Configuration

In [3]:
```
# Parameters
ENABLE_COLAB = False

PROJECT_NAME = 'ML1010-Group-Project'
EXPERIMENT_NAME = 'ReviewText_Lemma_TFIDF2_FullData (XGB)'
FILE_NAME = '01_ML1010_GP_XGB_TFIDF2_FullData'
LOAD_FROM_EXP = False

#Root Machine Learning Directory. Projects appear underneath
GOOGLE_DRIVE_MOUNT = '/content/gdrive'
COLAB_ROOT_DIR = GOOGLE_DRIVE_MOUNT + '/MyDrive/Colab Notebooks'
COLAB_INIT_DIR = COLAB_ROOT_DIR + '/utility_files'

LOCAL_ROOT_DIR = '/home/magni//ML_Root/project_root'
LOCAL_INIT_DIR = LOCAL_ROOT_DIR + '/utility_files'
```

Bootstrap Environment

In [4]:
```
#add in support for utility file directory and importing
import sys
import os

if ENABLE_COLAB:
  #Need access to drive
  from google.colab import drive
  drive.mount(GOOGLE_DRIVE_MOUNT, force_remount=True)

  #add in utility directory to syspath to import
  INIT_DIR = COLAB_INIT_DIR
  sys.path.append(os.path.abspath(INIT_DIR))

  #Config environment variables
  ROOT_DIR = COLAB_ROOT_DIR

else:
  #add in utility directory to syspath to import
  INIT_DIR = LOCAL_INIT_DIR
  sys.path.append(os.path.abspath(INIT_DIR))

  #Config environment variables
  ROOT_DIR = LOCAL_ROOT_DIR

#Import Utility Support
from jarvis import Jarvis
jarvis = Jarvis(ROOT_DIR, PROJECT_NAME)

import mv_python_utils as mvutils
```

```
Wha...where am I?
I am awake now.
```

```
I have set your current working directory to /home/magni/ML_Root/project_root
/ML1010-Group-Project
The current time is 18:26
Hello sir. Reminder, no more coffee.
```

Setup Runtime Environment

In [5]:

```
if ENABLE_COLAB:
  #!pip install scipy -q
  #!pip install scikit-learn -q
  #!pip install pycaret -q
  #!pip install matplotlib -q
  #!pip install joblib -q
  #!pip install pandasql -q
  !pip install umap_learn -q
  !pip install sentence_transformers -q
  !pip install spacytextblob -q
  !pip install flair -q
  display('Google Colab enabled')
else:
  display('Google Colab not enabled')

#Common imports
import json
import pandas as pd
import numpy as np
import matplotlib
import re
import nltk
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn import metrics
from sklearn.datasets import load_digits
from sklearn.model_selection import train_test_split as tts
#from yellowbrick.classifier import ConfusionMatrix
#from sklearn.linear_model import LogisticRegression
from yellowbrick.target import ClassBalance
from xgboost import XGBClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, confusion_matrix
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier

nltk.download('stopwords')
%matplotlib inline
```

```
'Google Colab not enabled'
```

```
[nltk_data] Downloading package stopwords to /home/magni/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

In [6]:
```
import importlib
import cw_df_metric_utils as cwutils
import DataPackage as dp
import DataPackageSupport as dps
import DataExperiment
import DataExperimentSupport
```

```
2022-01-25 18:26:08.853047: W tensorflow/stream_executor/platform/default/dso
_loader.cc:64] Could not load dynamic library 'libcudart.so.11.0'; dlerror: l
ibcudart.so.11.0: cannot open shared object file: No such file or directory
2022-01-25 18:26:08.853070: I tensorflow/stream_executor/cuda/cudart_stub.cc:
29] Ignore above cudart dlerror if you do not have a GPU set up on your machi
ne.
```

In [7]:
```
importlib.reload(dp)
importlib.reload(dps)
importlib.reload(DataExperiment)
importlib.reload(DataExperimentSupport)
```

Out[7]:
```
<module 'DataExperimentSupport' from '/home/magni/ML_Root/project_root/utilit
y_files/DataExperimentSupport.py'>
```

Load Data

In [8]:
```
#axis_labels=[1,2,3,4,5]
axis_labels=[0,1]
classifier = XGBClassifier(eval_metric='mlogloss')
#ANALSYSIS_COL = 'reviewText_lemma_bert'
UNIQUE_COL = 'uuid'
TARGET_COL = 'overall_posneg'
```

In [9]:
```
if LOAD_FROM_EXP:
    #start from saved state
    myExp = jarvis.loadExperiment(FILE_NAME)
    myExp.display()

else:
    #start from source file and regenerate
    testDf = pd.read_pickle(jarvis.DATA_DIR_EXP + '/reviewText_TF-IDF_Full.pk

    myExp = DataExperiment.DataExperiment(projectName=PROJECT_NAME,
                                          experimentName=EXPERIMENT_NAME,
                                          origData=testDf,
                                          uniqueColumn=UNIQUE_COL,
                                          targetColumn=TARGET_COL,
                                          classifier=classifier)
```

```
DataExperiment summary:
---> projectName: ML1010-Group-Project
---> experimentName: ReviewText_Lemma_TFIDF2_FullData (XGB)
---> isDataPackageLoaded: True
---> isBaseModelLoaded: False
---> isBaseModelPredicted: False
```

```
---> isBaseModelLearningCurveCreated: False
---> isFinalModelLoaded: False
---> isFinalModelPredicted: False
---> isFinalModelLearningCurveCreated: False
---> isClassifierLoaded: True
XGBClassifier(base_score=None, booster=None, colsample_bylevel=None,
              colsample_bynode=None, colsample_bytree=None,
              enable_categorical=False, eval_metric='mlogloss', gamma=None,
              gpu_id=None, importance_type=None, interaction_constraints=Non
e,
              learning_rate=None, max_delta_step=None, max_depth=None,
              min_child_weight=None, missing=nan, monotone_constraints=None,
              n_estimators=100, n_jobs=None, num_parallel_tree=None,
              predictor=None, random_state=None, reg_alpha=None,
              reg_lambda=None, scale_pos_weight=None, subsample=None,
              tree_method=None, validate_parameters=None, verbosity=None)

    DataPackage summary:
    Attributes:
    ---> uniqueColumn: uuid
    ---> targetColumn: overall_posneg
    Process:
    ---> isBalanced: False
    ---> isTrainTestSplit: False
    Data:
    ---> isOrigDataLoaded: True
    ---> isTrainDataLoaded: False
    ---> isTestDataLoaded: False
```

In [10]:

```
#myExp.processDataPackage()
myExp.dataPackage.classBalanceUndersample()
myExp.dataPackage.splitTrainTest()
```


