Avaliacao_ensemble_test

November 4, 2019

[1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
from datetime import datetime
import matplotlib.pyplot as plt
%matplotlib inline
from sklearn.model_selection import StratifiedKFold, GridSearchCV
from sklearn.ensemble import RandomForestClassifier,␣
↪GradientBoostingClassifier, AdaBoostClassifier, VotingClassifier
from sklearn.metrics import roc_auc_score, roc_curve, auc,␣
↪precision_recall_curve
from sklearn.metrics import classification_report, confusion_matrix
from xgboost import XGBClassifier
from mlxtend.plotting import plot_learning_curves
from yellowbrick.model_selection import LearningCurve
import matplotlib.gridspec as gridspec
import itertools
from sklearn.model_selection import cross_val_score, train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score
from sklearn.linear_model import LogisticRegression
from sklearn import tree
from sklearn.naive_bayes import MultinomialNB
from sklearn.utils import shuffle
from sklearn.preprocessing import LabelEncoder, OrdinalEncoder
```

[2]:
```
def timer(start_time=None):
    if not start_time:
        start_time = datetime.now()
        return start_time
    elif start_time:
        tmin, tsec = divmod((datetime.now() - start_time).total_seconds(), 60)
        print('\n Tempo Necessário: %i minutos and %s segundos.' % (tmin,␣
↪round(tsec, 2)))
```

[3]:
```
train = pd.read_csv('trainAG.csv')
train = shuffle(train)
```

```
X_train = train.iloc[:,1:105]
Y_train = train.loc[:, train.columns == 'Y']
test = pd.read_csv('testAG.csv')
test = shuffle(test)
X_test = test.iloc[:,1:105]
Y_test = test.loc[:, test.columns == 'Y']
```

[4]:
```
print(X_train.shape)
```

```
(109992, 104)
```

[5]:
```
print(X_test.shape)
```

```
(65995, 104)
```

[6]:
```
X_train.head()
```

[6]:

	v1	v2	v4	v5	v6	v9	v11	v13	v14	v15	…	v50	v54	v56	v66	\
10118	0	0	0	0	0	0	0	0	0	0	…	0.0	0.0	0.0	0.0	
62712	0	0	0	0	0	0	0	0	0	0	…	0.0	0.0	0.0	0.0	
59663	0	0	0	0	0	0	0	0	0	0	…	0.0	0.0	0.0	0.0	
46701	0	0	0	0	0	0	0	0	0	0	…	0.0	0.0	0.0	0.0	
22379	0	0	0	0	0	0	0	0	0	0	…	0.0	0.0	0.0	0.0	

	v68	v70	v72	v74	v76	v78
10118	0.0	0.0	0.0	0.0	0.0	0.0
62712	0.0	0.0	0.0	0.0	0.0	0.0
59663	0.0	0.0	927.0	800.0	20000.0	52722.5
46701	0.0	0.0	0.0	0.0	0.0	0.0
22379	0.0	0.0	0.0	0.0	0.0	0.0

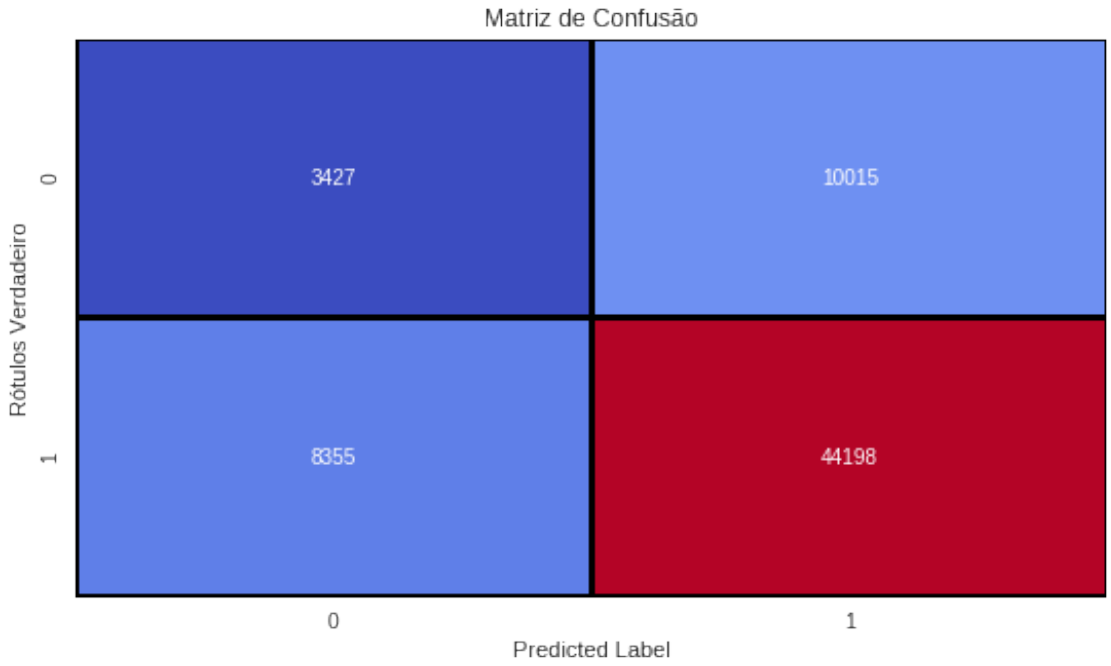
[5 rows x 104 columns]

[7]:
```
# Fit a Decision Tree model as comparison
starttime = timer(None)
start_time = timer(None)
clf_DecisionTreeClassifier = DecisionTreeClassifier()
clf_DecisionTreeClassifier.fit(X_train, Y_train.values.ravel())
DecisionTreeClassifier_pred = clf_DecisionTreeClassifier.predict(X_test)
timer(start_time)
accuracy_score(Y_test, DecisionTreeClassifier_pred)
false_positive_rate, true_positive_rate, thresholds = roc_curve(Y_test␣
↪,DecisionTreeClassifier_pred)
roc_auc = auc(false_positive_rate, true_positive_rate)

