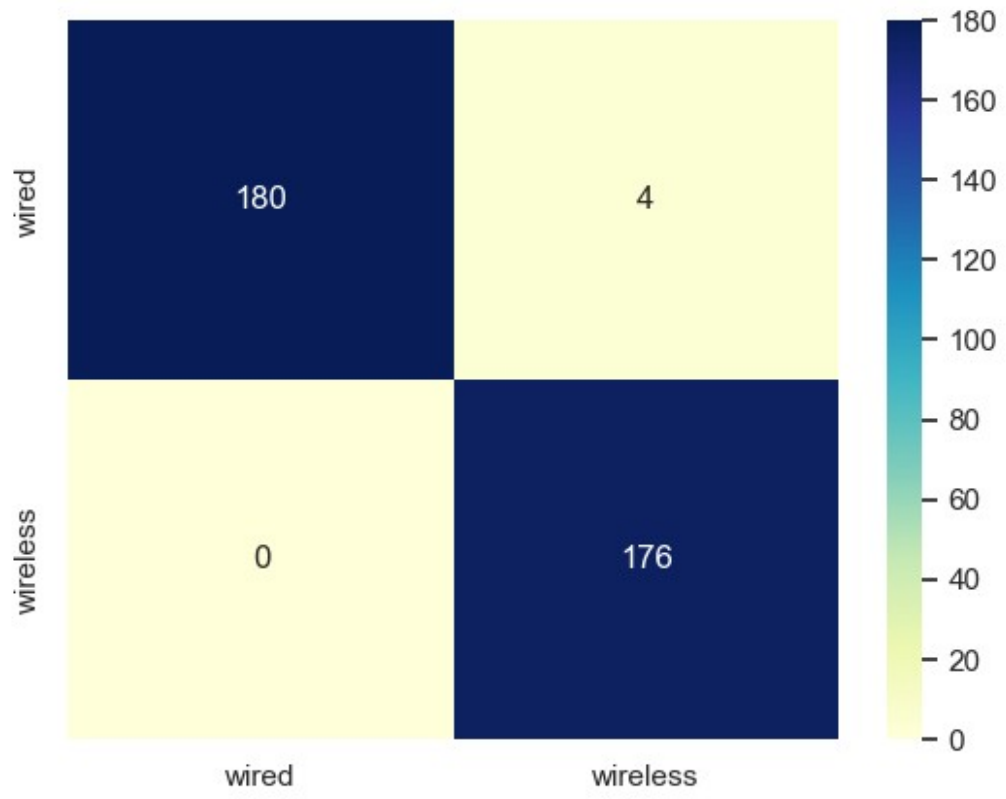
```
[CV 5/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 1/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 2/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
```

```
score=0.340 total time=   0.0s
[CV 3/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 5/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 1/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 4/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 1/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 2/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
```

```
[CV 5/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly..................
[CV 5/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 1/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 2/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 3/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 4/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 5/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 1/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.366 total time=   0.0s
[CV 2/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 2/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.350 total time=   0.0s
[CV 3/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 3/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.353 total time=   0.0s
[CV 4/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 4/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.391 total time=   0.0s
[CV 5/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 5/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.369 total time=   0.0s
[CV 1/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 1/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.851 total time=   0.0s
[CV 2/5; 26/28] START C=100, degree=2, gamma=0.02,
```

```
kernel=poly.................
[CV 2/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.809 total time=   0.0s
[CV 3/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.869 total time=   0.0s
[CV 4/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.863 total time=   0.0s
[CV 5/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.850 total time=   0.0s
[CV 1/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................