```
Undersampling data to match min class: 0 of size: 176948
```

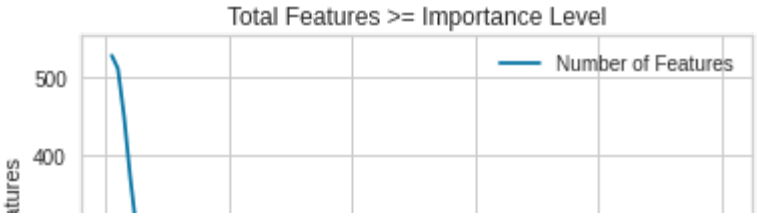
	overall_posneg	ttlCol
0	0	176948

In [11]:
```
%%time
myExp.createBaseModel()
```

```
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
Base Model Stats:
Accuracy: 0.85
Precision: 0.85
Recalll: 0.85
F1 Score: 0.85
Cohen kappa:: 0.7
CPU times: user 12min 41s, sys: 1.63 s, total: 12min 43s
Wall time: 51.2 s
```

In [15]:
```
impFeatures = myExp.analyzeBaseModelFeatureImportance(returnAbove=0.0015)
```

```
  0%|          | 0/101 [00:00<?, ?it/s]
Feature Importance Summary:
---> Original feature count: 768
---> Returned feature count: 159
---> Removed feature count: 609
---> Return items above (including): 0.0015
```



In [16]:
```
%%time
myExp.createFinalModel(featureImportanceThreshold=0.0015)
```

```
  0%|          | 0/101 [00:00<?, ?it/s]
  0%|          | 0/101 [00:00<?, ?it/s]
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
Final Model Stats:
Accuracy: 0.84
Precision: 0.84
Recalll: 0.84
F1 Score: 0.84
Cohen kappa:: 0.69
CPU times: user 3min 5s, sys: 425 ms, total: 3min 5s
Wall time: 12.7 s
```

In [17]:
```
%%time
myExp.createBaseModelLearningCurve()
```

```
[learning_curve] Training set sizes: [ 22649  45298 113246 226492]
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent worke
rs.
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.897, test=0.839) total time=
4.7s
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    4.8s remaining:    0.
0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.886, test=0.843) total time=
8.5s
[Parallel(n_jobs=1)]: Done   2 out of   2 | elapsed:   13.4s remaining:    0.
```

```
0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
[CV] END ....................., score=(train=0.871, test=0.847) total time=  1
9.2s
[Parallel(n_jobs=1)]: Done   3 out of   3 | elapsed:   32.8s remaining:    0.
0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.863, test=0.849) total time=  3
9.2s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.899, test=0.838) total time=
4.1s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.886, test=0.841) total time=
8.0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.871, test=0.843) total time=  2
0.0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.864, test=0.847) total time=  3
9.2s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
```

```
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label encoder deprecation msg, UserWarning)
[CV] END ....................., score=(train=0.897, test=0.839) total time=
4.4s

/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.885, test=0.840) total time=
8.2s

/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.872, test=0.845) total time=  1
9.5s

/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.863, test=0.846) total time=  3
9.0s

/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.900, test=0.838) total time=
4.4s

/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.884, test=0.842) total time=
8.3s

/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
```

```
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.871, test=0.845) total time=  1
9.8s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.864, test=0.847) total time=  3
8.9s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.900, test=0.841) total time=
4.1s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.885, test=0.844) total time=
8.1s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.872, test=0.846) total time=  2
0.1s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.864, test=0.849) total time=  3
8.7s
CPU times: user 1h 30min 5s, sys: 10.4 s, total: 1h 30min 15s
Wall time: 5min 59s
[Parallel(n_jobs=1)]: Done  20 out of  20 | elapsed:  6.0min finished
```

In [18]:

```
%%time
myExp.createFinalModelLearningCurve()
```

```
[learning_curve] Training set sizes: [ 22649  45298 113246 226492]
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent worke
rs.
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.882, test=0.835) total time=
1.1s
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    1.1s remaining:    0.
0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.872, test=0.839) total time=
1.9s
[Parallel(n_jobs=1)]: Done   2 out of   2 | elapsed:    3.0s remaining:    0.
0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.861, test=0.843) total time=
5.7s
[Parallel(n_jobs=1)]: Done   3 out of   3 | elapsed:    8.7s remaining:    0.
0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.856, test=0.843) total time=
8.9s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.884, test=0.834) total time=
1.0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
```