plt.figure(1)
```

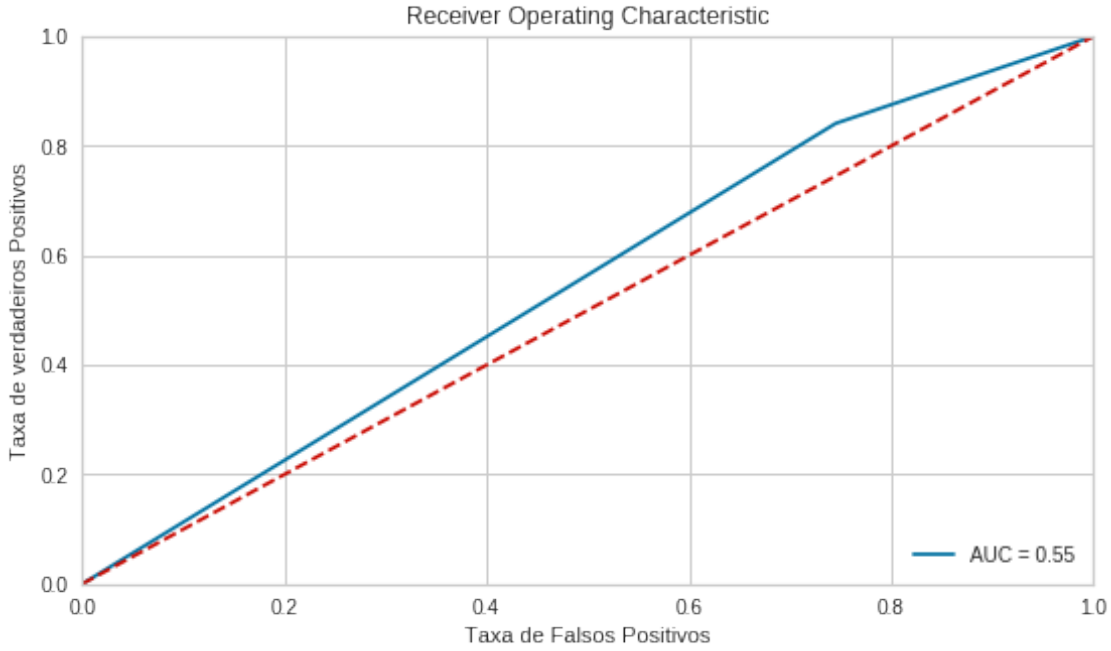
```
matrix_DecisionTreeClassifier = confusion_matrix(Y_test,␣
 ↪DecisionTreeClassifier_pred)
plt.figure(figsize=(9,5))
DecisionTreeClassifier = sns.heatmap(matrix_DecisionTreeClassifier, annot=True,␣
 ↪cbar=False, fmt="d", cmap ='coolwarm', linecolor ='black', linewidths = 2)
bottom, top = DecisionTreeClassifier.get_ylim()
DecisionTreeClassifier.set_ylim(bottom + 0.5, top - 0.5)
plt.ylabel('Rótulos Verdadeiro')
plt.xlabel('Predicted Label')
plt.title('Matriz de Confusão')
plt.show()



plt.figure(2)
plt.figure(figsize=(9,5))
plt.title('Receiver Operating Characteristic')
plt.plot(false_positive_rate, true_positive_rate, 'b',
label='AUC = %0.2f'% roc_auc)
plt.legend(loc='lower right')
plt.plot([0,1],[0,1],'r--')
plt.xlim([-0.0,1.0])
plt.ylim([-0.0,1.0])
plt.ylabel('Taxa de verdadeiros Positivos')
plt.xlabel('Taxa de Falsos Positivos')
plt.show()



print("Relatório de Classificação")
print(classification_report(Y_test, DecisionTreeClassifier_pred))

print("Acurácia do Modelo")
accuracy_score(Y_test, DecisionTreeClassifier_pred)
```

```
 Tempo Necessário: 0 minutos and 4.17 segundos.
```

```
<Figure size 432x288 with 0 Axes>
```



<Figure size 432x288 with 0 Axes>



Relatório de Classificação

```
              precision    recall  f1-score   support

           0       0.29      0.25      0.27     13442
           1       0.82      0.84      0.83     52553

    accuracy                           0.72     65995
   macro avg       0.55      0.55      0.55     65995
weighted avg       0.71      0.72      0.71     65995