[CV 1/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.893 total time=   0.0s
[CV 2/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 2/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.827 total time=   0.0s
[CV 3/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 3/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.893 total time=   0.0s
[CV 4/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 4/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.887 total time=   0.0s
[CV 5/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 5/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.874 total time=   0.0s
[CV 1/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.899 total time=   0.0s
[CV 2/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.844 total time=   0.0s
[CV 3/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.917 total time=   0.0s
[CV 4/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
```

```
[CV 4/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.905 total time=   0.0s
[CV 5/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.886 total time=   0.0s
GridSearch CV best score : 0.9893


Parameters that give the best results :

 {'C': 100, 'gamma': 0.2, 'kernel': 'rbf'}


Estimator that was chosen by the search :

 SVC(C=100, gamma=0.2)
Model classification report with GridSearch CV:
              precision    recall  f1-score   support

           0       1.00      0.98      0.99       184
           1       0.98      1.00      0.99       176

    accuracy                           0.99       360
   macro avg       0.99      0.99      0.99       360
weighted avg       0.99      0.99      0.99       360
```



Latency & Retransmission

```
svc=SVC()
parameters = [ {'C':[1, 10, 100, 1000], 'kernel':['linear']},
               {'C':[1, 10, 100, 1000], 'kernel':['rbf'], 'gamma':
[0.1, 0.2, 0.3, 0.4]},
               {'C':[1, 10, 100, 1000], 'kernel':['poly'], 'degree':
[2] ,'gamma':[0.01,0.02]}
              ]

grid_search = GridSearchCV(estimator = svc,
                           param_grid = parameters,
                           scoring = 'f1_weighted',
                           cv = 5,
                           verbose=10)


grid_search.fit(X_train_lat_ret, t_train)
# examine the best model

# best score achieved during the GridSearchCV
print('GridSearch CV best score : {:.4f}\n\
n'.format(grid_search.best_score_))

# print parameters that give the best results
print('Parameters that give the best results :','\n\n',
```

```
(grid_search.best_params_))

# print estimator that was chosen by the GridSearch
print('\n\nEstimator that was chosen by the search :','\n\n',
(grid_search.best_estimator_))

estimator = grid_search.best_estimator_

# calculate GridSearch CV score on test set
t_pred = estimator.predict(X_test_lat_ret)

print('Model classification report with GridSearch CV: \n',
classification_report(t_test, t_pred))
cm = confusion_matrix(t_test, t_pred, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()

Fitting 5 folds for each of 28 candidates, totalling 140 fits
[CV 1/5; 1/28] START C=1,
kernel=linear.....................................
[CV 1/5; 1/28] END .........C=1, kernel=linear;, score=0.904 total
time=   0.0s
[CV 2/5; 1/28] START C=1,
kernel=linear.....................................
[CV 2/5; 1/28] END .........C=1, kernel=linear;, score=0.916 total
time=   0.0s
[CV 3/5; 1/28] START C=1,
kernel=linear.....................................
[CV 3/5; 1/28] END .........C=1, kernel=linear;, score=0.861 total
time=   0.0s
[CV 4/5; 1/28] START C=1,
kernel=linear.....................................
[CV 4/5; 1/28] END .........C=1, kernel=linear;, score=0.910 total
time=   0.0s
[CV 5/5; 1/28] START C=1,
kernel=linear.....................................
[CV 5/5; 1/28] END .........C=1, kernel=linear;, score=0.903 total
time=   0.0s
[CV 1/5; 2/28] START C=10,
kernel=linear.....................................
[CV 1/5; 2/28] END .........C=10, kernel=linear;, score=0.958 total
time=   0.0s
[CV 2/5; 2/28] START C=10,
kernel=linear.....................................
[CV 2/5; 2/28] END .........C=10, kernel=linear;, score=0.940 total
time=   0.0s
[CV 3/5; 2/28] START C=10,
```

```
kernel=linear.....................................
[CV 3/5; 2/28] END .........C=10, kernel=linear;, score=0.928 total
time=   0.0s
[CV 4/5; 2/28] START C=10,
kernel=linear.....................................
[CV 4/5; 2/28] END .........C=10, kernel=linear;, score=0.940 total
time=   0.0s
[CV 5/5; 2/28] START C=10,
kernel=linear.....................................
[CV 5/5; 2/28] END .........C=10, kernel=linear;, score=0.928 total
time=   0.0s
[CV 1/5; 3/28] START C=100,
kernel=linear.....................................
[CV 1/5; 3/28] END ........C=100, kernel=linear;, score=0.958 total
time=   0.0s
[CV 2/5; 3/28] START C=100,
kernel=linear.....................................
[CV 2/5; 3/28] END ........C=100, kernel=linear;, score=0.952 total
time=   0.0s
[CV 3/5; 3/28] START C=100,
kernel=linear.....................................
[CV 3/5; 3/28] END ........C=100, kernel=linear;, score=0.934 total
time=   0.0s
[CV 4/5; 3/28] START C=100,
kernel=linear.....................................
[CV 4/5; 3/28] END ........C=100, kernel=linear;, score=0.940 total
time=   0.0s
[CV 5/5; 3/28] START C=100,
kernel=linear.....................................
[CV 5/5; 3/28] END ........C=100, kernel=linear;, score=0.928 total
time=   0.0s
[CV 1/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 1/5; 4/28] END .......C=1000, kernel=linear;, score=0.958 total
time=   0.0s
[CV 2/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 2/5; 4/28] END .......C=1000, kernel=linear;, score=0.952 total
time=   0.0s
[CV 3/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 3/5; 4/28] END .......C=1000, kernel=linear;, score=0.934 total
time=   0.0s
[CV 4/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 4/5; 4/28] END .......C=1000, kernel=linear;, score=0.952 total
time=   0.0s
[CV 5/5; 4/28] START C=1000,
kernel=linear.....................................