```
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.874, test=0.837) total time=
1.9s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.862, test=0.839) total time=
4.6s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.856, test=0.841) total time=
8.8s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.882, test=0.835) total time=
0.9s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.873, test=0.837) total time=
1.8s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.862, test=0.841) total time=
4.6s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
```

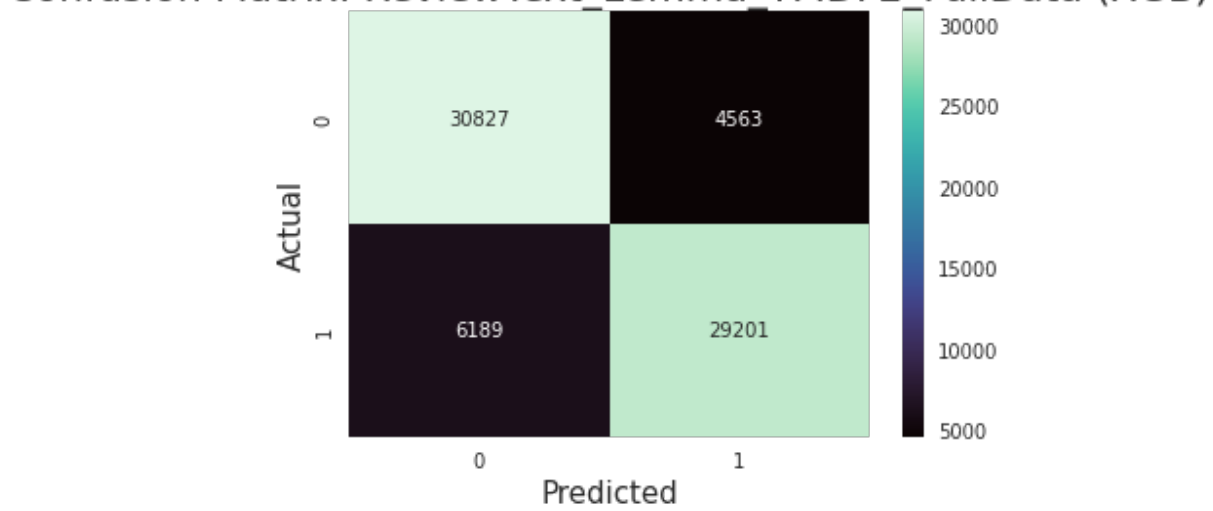
```
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.856, test=0.841) total time=
8.7s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.882, test=0.835) total time=
1.0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.872, test=0.838) total time=
1.8s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.862, test=0.840) total time=
4.7s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.855, test=0.842) total time=
9.0s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.883, test=0.838) total time=
1.1s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.872, test=0.840) total time=
1.9s
```

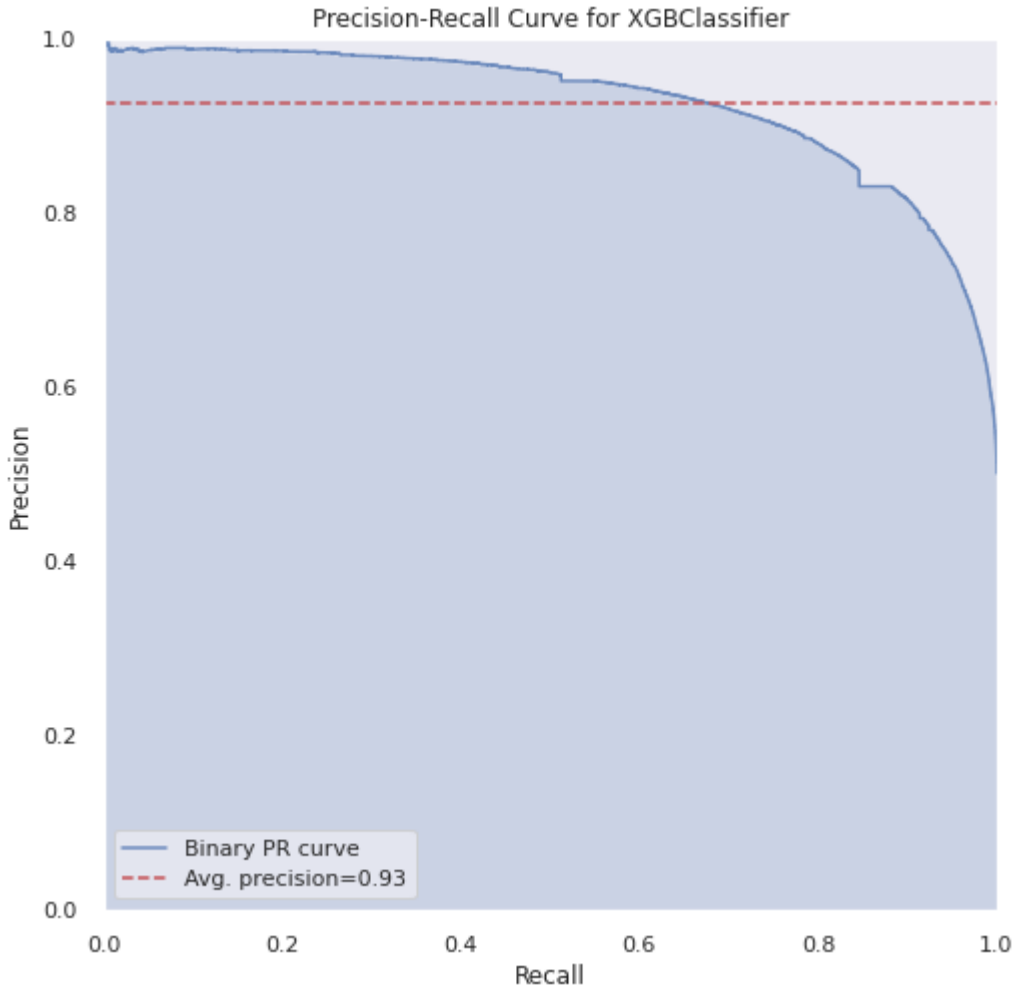
```
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.861, test=0.842) total time=
4.6s
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprec
ated and will be removed in a future release. To remove this warning, do the
following: 1) Pass option use_label_encoder=False when constructing XGBClassi
fier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[CV] END ....................., score=(train=0.855, test=0.844) total time=
8.9s
CPU times: user 21min 5s, sys: 2.48 s, total: 21min 7s
Wall time: 1min 23s
```

In [19]:

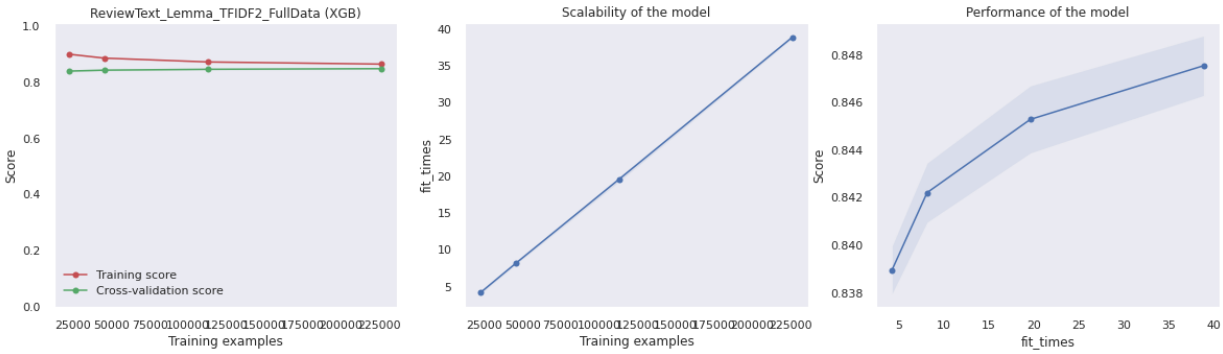
```
myExp.showBaseModelReport(axis_labels,
                          upperValue=0.025,
                          topn=10)
```

```
Base Model Stats:
Accuracy: 0.85
Precision: 0.85
Recalll: 0.85
F1 Score: 0.85
Cohen kappa:: 0.7
              precision    recall  f1-score   support