Acurácia do Modelo
```

[7]:
```
0.7216455792105463
```

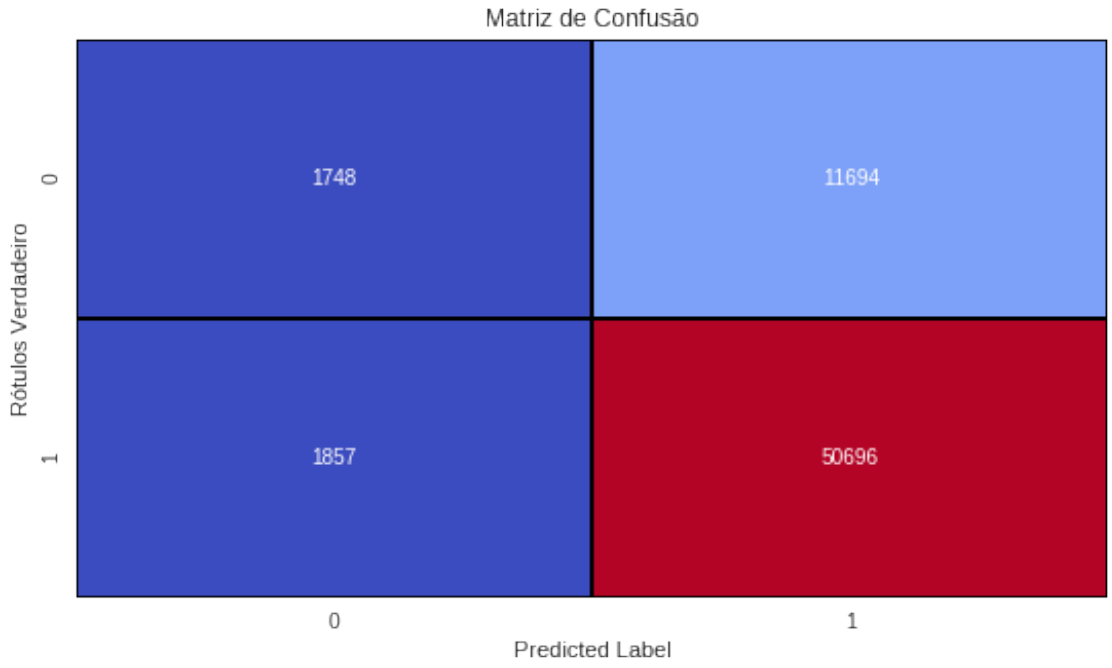
Fit a Simple Random Forest model

[8]:
```
starttime = timer(None)
start_time = timer(None)
clf = RandomForestClassifier(n_estimators=100,␣
 ↪max_features="auto",random_state=0)
clf.fit(X_train, Y_train.values.ravel())
scores = cross_val_score(clf, X_train, Y_train.values.ravel(), cv=3)
RandomForestClassifier_pred = clf.predict(X_test)
timer(start_time)
accuracy_score(Y_test, RandomForestClassifier_pred)
false_positive_rate, true_positive_rate, thresholds = roc_curve(Y_test,␣
 ↪RandomForestClassifier_pred)
roc_auc = auc(false_positive_rate, true_positive_rate)


plt.figure(1)
matrix_RandomForestClassifier = confusion_matrix(Y_test,␣
 ↪RandomForestClassifier_pred)
plt.figure(figsize=(9,5))
map_RandomForestClassifier = sns.heatmap(matrix_RandomForestClassifier,␣
 ↪annot=True, cbar=False, fmt="d", cmap ='coolwarm', linecolor ='black',␣
 ↪linewidths = 1)
bottom, top = map_RandomForestClassifier.get_ylim()
map_RandomForestClassifier.set_ylim(bottom + 0.5, top - 0.5)
plt.ylabel('Rótulos Verdadeiro')
plt.xlabel('Predicted Label')
plt.title('Matriz de Confusão')
plt.show()