```

```
[CV 5/5; 4/28] END .......C=1000, kernel=linear;, score=0.928 total
time=   0.0s
[CV 1/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 1/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.898 total
time=   0.0s
[CV 2/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 2/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.904 total
time=   0.0s
[CV 3/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 3/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.854 total
time=   0.0s
[CV 4/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 4/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.880 total
time=   0.0s
[CV 5/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.................................
[CV 5/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.903 total
time=   0.0s
[CV 1/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 1/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.898 total
time=   0.0s
[CV 2/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 2/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 3/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 3/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.861 total
time=   0.0s
[CV 4/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 4/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.898 total
time=   0.0s
[CV 5/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 5/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.903 total
time=   0.0s
[CV 1/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 1/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 2/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 2/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.916 total
```

```
time=   0.0s
[CV 3/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.867 total
time=   0.0s
[CV 4/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 5/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.903 total
time=   0.0s
[CV 1/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 2/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.916 total
time=   0.0s
[CV 3/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.873 total
time=   0.0s
[CV 4/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.910 total
time=   0.0s
[CV 5/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.903 total
time=   0.0s
[CV 1/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 2/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 3/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.922 total
time=   0.0s
[CV 4/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.928 total
time=   0.0s
```

```
[CV 5/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.916 total
time=   0.0s
[CV 1/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 3/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 4/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 5/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.928 total
time=   0.0s
[CV 1/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 3/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 4/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 5/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 12/28] START C=10, gamma=0.4,
```

```
kernel=rbf.............................
[CV 2/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 3/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 4/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 5/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 3/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 4/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................

[CV 4/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 5/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 3/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 4/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
```

```
[CV 4/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 5/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 2/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 3/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.946 total
time=   0.0s
[CV 4/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 5/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 2/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 3/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 4/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 5/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.964 total
```

```
time=   0.0s
[CV 2/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 3/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 4/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 5/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.934 total
time=   0.0s
[CV 1/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 2/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 3/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 4/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 5/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.940 total
time=   0.0s
[CV 1/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 2/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 3/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
```

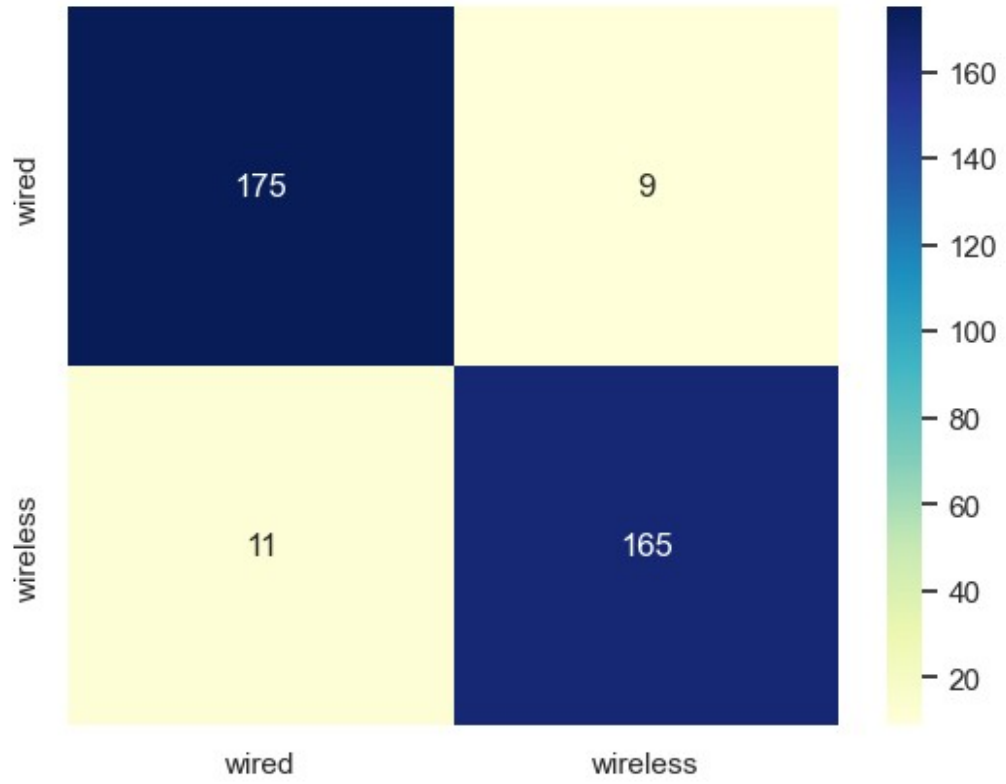
```
[CV 4/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 5/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 1/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 2/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 3/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 4/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 5/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.952 total
time=   0.0s
[CV 1/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 1/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 2/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 3/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 4/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 5/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 22/28] START C=1, degree=2, gamma=0.02,
```

```
kernel=poly.....................