           0       0.83      0.87      0.85     35390
           1       0.86      0.83      0.84     35390

    accuracy                           0.85     70780
   macro avg       0.85      0.85      0.85     70780
weighted avg       0.85      0.85      0.85     70780
```

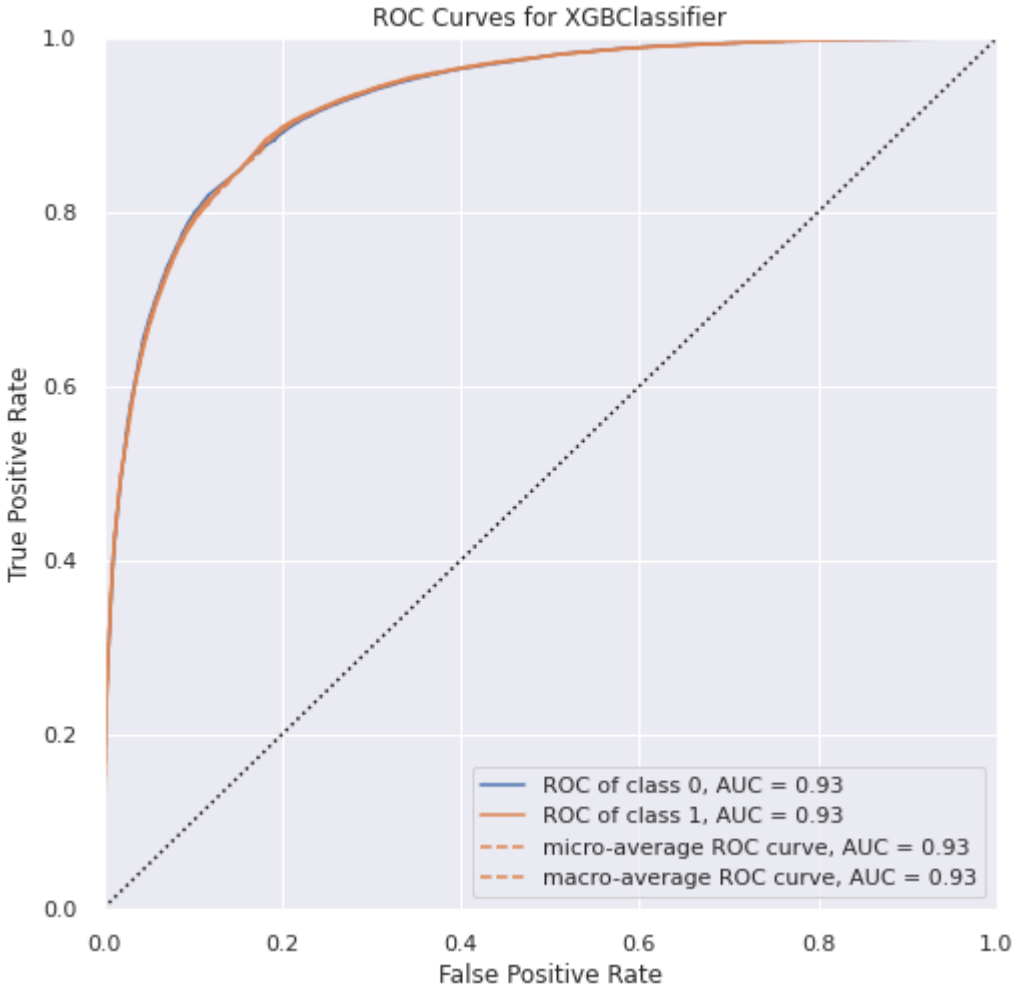




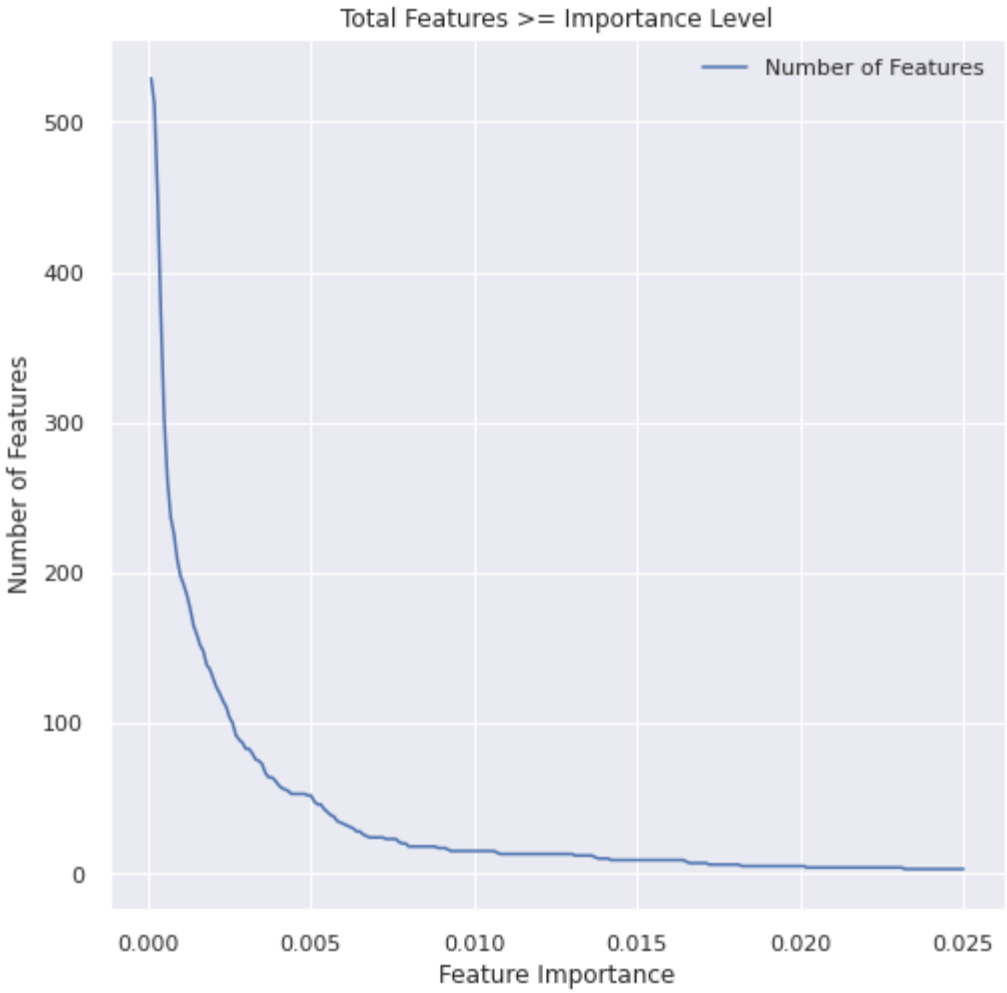
<Figure size 576x576 with 0 Axes>

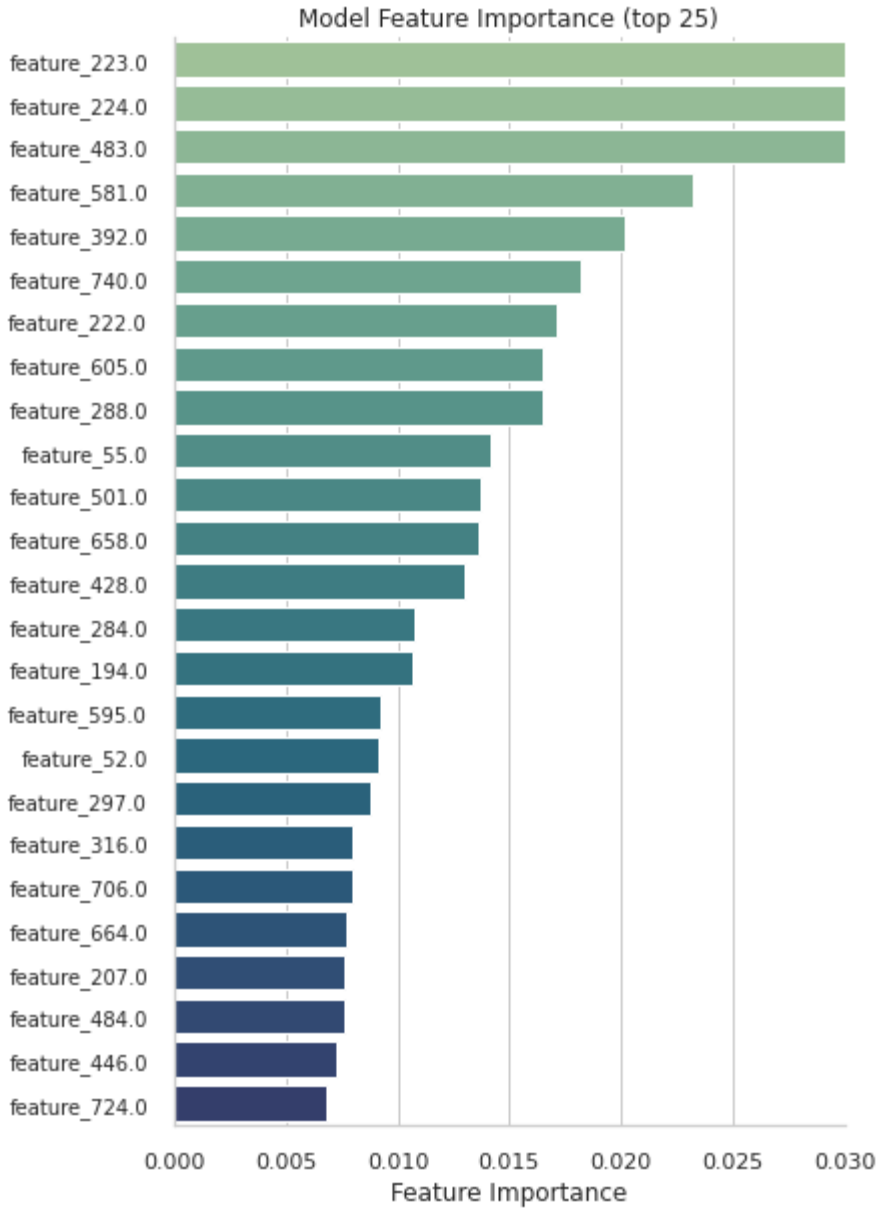


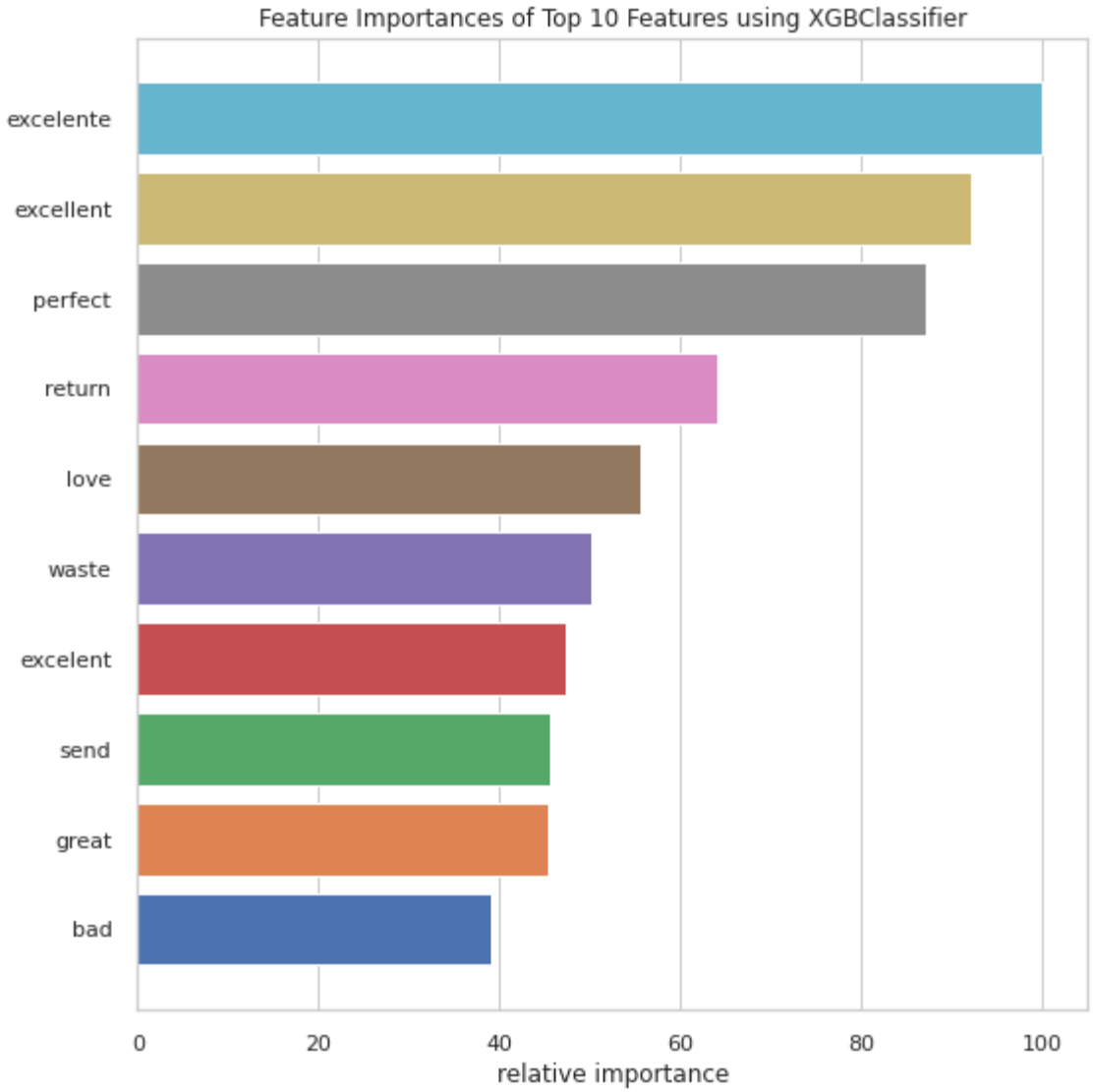