plt.figure(2)
plt.figure(figsize=(9,5))
plt.title('Receiver Operating Characteristic')
plt.plot(false_positive_rate, true_positive_rate, 'b',
```

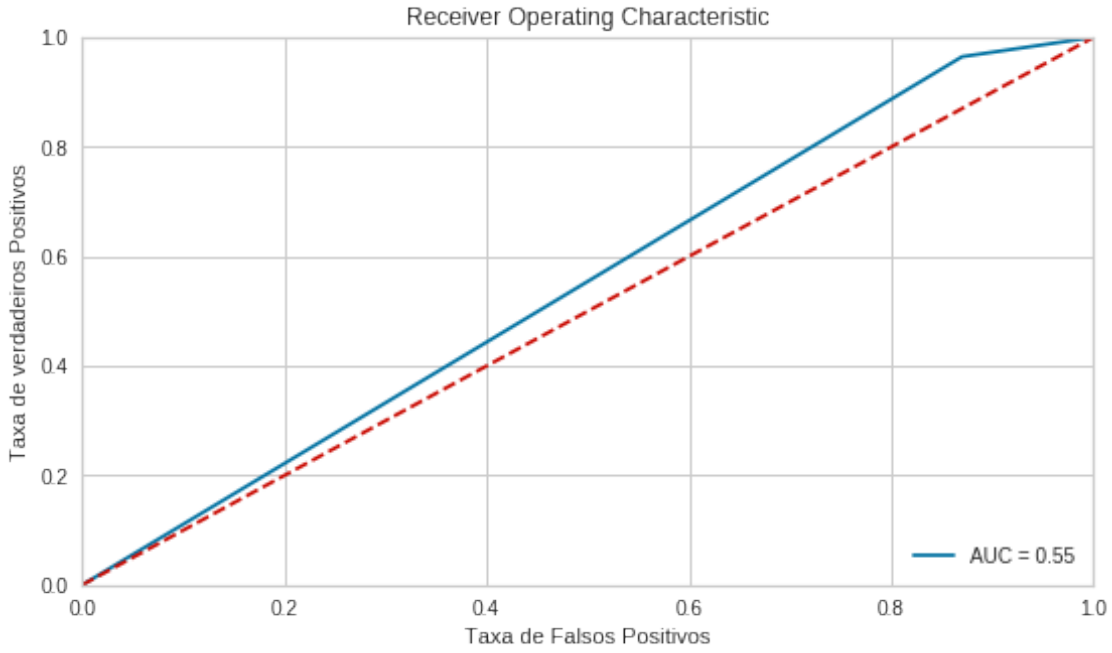
```
label='AUC = %0.2f'% roc_auc)
plt.legend(loc='lower right')
plt.plot([0,1],[0,1],'r--')
plt.xlim([-0.0,1.0])
plt.ylim([-0.0,1.0])
plt.ylabel('Taxa de verdadeiros Positivos')
plt.xlabel('Taxa de Falsos Positivos')
plt.show()



print("Relatório de Classificação")
print(classification_report(Y_test, RandomForestClassifier_pred))

print("Acurácia do Modelo")
accuracy_score(Y_test, RandomForestClassifier_pred)

print("Acurácia do Modelo Cross Validation")
print(scores.mean())
```

```
 Tempo Necessário: 1 minutos and 47.31 segundos.
```

```
<Figure size 432x288 with 0 Axes>
```



```
<Figure size 432x288 with 0 Axes>
```




```
Relatório de Classificação
              precision    recall  f1-score   support

           0       0.48      0.13      0.21     13442
           1       0.81      0.96      0.88     52553

    accuracy                           0.79     65995
   macro avg       0.65      0.55      0.54     65995
weighted avg       0.75      0.79      0.74     65995