[CV 1/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.458 total time=   0.0s
[CV 2/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.401 total time=   0.0s
[CV 3/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.436 total time=   0.0s
[CV 4/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 4/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.436 total time=   0.0s
[CV 5/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.433 total time=   0.0s
[CV 1/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 1/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.479 total time=   0.0s
[CV 2/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 2/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.447 total time=   0.0s
[CV 3/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.479 total time=   0.0s
[CV 4/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.458 total time=   0.0s
[CV 5/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................

[CV 5/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.487 total time=   0.0s
[CV 1/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 1/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.529 total time=   0.0s
[CV 2/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.499 total time=   0.0s
[CV 3/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
```

```
[CV 3/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.557 total time=   0.0s
[CV 4/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 4/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.515 total time=   0.0s
[CV 5/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 5/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.536 total time=   0.0s
[CV 1/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 1/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.566 total time=   0.0s
[CV 2/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 2/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.548 total time=   0.0s
[CV 3/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 3/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.593 total time=   0.0s
[CV 4/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 4/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.543 total time=   0.0s
[CV 5/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 5/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.582 total time=   0.0s
[CV 1/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 1/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.659 total time=   0.0s
[CV 2/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 2/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.593 total time=   0.0s
[CV 3/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 3/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.643 total time=   0.0s
[CV 4/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 4/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.614 total time=   0.0s
[CV 5/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 5/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
```

```
score=0.633 total time=   0.0s
[CV 1/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 1/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.683 total time=   0.0s
[CV 2/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 2/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.602 total time=   0.0s
[CV 3/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 3/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.667 total time=   0.0s
[CV 4/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 4/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.638 total time=   0.0s
[CV 5/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 5/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.665 total time=   0.0s
[CV 1/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.727 total time=   0.0s
[CV 2/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.643 total time=   0.0s
[CV 3/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.675 total time=   0.0s
[CV 4/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.707 total time=   0.0s
[CV 5/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.689 total time=   0.0s
GridSearch CV best score : 0.9559


Parameters that give the best results :

 {'C': 1000, 'gamma': 0.4, 'kernel': 'rbf'}


Estimator that was chosen by the search :
```

```
 SVC(C=1000, gamma=0.4)
Model classification report with GridSearch CV:
              precision    recall  f1-score   support

           0       0.94      0.95      0.95       184
           1       0.95      0.94      0.94       176

    accuracy                           0.94       360
   macro avg       0.94      0.94      0.94       360
weighted avg       0.94      0.94      0.94       360
```



Latency & Bandwidth

```
svc=SVC()
parameters = [ {'C':[1, 10, 100, 1000], 'kernel':['linear']},
               {'C':[1, 10, 100, 1000], 'kernel':['rbf'], 'gamma':
[0.1, 0.2, 0.3, 0.4]},
               {'C':[1, 10, 100, 1000], 'kernel':['poly'], 'degree':
[2] ,'gamma':[0.01,0.02]}
              ]

grid_search = GridSearchCV(estimator = svc,
                           param_grid = parameters,
```

```
                            scoring = 'f1_weighted',
                            cv = 5,
                            verbose=10)


grid_search.fit(X_train_lat_ban, t_train)
# examine the best model

# best score achieved during the GridSearchCV
print('GridSearch CV best score : {:.4f}\n\
n'.format(grid_search.best_score_))

# print parameters that give the best results
print('Parameters that give the best results :','\n\n',
(grid_search.best_params_))

# print estimator that was chosen by the GridSearch
print('\n\nEstimator that was chosen by the search :','\n\n',
(grid_search.best_estimator_))

estimator = grid_search.best_estimator_

# calculate GridSearch CV score on test set
t_pred = estimator.predict(X_test_lat_ban)

print('Model classification report with GridSearch CV: \n',
classification_report(t_test, t_pred))
cm = confusion_matrix(t_test, t_pred, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()
```

```
Fitting 5 folds for each of 28 candidates, totalling 140 fits
[CV 1/5; 1/28] START C=1,
kernel=linear.....................................
[CV 1/5; 1/28] END .........C=1, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 1/28] START C=1,
kernel=linear.....................................
[CV 2/5; 1/28] END .........C=1, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 1/28] START C=1,
kernel=linear.....................................