```
Base model ROCAUC not calculated. Starting now
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/sklearn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprecated and will be removed in a future release. To remove this warning, do the following: 1) Pass option use_label_encoder=False when constructing XGBClassifier object; and 2) Encode your labels (y) as integers starting with 0, i.e. 0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
```




```
0%|          | 0/251 [00:00<?, ?it/s]
```


Total Features >= Importance Level
Number of Features
500
400
300
200
100
0
Number of Features
0.000
0.005
0.010
0.015
0.020
0.025
Feature Importance


Model Feature Importance (top 25)
feature_223.0
feature_224.0
feature_483.0
feature_581.0
feature_392.0
feature_740.0
feature_222.0
feature_605.0
feature_288.0
feature_55.0
feature_501.0
feature_658.0
feature_428.0
feature_284.0
feature_194.0
feature_595.0
feature_52.0
feature_297.0
feature_316.0
feature_706.0
feature_664.0
feature_207.0
feature_484.0
feature_446.0
feature_724.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
Feature Importance



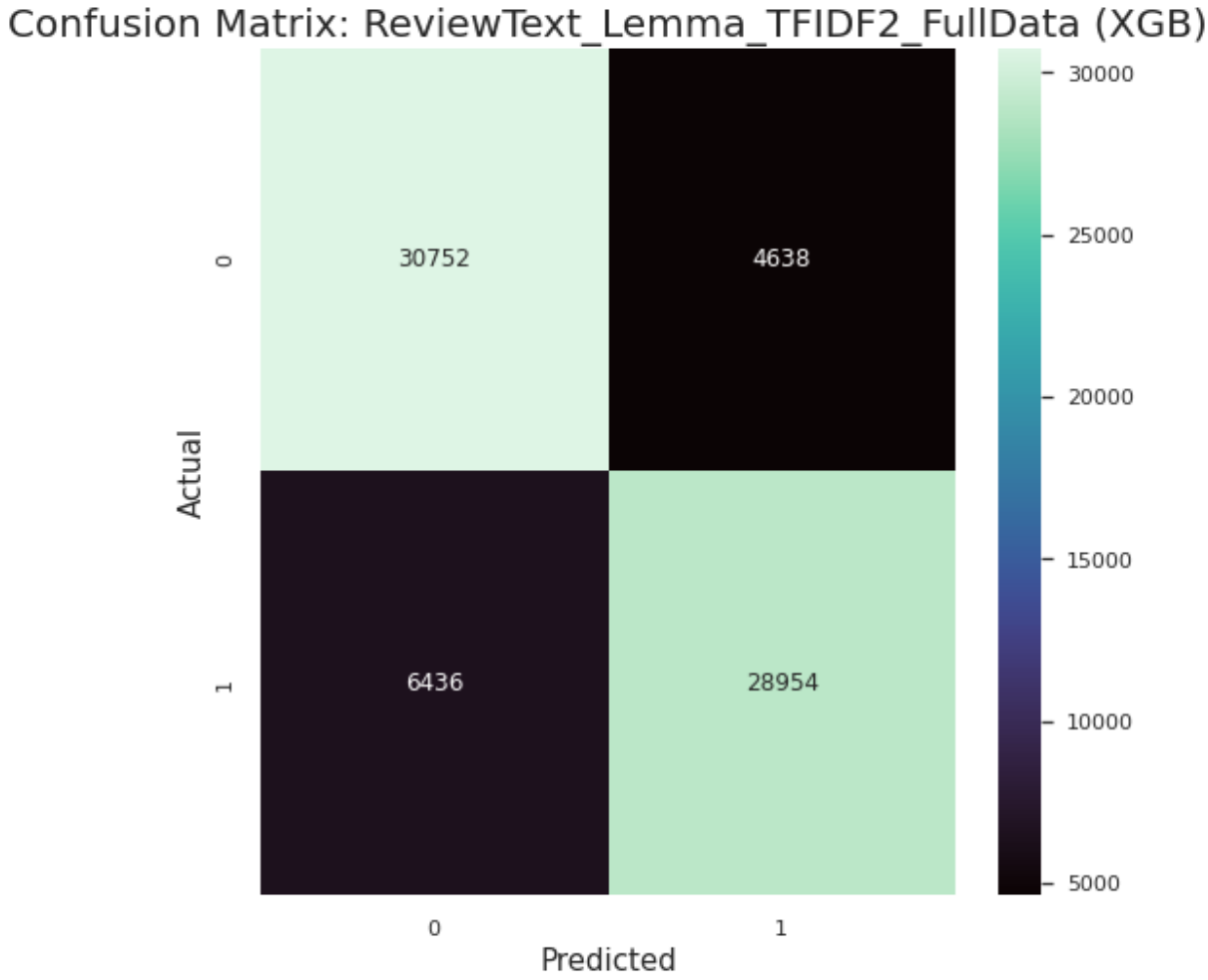

```
/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/sklearn/line
ar_model/_logistic.py:818: ConvergenceWarning: lbfgs failed to converge (stat
us=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regres
```

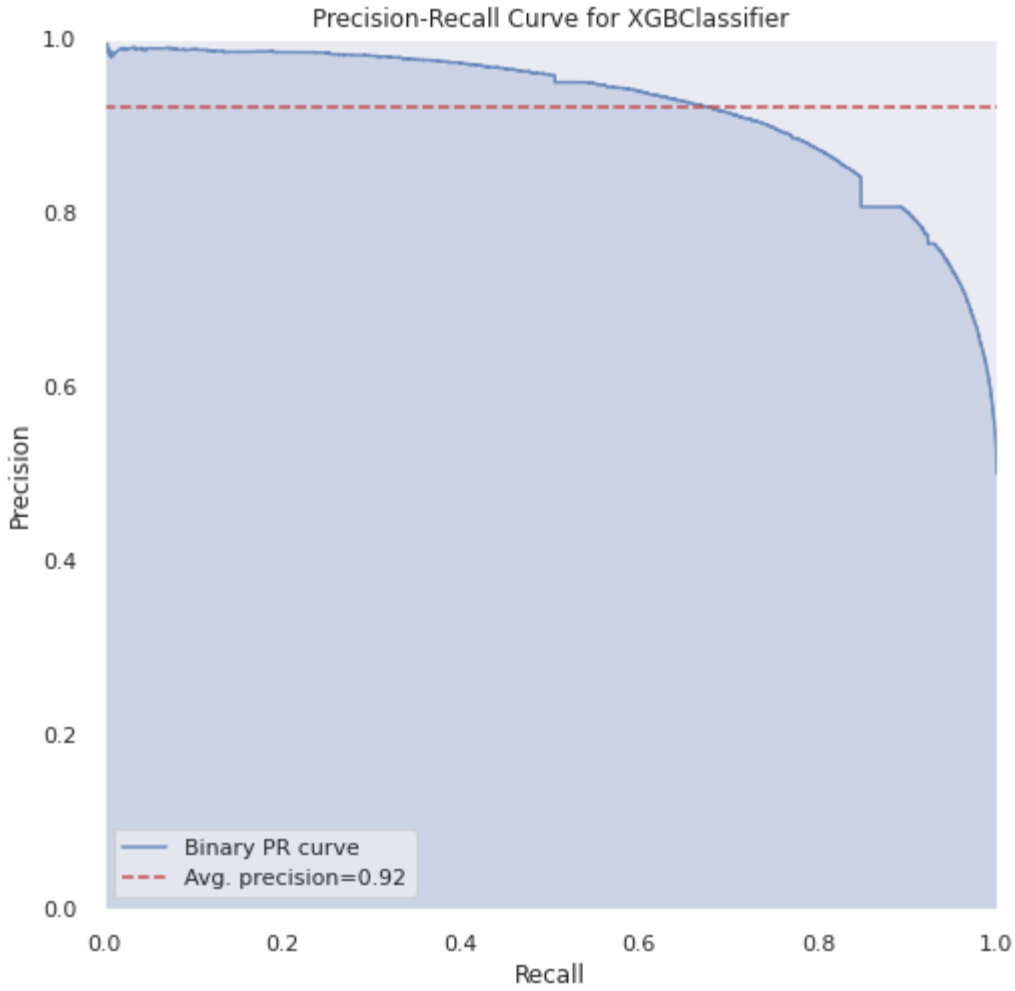
In [20]:

```
myExp.showFinalModelReport(axis_labels,
                           startValue=0.01,
                           increment=0.001,
                           upperValue=0.03,
                           topn=10)
```

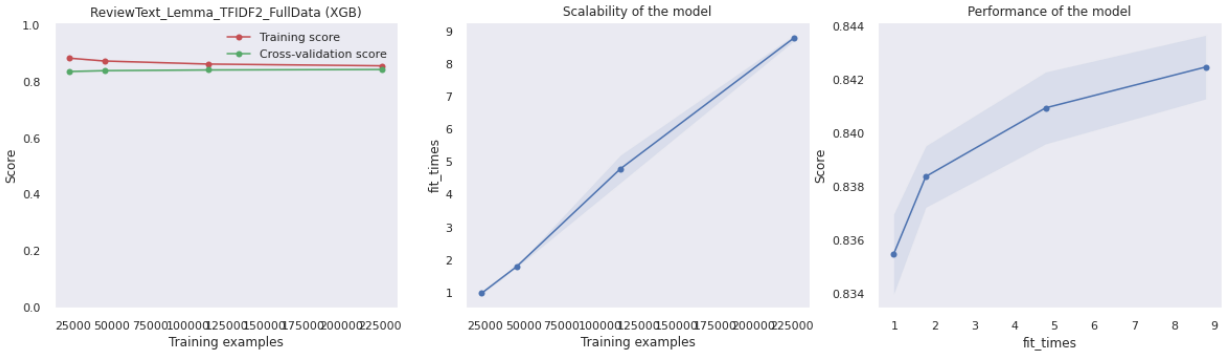
```
Final Model Stats:
Accuracy: 0.84
Precision: 0.84
Recalll: 0.84
F1 Score: 0.84
Cohen kappa:: 0.69
              precision    recall  f1-score   support
```

0	0.83	0.87	0.85	35390
1	0.86	0.82	0.84	35390
accuracy			0.84	70780
macro avg	0.84	0.84	0.84	70780
weighted avg	0.84	0.84	0.84	70780



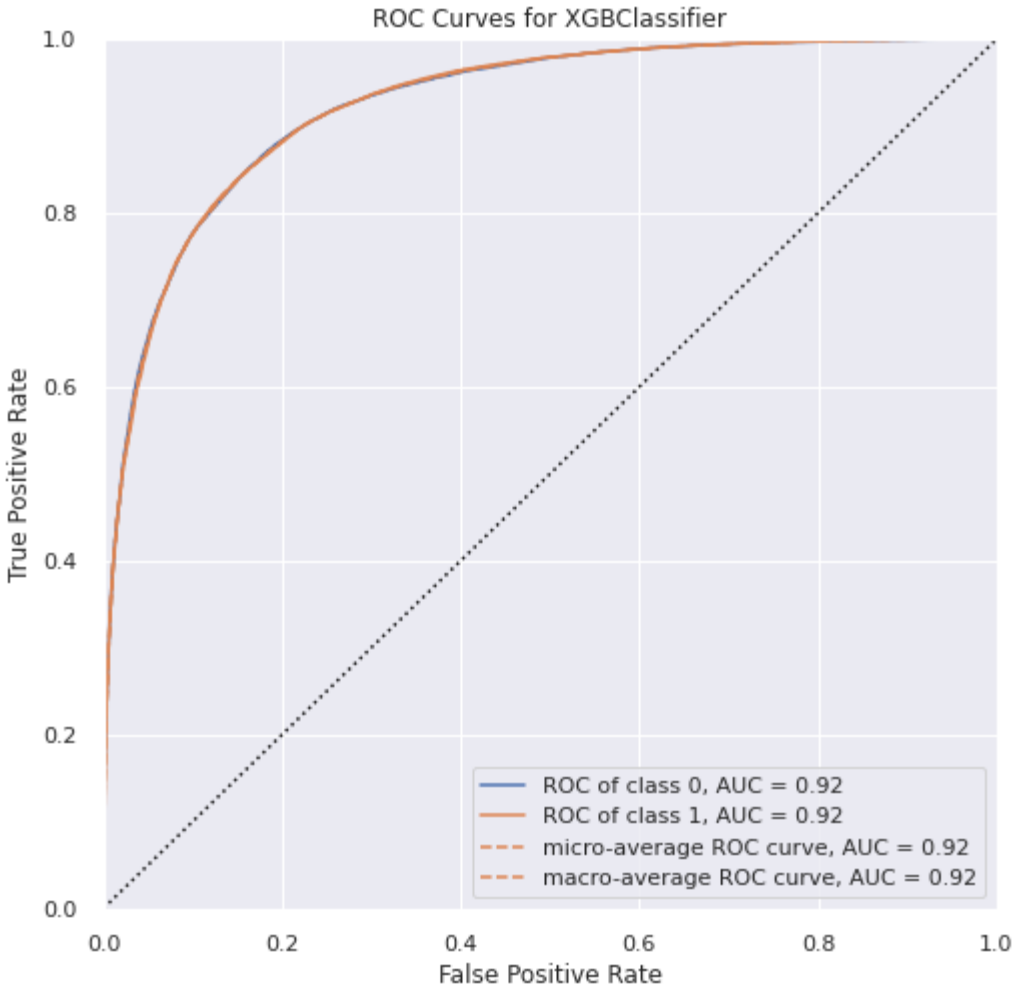


<Figure size 576x576 with 0 Axes>



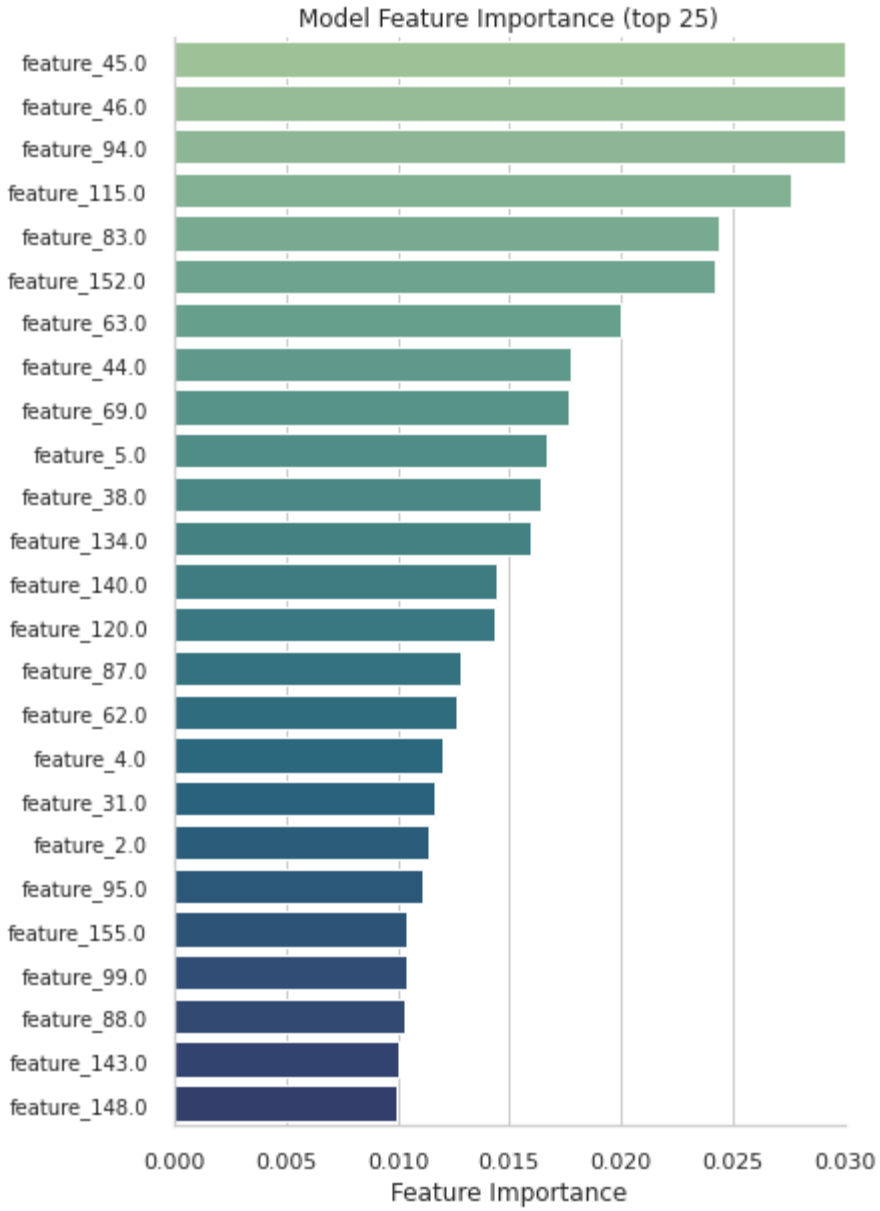
Final model ROCAUC not calculated. Starting now

/home/magni/python_env/ML1010_env2/lib64/python3.7/site-packages/xgboost/sklearn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprecated and will be removed in a future release. To remove this warning, do the following: 1) Pass option use_label_encoder=False when constructing XGBClassifier object; and 2) Encode your labels (y) as integers starting with 0, i.e. 0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)