Acurácia do Modelo
Acurácia do Modelo Cross Validation
0.7904847810221067
```

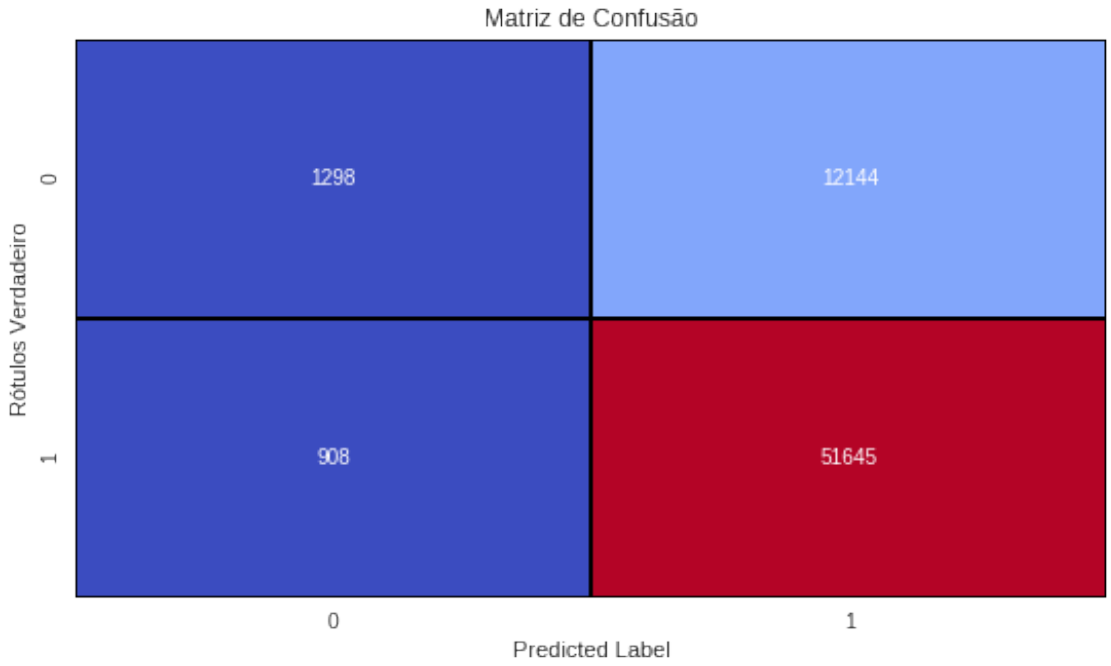
Fit a AdaBoost model

[9]:
```
starttime = timer(None)
start_time = timer(None)
clf = AdaBoostClassifier(n_estimators=100)
clf.fit(X_train, Y_train.values.ravel())
AdaBoostClassifier_pred = clf.predict(X_test)
scores = cross_val_score(clf, X_train, Y_train.values.ravel(), cv=3)
timer(start_time)
accuracy_score(Y_test, AdaBoostClassifier_pred)
```

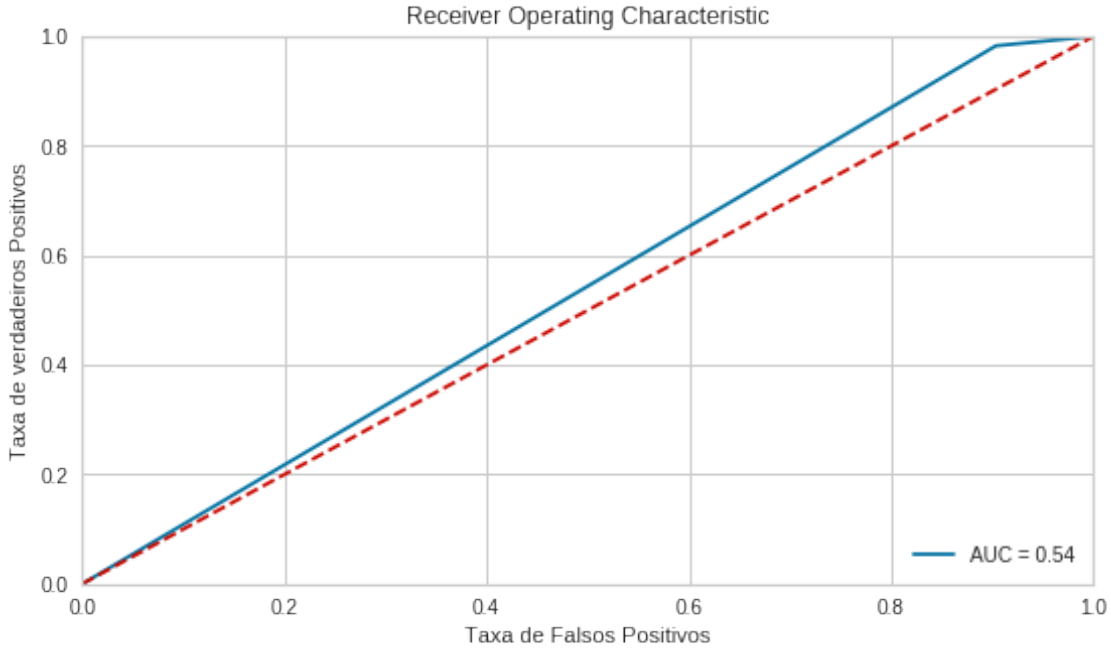
```
false_positive_rate, true_positive_rate, thresholds = roc_curve(Y_test,␣
 ↪AdaBoostClassifier_pred)
roc_auc = auc(false_positive_rate, true_positive_rate)


plt.figure(1)
matrix_AdaBoostClassifier = confusion_matrix(Y_test, AdaBoostClassifier_pred)
plt.figure(figsize=(9,5))
map_matrix_AdaBoostClassifier = sns.heatmap(matrix_AdaBoostClassifier,␣
 ↪annot=True, cbar=False, fmt="d", cmap ='coolwarm', linecolor ='black',␣
 ↪linewidths = 1)
bottom, top = map_matrix_AdaBoostClassifier.get_ylim()
map_matrix_AdaBoostClassifier.set_ylim(bottom + 0.5, top - 0.5)
plt.ylabel('Rótulos Verdadeiro')
plt.xlabel('Predicted Label')
plt.title('Matriz de Confusão')
plt.show()

plt.figure(2)
plt.figure(figsize=(9,5))
plt.title('Receiver Operating Characteristic')
plt.plot(false_positive_rate, true_positive_rate, 'b',
label='AUC = %0.2f'% roc_auc)
plt.legend(loc='lower right')
plt.plot([0,1],[0,1],'r--')
plt.xlim([-0.0,1.0])
plt.ylim([-0.0,1.0])
plt.ylabel('Taxa de verdadeiros Positivos')
plt.xlabel('Taxa de Falsos Positivos')
plt.show()


print("Relatório de Classificação")
print(classification_report(Y_test, AdaBoostClassifier_pred))

print("Acurácia do Modelo")
accuracy_score(Y_test, AdaBoostClassifier_pred)