[CV 3/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 1/28] START C=1,
kernel=linear.....................................
[CV 4/5; 1/28] END .........C=1, kernel=linear;, score=0.958 total
```

```
time=   0.0s
[CV 5/5; 1/28] START C=1,
kernel=linear.....................................
[CV 5/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 2/28] START C=10,
kernel=linear.....................................
[CV 1/5; 2/28] END .........C=10, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 2/28] START C=10,
kernel=linear.....................................
[CV 2/5; 2/28] END .........C=10, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 2/28] START C=10,
kernel=linear.....................................
[CV 3/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 2/28] START C=10,
kernel=linear.....................................
[CV 4/5; 2/28] END .........C=10, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 2/28] START C=10,
kernel=linear.....................................
[CV 5/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 3/28] START C=100,
kernel=linear.....................................
[CV 1/5; 3/28] END ........C=100, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 3/28] START C=100,
kernel=linear.....................................
[CV 2/5; 3/28] END ........C=100, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 3/28] START C=100,
kernel=linear.....................................
[CV 3/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 3/28] START C=100,
kernel=linear.....................................
[CV 4/5; 3/28] END ........C=100, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 3/28] START C=100,
kernel=linear.....................................
[CV 5/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 1/5; 4/28] END .......C=1000, kernel=linear;, score=0.982 total
time=   0.0s
```

```
[CV 2/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 2/5; 4/28] END .......C=1000, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 3/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 4/5; 4/28] END .......C=1000, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 5/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 1/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 2/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 3/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 4/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 5/28] START C=1, gamma=0.1,
kernel=rbf................................
[CV 5/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 1/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 2/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 2/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 6/28] START C=1, gamma=0.2,
kernel=rbf................................
[CV 3/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 6/28] START C=1, gamma=0.2,
```

```
kernel=rbf.................................
[CV 4/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.................................
[CV 5/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 1/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 2/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 3/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 4/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.................................
[CV 5/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 1/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 2/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 3/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 4/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.958 total
time=   0.0s
[CV 5/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.................................
[CV 5/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.................................
```

```
[CV 1/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 4/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.982 total
```

```
time=   0.0s
[CV 4/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................

[CV 1/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 4/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
```

```
[CV 1/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 4/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 16/28] START C=100, gamma=0.4,
```

```
kernel=rbf.............................
[CV 3/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 2/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
```

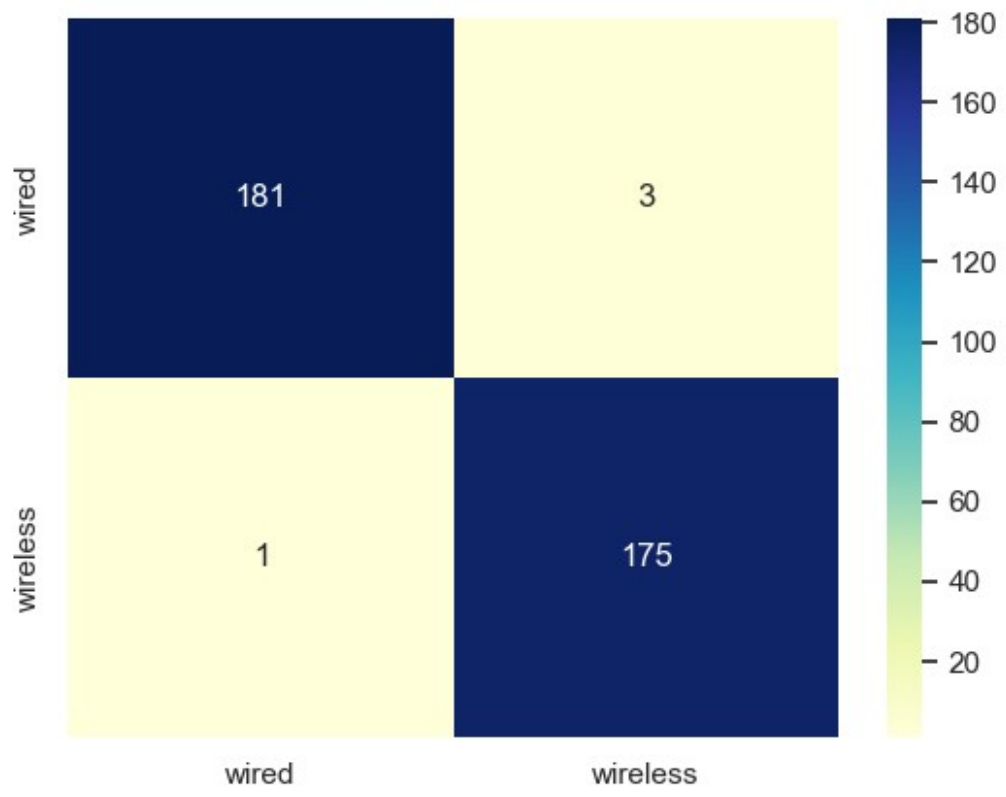
```
[CV 5/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 3/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 1/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 2/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
```

```
score=0.340 total time=   0.0s
[CV 3/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly.....................