```
0%|          | 0/22 [00:00<?, ?it/s]
```


Total Features >= Importance Level
Number of Features
25
20
15
10
5
Number of Features
0.0100
0.0125
0.0150
0.0175
0.0200
0.0225
0.0250
0.0275
0.0300
Feature Importance


Model Feature Importance (top 25)
feature_45.0
feature_46.0
feature_94.0
feature_115.0
feature_83.0
feature_152.0
feature_63.0
feature_44.0
feature_69.0
feature_5.0
feature_38.0
feature_134.0
feature_140.0
feature_120.0
feature_87.0
feature_62.0
feature_4.0
feature_31.0
feature_2.0
feature_95.0
feature_155.0
feature_99.0
feature_88.0
feature_143.0
feature_148.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
Feature Importance

In [21]:
```
myExp.display()
```

```
DataExperiment summary:
---> projectName: ML1010-Group-Project
---> experimentName: ReviewText_Lemma_TFIDF2_FullData (XGB)
---> isDataPackageLoaded: True
---> isBaseModelLoaded: True
---> isBaseModelPredicted: True
---> isBaseModelLearningCurveCreated: True
---> isFinalModelLoaded: True
---> isFinalModelPredicted: True
---> isFinalModelLearningCurveCreated: True
---> isClassifierLoaded: True
XGBClassifier(base_score=None, booster=None, colsample_bylevel=None,
              colsample_bynode=None, colsample_bytree=None,
              enable_categorical=False, eval_metric='mlogloss', gamma=None,
              gpu_id=None, importance_type=None, interaction_constraints=Non
e,
              learning_rate=None, max_delta_step=None, max_depth=None,
              min_child_weight=None, missing=nan, monotone_constraints=None,
              n_estimators=100, n_jobs=None, num_parallel_tree=None,
              predictor=None, random_state=None, reg_alpha=None,
              reg_lambda=None, scale_pos_weight=None, subsample=None,
              tree_method=None, validate_parameters=None, verbosity=None)

    DataPackage summary:
    Attributes:
    ---> uniqueColumn: uuid
    ---> targetColumn: overall_posneg
    Process:
    ---> isBalanced: True
    ---> isTrainTestSplit: True
    Data:
    ---> isOrigDataLoaded: False
    ---> isTrainDataLoaded: True
    ---> isTestDataLoaded: True
```

Save Experiment

In [22]:
```
jarvis.saveExperiment(myExp, FILE_NAME)
```

In [ ]:

Scratchpad

In [ ]:

In [ ]:

In [ ]:

```
```

In [23]:

```
importlib.reload(dp)
importlib.reload(dps)
importlib.reload(DataExperiment)
importlib.reload(DataExperimentSupport)
```

Out[23]:

```
<module 'DataExperimentSupport' from '/home/magni/ML_Root/project_root/utilit
y_files/DataExperimentSupport.py'>
```