print("Acurácia do Modelo Cross Validation")
print(scores.mean())
```

```
 Tempo Necessário: 0 minutos and 57.38 segundos.
```

```
<Figure size 432x288 with 0 Axes>
```



<Figure size 432x288 with 0 Axes>



Relatório de Classificação

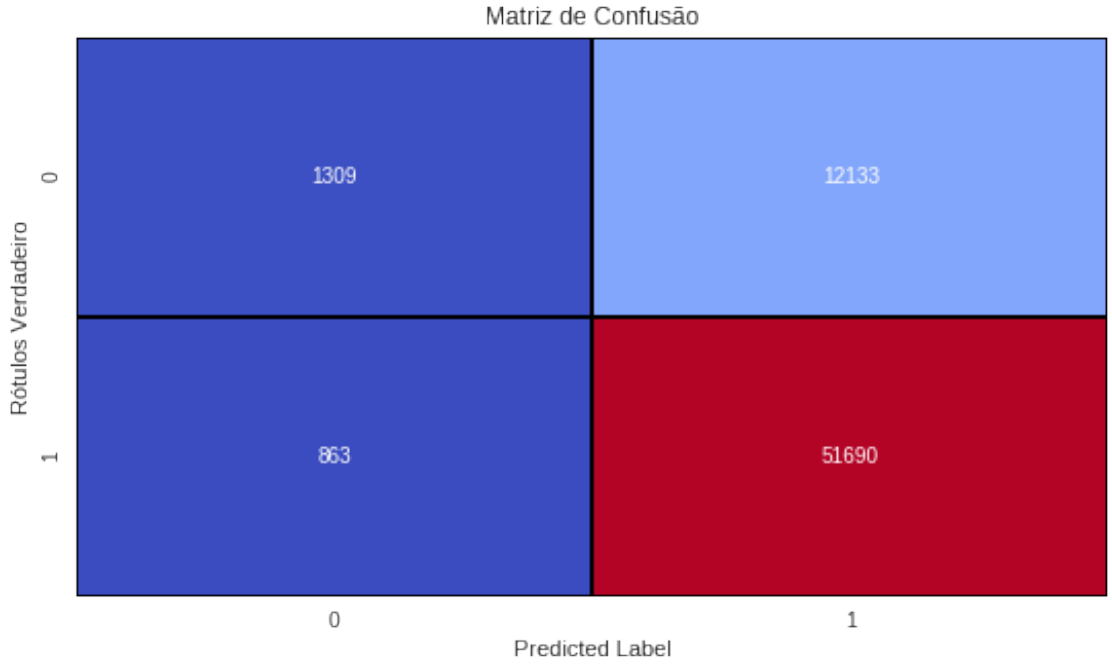
```
              precision    recall  f1-score   support

           0       0.59      0.10      0.17     13442
           1       0.81      0.98      0.89     52553

    accuracy                           0.80     65995
   macro avg       0.70      0.54      0.53     65995
weighted avg       0.76      0.80      0.74     65995

Acurácia do Modelo
Acurácia do Modelo Cross Validation
0.7994036090069704
```

Fit a Gradient Boosting model

[10]:
```
gb_clf2 = GradientBoostingClassifier(n_estimators=200, learning_rate=0.5,␣
 ↪max_features=2, max_depth=2, random_state=1)
gb_clf2.fit(X_train, Y_train.values.ravel())
GradientBoostingClassifier_predictions = gb_clf2.predict(X_test)

matrix_GradientBoostingClassifier2 = confusion_matrix(Y_test,␣
 ↪GradientBoostingClassifier_predictions)
scores = cross_val_score(gb_clf2, X_train, Y_train.values.ravel(), cv=3)
plt.figure(figsize=(9,5))
map_matrix_GradientBoostingClassifier2 = sns.
 ↪heatmap(matrix_GradientBoostingClassifier2, annot=True, cbar=False, fmt="d",␣
 ↪cmap ='coolwarm', linecolor ='black', linewidths = 1)
bottom, top = map_matrix_GradientBoostingClassifier2.get_ylim()
map_matrix_GradientBoostingClassifier2.set_ylim(bottom + 0.5, top - 0.5)
plt.ylabel('Rótulos Verdadeiro')
plt.xlabel('Predicted Label')
plt.title('Matriz de Confusão')



print("Relatório de Classificação")
print(classification_report(Y_test, GradientBoostingClassifier_predictions))

print("Acurácia do Modelo")
accuracy_score(Y_test, GradientBoostingClassifier_predictions)

print("Acurácia do Modelo Cross Validation")
print(scores.mean())
```

```
Relatório de Classificação
              precision    recall  f1-score   support

           0       0.60      0.10      0.17     13442
```

```
           1       0.81      0.98      0.89     52553

    accuracy                           0.80     65995
   macro avg       0.71      0.54      0.53     65995
weighted avg       0.77      0.80      0.74     65995