[CV 5/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 1/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.401 total time=   0.0s
[CV 2/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.401 total time=   0.0s
[CV 3/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.458 total time=   0.0s
[CV 4/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 4/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.378 total time=   0.0s
[CV 5/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.387 total time=   0.0s
[CV 1/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................

[CV 1/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.413 total time=   0.0s
[CV 2/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 2/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.401 total time=   0.0s
[CV 3/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.436 total time=   0.0s
[CV 4/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.386 total time=   0.0s
```

```
[CV 5/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly..................
[CV 5/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.422 total time=   0.0s
[CV 1/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 1/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.458 total time=   0.0s
[CV 2/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 2/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.447 total time=   0.0s
[CV 3/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 3/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.447 total time=   0.0s
[CV 4/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 4/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.421 total time=   0.0s
[CV 5/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly..................
[CV 5/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.487 total time=   0.0s
[CV 1/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 1/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.659 total time=   0.0s
[CV 2/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 2/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.707 total time=   0.0s
[CV 3/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 3/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.782 total time=   0.0s
[CV 4/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 4/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.699 total time=   0.0s
[CV 5/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly..................
[CV 5/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.721 total time=   0.0s
[CV 1/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly..................
[CV 1/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.821 total time=   0.0s
[CV 2/5; 26/28] START C=100, degree=2, gamma=0.02,
```

```
kernel=poly.................
[CV 2/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.785 total time=   0.0s
[CV 3/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.905 total time=   0.0s
[CV 4/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.797 total time=   0.0s
[CV 5/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.856 total time=   0.0s
[CV 1/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 1/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.881 total time=   0.0s
[CV 2/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 2/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.844 total time=   0.0s
[CV 3/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 3/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.923 total time=   0.0s
[CV 4/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 4/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.875 total time=   0.0s
[CV 5/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 5/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.910 total time=   0.0s
[CV 1/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.922 total time=   0.0s
[CV 2/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.855 total time=   0.0s
[CV 3/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.934 total time=   0.0s
[CV 4/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
```

```
[CV 4/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.905 total time=   0.0s
[CV 5/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.904 total time=   0.0s
GridSearch CV best score : 0.9917


Parameters that give the best results :

 {'C': 1000, 'gamma': 0.3, 'kernel': 'rbf'}


Estimator that was chosen by the search :

 SVC(C=1000, gamma=0.3)
Model classification report with GridSearch CV:
               precision    recall  f1-score   support

           0       0.99      0.98      0.99       184
           1       0.98      0.99      0.99       176

    accuracy                           0.99       360
   macro avg       0.99      0.99      0.99       360
weighted avg       0.99      0.99      0.99       360
```



Retransmission & Bandwidth

```
svc=SVC()
parameters = [ {'C':[1, 10, 100, 1000], 'kernel':['linear']},
               {'C':[1, 10, 100, 1000], 'kernel':['rbf'], 'gamma':
[0.1, 0.2, 0.3, 0.4]},
               {'C':[1, 10, 100, 1000], 'kernel':['poly'], 'degree':
[2] ,'gamma':[0.01,0.02]}
              ]

grid_search = GridSearchCV(estimator = svc,
                           param_grid = parameters,
                           scoring = 'f1_weighted',
                           cv = 5,
                           verbose=10)


grid_search.fit(X_train_ret_ban, t_train)
# examine the best model

# best score achieved during the GridSearchCV
print('GridSearch CV best score : {:.4f}\n\
n'.format(grid_search.best_score_))

# print parameters that give the best results
print('Parameters that give the best results :','\n\n',
```

```
(grid_search.best_params_))

# print estimator that was chosen by the GridSearch
print('\n\nEstimator that was chosen by the search :','\n\n',
(grid_search.best_estimator_))

estimator = grid_search.best_estimator_

# calculate GridSearch CV score on test set
t_pred = estimator.predict(X_test_ret_ban)

print('Model classification report with GridSearch CV: \n',
classification_report(t_test, t_pred))
cm = confusion_matrix(t_test, t_pred, labels=[0,1])
cm_matrix = pd.DataFrame(data=cm, columns=['wired', 'wireless'],
                                  index=['wired', 'wireless'])

sea.heatmap(cm_matrix, annot=True, fmt='d', cmap='YlGnBu')
plt.show()
```

```
Fitting 5 folds for each of 28 candidates, totalling 140 fits
[CV 1/5; 1/28] START C=1,
kernel=linear.....................................
[CV 1/5; 1/28] END .........C=1, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 1/28] START C=1,
kernel=linear.....................................
[CV 2/5; 1/28] END .........C=1, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 1/28] START C=1,
kernel=linear.....................................
[CV 3/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 1/28] START C=1,
kernel=linear.....................................
[CV 4/5; 1/28] END .........C=1, kernel=linear;, score=0.964 total
time=   0.0s
[CV 5/5; 1/28] START C=1,
kernel=linear.....................................
[CV 5/5; 1/28] END .........C=1, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 2/28] START C=10,
kernel=linear.....................................
[CV 1/5; 2/28] END .........C=10, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 2/28] START C=10,
kernel=linear.....................................
[CV 2/5; 2/28] END .........C=10, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 2/28] START C=10,
```

```
kernel=linear.....................................
[CV 3/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 2/28] START C=10,
kernel=linear.....................................
[CV 4/5; 2/28] END .........C=10, kernel=linear;, score=0.964 total
time=   0.0s
[CV 5/5; 2/28] START C=10,
kernel=linear.....................................
[CV 5/5; 2/28] END .........C=10, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 3/28] START C=100,
kernel=linear.....................................
[CV 1/5; 3/28] END ........C=100, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 3/28] START C=100,
kernel=linear.....................................
[CV 2/5; 3/28] END ........C=100, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 3/28] START C=100,
kernel=linear.....................................
[CV 3/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 3/28] START C=100,
kernel=linear.....................................
[CV 4/5; 3/28] END ........C=100, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 3/28] START C=100,
kernel=linear.....................................
[CV 5/5; 3/28] END ........C=100, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 1/5; 4/28] END .......C=1000, kernel=linear;, score=0.982 total
time=   0.0s
[CV 2/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 2/5; 4/28] END .......C=1000, kernel=linear;, score=0.970 total
time=   0.0s
[CV 3/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 3/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 4/5; 4/28] START C=1000,
kernel=linear.....................................
[CV 4/5; 4/28] END .......C=1000, kernel=linear;, score=0.958 total
time=   0.0s
[CV 5/5; 4/28] START C=1000,
kernel=linear.....................................
```

```
[CV 5/5; 4/28] END .......C=1000, kernel=linear;, score=0.976 total
time=   0.0s
[CV 1/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 5/28] START C=1, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 5/28] END ..C=1, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 2/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 6/28] START C=1, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 6/28] END ..C=1, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 2/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.970 total
```

```
time=   0.0s
[CV 3/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 7/28] START C=1, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 7/28] END ..C=1, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 8/28] START C=1, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 8/28] END ..C=1, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 2/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 4/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.964 total
time=   0.0s
```

```
[CV 5/5; 9/28] START C=10, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 9/28] END .C=10, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 2/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 10/28] START C=10, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 10/28] END C=10, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 1/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.964 total
time=   0.0s
[CV 5/5; 11/28] START C=10, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 11/28] END C=10, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 12/28] START C=10, gamma=0.4,
```

```
kernel=rbf.............................
[CV 2/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 4/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 12/28] START C=10, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 12/28] END C=10, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.970 total
time=   0.0s
[CV 3/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................

[CV 3/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 4/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 13/28] START C=100, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 13/28] END C=100, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
```

```
[CV 4/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 14/28] START C=100, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 14/28] END C=100, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 15/28] START C=100, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 15/28] END C=100, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 16/28] START C=100, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 16/28] END C=100, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 1/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 1/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.994 total
```

```
time=   0.0s
[CV 2/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 2/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 3/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 4/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 17/28] START C=1000, gamma=0.1,
kernel=rbf.............................
[CV 5/5; 17/28] END C=1000, gamma=0.1, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 1/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 2/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 3/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 4/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.982 total
time=   0.0s
[CV 5/5; 18/28] START C=1000, gamma=0.2,
kernel=rbf.............................
[CV 5/5; 18/28] END C=1000, gamma=0.2, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 1/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 2/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 3/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=1.000 total
time=   0.0s
```

```
[CV 4/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 4/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 19/28] START C=1000, gamma=0.3,
kernel=rbf.............................
[CV 5/5; 19/28] END C=1000, gamma=0.3, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 1/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.994 total
time=   0.0s
[CV 2/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 2/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.976 total
time=   0.0s
[CV 3/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 3/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=1.000 total
time=   0.0s
[CV 4/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 4/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 5/5; 20/28] START C=1000, gamma=0.4,
kernel=rbf.............................