Acurácia do Modelo
Acurácia do Modelo Cross Validation
0.798830826439656
```



XGboost Classifier

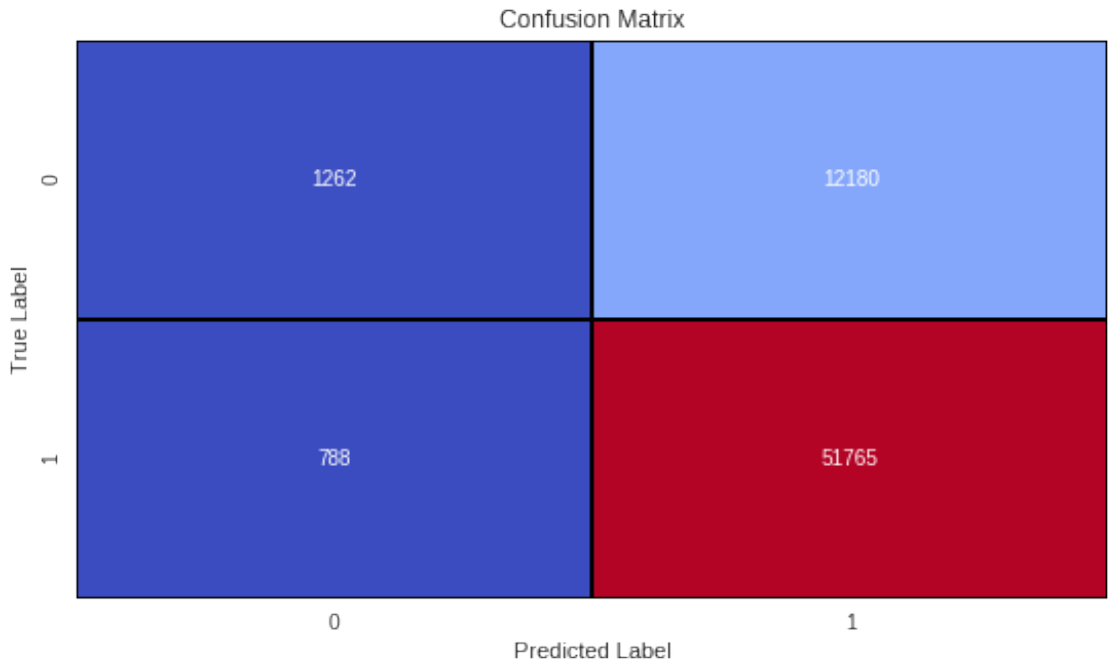
[11]:
```
starttime = timer(None)
start_time = timer(None)
xgb_clf = XGBClassifier(base_score=0.2, booster='gbtree', colsample_bylevel=1,
              colsample_bynode=0.1, colsample_bytree=1, gamma=1,
              learning_rate=0.1, max_delta_step=1, max_depth=3,
              min_child_weight=1, missing=None, n_estimators=300, n_jobs=4,
              nthread=None, objective='reg:squarederror', random_state=1,
              reg_alpha=0, reg_lambda=10, scale_pos_weight=1, seed=None,
              silent=None, subsample=1, verbosity=1)
xgb_clf.fit(X_train, Y_train.values.ravel())
predictions_xgb = xgb_clf.predict(X_test)
scores = cross_val_score(xgb_clf, X_train, Y_train.values.ravel(), cv=3)
timer(start_time)
```

```
false_positive_rate, true_positive_rate, thresholds = roc_curve(Y_test,␣
 ↪predictions_xgb)
roc_auc = auc(false_positive_rate, true_positive_rate)
matrix_xgb_clf = confusion_matrix(Y_test, predictions_xgb)



plt.figure(1)
plt.figure(figsize=(9,5))
xgb_clf_heatmap = sns.heatmap(matrix_xgb_clf,annot=True, cbar=False, fmt="d",␣
 ↪cmap ='coolwarm', linecolor ='black', linewidths = 1)
bottom, top = xgb_clf_heatmap.get_ylim()
xgb_clf_heatmap.set_ylim(bottom + 0.5, top - 0.5)
plt.ylabel('True Label')
plt.xlabel('Predicted Label')
plt.title('Confusion Matrix')
plt.show()

plt.figure(2)
plt.figure(figsize=(9,5))
plt.title('Receiver Operating Characteristic')
plt.plot(false_positive_rate, true_positive_rate, 'b',
label='AUC = %0.2f'% roc_auc)
plt.legend(loc='lower right')
plt.plot([0,1],[0,1],'r--')
plt.xlim([-0.0,1.0])
plt.ylim([-0.0,1.0])
plt.ylabel('True Positive Rate')
plt.xlabel('False Positive Rate')
plt.show()

plt.figure(3)
precision, recall, thresholds = precision_recall_curve(Y_test, predictions_xgb)
plt.figure(figsize = (9,5))
plt.plot(recall, precision)
plt.plot([0, 1], [0.5, 0.5], linestyle = '--')
plt.xlabel('Recall', fontsize = 16)
plt.ylabel('Precision', fontsize = 16)
plt.xticks(size = 18)
plt.yticks(size = 18)
plt.title('Precision-Recall', fontsize = 28)
plt.show();


print("Classification Report")
print(classification_report(Y_test, predictions_xgb))
```

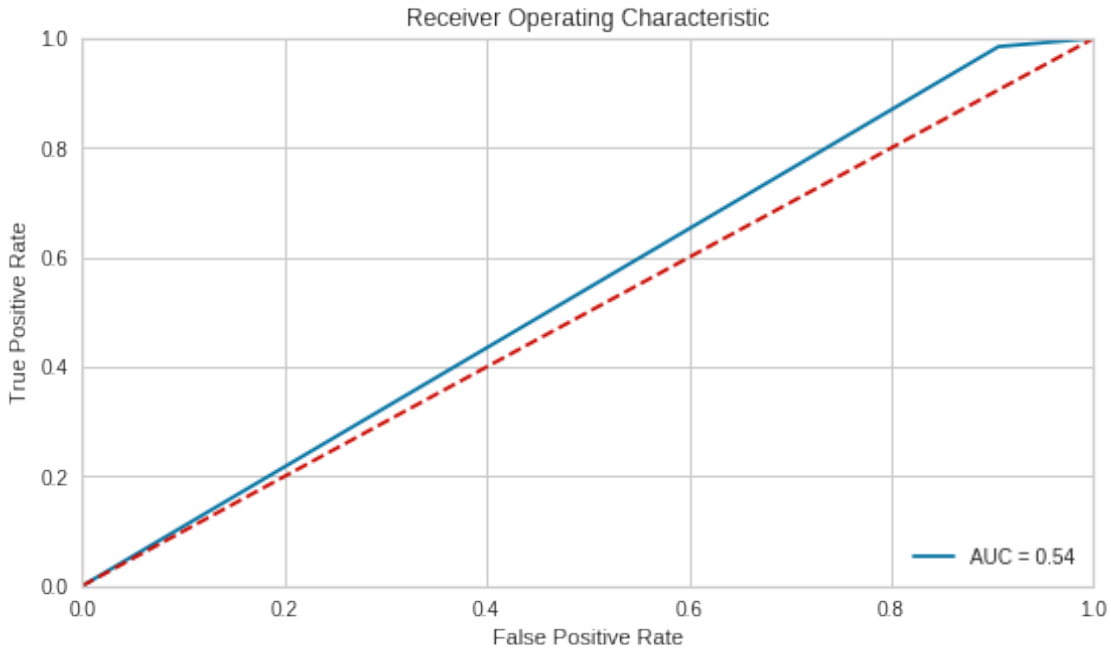
```
print("Acurácia do Modelo")
accuracy_score(Y_test, predictions_xgb)

print("Acurácia do Modelo Cross Validation")
print(scores.mean())
```

```
 Tempo Necessário: 0 minutos and 18.3 segundos.
```

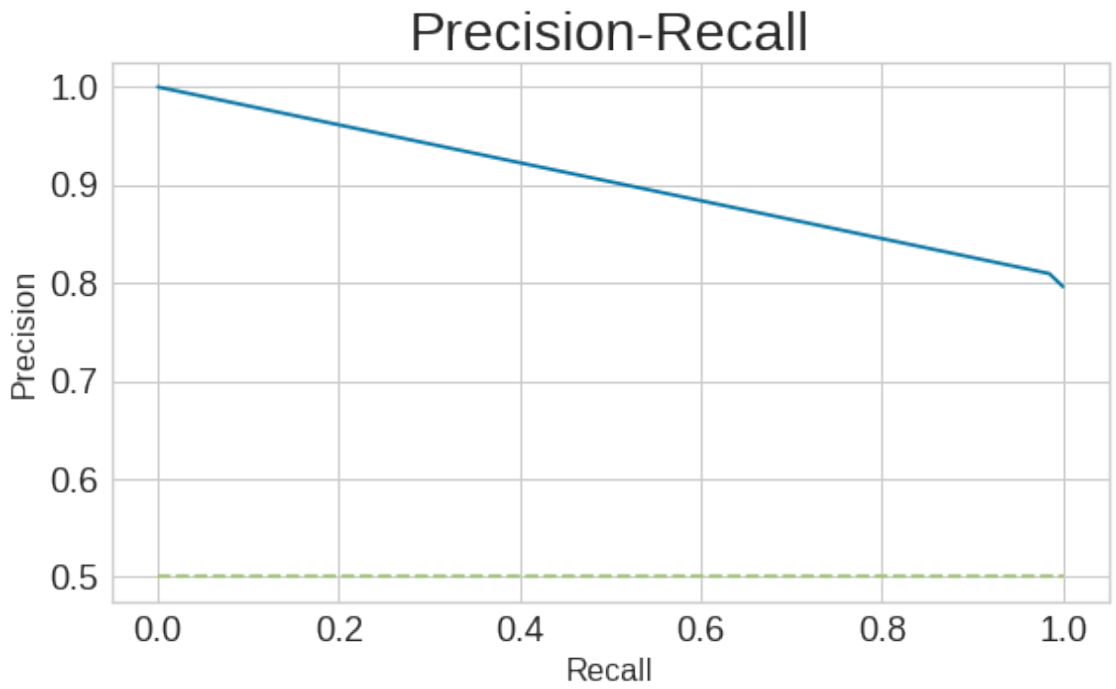
```
<Figure size 432x288 with 0 Axes>
```




```
<Figure size 432x288 with 0 Axes>
```




```
<Figure size 432x288 with 0 Axes>
```




```
Classification Report
```

```
                precision    recall  f1-score   support

             0       0.62      0.09      0.16     13442
             1       0.81      0.99      0.89     52553

    accuracy                           0.80     65995
   macro avg       0.71      0.54      0.53     65995
weighted avg       0.77      0.80      0.74     65995

Acurácia do Modelo
Acurácia do Modelo Cross Validation
0.8005946019886411
```

[12]:
```
plt.figure()
plot_learning_curves(X_train, Y_train.values.ravel(), X_test, Y_test.values.
 ↪ravel(), xgb_clf, print_model=False, style='ggplot')
plt.show()
```