[CV 5/5; 20/28] END C=1000, gamma=0.4, kernel=rbf;, score=0.988 total
time=   0.0s
[CV 1/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 1/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 2/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 3/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 3/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 4/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 4/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.340 total time=   0.0s
[CV 5/5; 21/28] START C=1, degree=2, gamma=0.01,
kernel=poly....................
[CV 5/5; 21/28] END C=1, degree=2, gamma=0.01, kernel=poly;,
score=0.343 total time=   0.0s
[CV 1/5; 22/28] START C=1, degree=2, gamma=0.02,
```

```
kernel=poly.....................
[CV 1/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.340 total time=   0.0s
[CV 2/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.659 total time=   0.0s
[CV 3/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.619 total time=   0.0s
[CV 4/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 4/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.785 total time=   0.0s
[CV 5/5; 22/28] START C=1, degree=2, gamma=0.02,
kernel=poly.....................
[CV 5/5; 22/28] END C=1, degree=2, gamma=0.02, kernel=poly;,
score=0.726 total time=   0.0s
[CV 1/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 1/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.436 total time=   0.0s
[CV 2/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 2/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.390 total time=   0.0s
[CV 3/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 3/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.401 total time=   0.0s
[CV 4/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 4/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.436 total time=   0.0s
[CV 5/5; 23/28] START C=10, degree=2, gamma=0.01,
kernel=poly.....................
[CV 5/5; 23/28] END C=10, degree=2, gamma=0.01, kernel=poly;,
score=0.410 total time=   0.0s
[CV 1/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 1/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.499 total time=   0.0s
[CV 2/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 2/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.458 total time=   0.0s
[CV 3/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly.....................
[CV 3/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
```

```
score=0.489 total time=   0.0s
[CV 4/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly...................

[CV 4/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.479 total time=   0.0s
[CV 5/5; 24/28] START C=10, degree=2, gamma=0.02,
kernel=poly...................
[CV 5/5; 24/28] END C=10, degree=2, gamma=0.02, kernel=poly;,
score=0.497 total time=   0.0s
[CV 1/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 1/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.700 total time=   0.0s
[CV 2/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 2/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.616 total time=   0.0s
[CV 3/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 3/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.763 total time=   0.0s
[CV 4/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 4/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.712 total time=   0.0s
[CV 5/5; 25/28] START C=100, degree=2, gamma=0.01,
kernel=poly...................
[CV 5/5; 25/28] END C=100, degree=2, gamma=0.01, kernel=poly;,
score=0.688 total time=   0.0s
[CV 1/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly...................
[CV 1/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.833 total time=   0.0s
[CV 2/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly...................
[CV 2/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.768 total time=   0.0s
[CV 3/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly...................
[CV 3/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.875 total time=   0.0s
[CV 4/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly...................
[CV 4/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.827 total time=   0.0s
[CV 5/5; 26/28] START C=100, degree=2, gamma=0.02,
kernel=poly...................
[CV 5/5; 26/28] END C=100, degree=2, gamma=0.02, kernel=poly;,
score=0.808 total time=   0.0s
```

```
[CV 1/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 1/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.899 total time=   0.0s
[CV 2/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 2/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.815 total time=   0.0s
[CV 3/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 3/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.923 total time=   0.0s
[CV 4/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 4/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.905 total time=   0.0s
[CV 5/5; 27/28] START C=1000, degree=2, gamma=0.01,
kernel=poly.................
[CV 5/5; 27/28] END C=1000, degree=2, gamma=0.01, kernel=poly;,
score=0.910 total time=   0.0s
[CV 1/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 1/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.922 total time=   0.0s
[CV 2/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 2/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.838 total time=   0.0s
[CV 3/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 3/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.934 total time=   0.0s
[CV 4/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 4/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.928 total time=   0.0s
[CV 5/5; 28/28] START C=1000, degree=2, gamma=0.02,
kernel=poly.................
[CV 5/5; 28/28] END C=1000, degree=2, gamma=0.02, kernel=poly;,
score=0.910 total time=   0.0s
GridSearch CV best score : 0.9893


Parameters that give the best results :

 {'C': 100, 'gamma': 0.2, 'kernel': 'rbf'}


Estimator that was chosen by the search :
```

```
 SVC(C=100, gamma=0.2)
Model classification report with GridSearch CV:
              precision    recall  f1-score   support

           0       0.99      0.98      0.99       184
           1       0.98      0.99      0.99       176

    accuracy                           0.99       360
   macro avg       0.99      0.99      0.99       360
weighted avg       0.99      0.99      0.99       360
```