

```
In [2]: # import libraries
import boto3, re, sys, math, json, os, sagemaker, urllib.request
from sagemaker import get_execution_role
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from IPython.display import Image
from IPython.display import display
from time import gmtime, strftime
from sagemaker.predictor import csv_serializer

# Define IAM role
role = get_execution_role()
prefix = 'sagemaker/DEMO-xgboost-dm'
my_region = boto3.session.Session().region_name # set the region of the instance

# this line automatically looks for the XGBoost image URI and builds an XGBoost container.
xgboost_container = sagemaker.image_uris.retrieve("xgboost", my_region, "latest")

print("Success - the MySageMakerInstance is in the " + my_region + " region. You will use the " + xgboost_container + " container for your SageMaker endpoint.")
```

Success - the MySageMakerInstance is in the us-east-1 region. You will use the 811284229777.dkr.ecr.us-east-1.amazonaws.com/xgboost:latest container for your SageMaker endpoint.

```
In [3]: bucket_name = 'sagemaker-tutorial-bdewhirst' # <--- CHANGE THIS VARIABLE TO A
        UNIQUE NAME FOR YOUR BUCKET
s3 = boto3.resource('s3')
try:
    if my_region == 'us-east-1':
        s3.create_bucket(Bucket=bucket_name)
    else:
        s3.create_bucket(Bucket=bucket_name, CreateBucketConfiguration={ 'LocationConstraint': my_region })
    print('S3 bucket created successfully')
except Exception as e:
    print('S3 error: ', e)
```

S3 bucket created successfully

```
In [4]: try:
        urllib.request.urlretrieve ("https://d1.awsstatic.com/tmt/build-train-deploy-
        -machine-learning-model-sagemaker/bank_clean.27f01fbbdf43271788427f3682996ae29
        ceca05d.csv", "bank_clean.csv")
        print('Success: downloaded bank_clean.csv.')
    except Exception as e:
        print('Data load error: ',e)

    try:
        model_data = pd.read_csv('./bank_clean.csv',index_col=0)
        print('Success: Data loaded into dataframe.')
    except Exception as e:
        print('Data load error: ',e)
```

Success: downloaded bank_clean.csv.

Success: Data loaded into dataframe.

```
In [5]: train_data, test_data = np.split(model_data.sample(frac=1, random_state=1729),
        [int(0.7 * len(model_data))])
        print(train_data.shape, test_data.shape)

(28831, 61) (12357, 61)
```

```
In [6]: pd.concat([train_data['y_yes'], train_data.drop(['y_no', 'y_yes'], axis=1)], a
        xis=1).to_csv('train.csv', index=False, header=False)
        boto3.Session().resource('s3').Bucket(bucket_name).Object(os.path.join(prefix,
        'train/train.csv')).upload_file('train.csv')
        s3_input_train = sagemaker.inputs.TrainingInput(s3_data='s3://{}/{}/train'.for
        mat(bucket_name, prefix), content_type='csv')
```

```
In [7]: sess = sagemaker.Session()
        xgb = sagemaker.estimator.Estimator(xgboost_container,role, instance_count=1,
        instance_type='ml.m4.xlarge',output_path='s3://{}/{}/output'.format(bucket_nam
        e, prefix),sagemaker_session=sess)
        xgb.set_hyperparameters(max_depth=5,eta=0.2,gamma=4,min_child_weight=6,subsamp
        le=0.8,silent=0,objective='binary:logistic',num_round=100)
```

```
In [8]: xgb.fit({'train': s3_input_train})
```

```
2022-08-16 03:42:46 Starting - Starting the training job...
2022-08-16 03:43:12 Starting - Preparing the instances for trainingProfilerReport-1660621365: InProgress
.....
2022-08-16 03:45:09 Downloading - Downloading input data...
2022-08-16 03:45:42 Training - Downloading the training image.....
2022-08-16 03:46:38 Training - Training image download completed. Training in progress.Arguments: train
[2022-08-16:03:46:42:INFO] Running standalone xgboost training.
[2022-08-16:03:46:42:INFO] Path /opt/ml/input/data/validation does not exist!
[2022-08-16:03:46:42:INFO] File size need to be processed in the node: 3.38mb. Available memory size in the node: 8435.23mb
[2022-08-16:03:46:42:INFO] Determined delimiter of CSV input is ','
[03:46:42] S3DistributionType set as FullyReplicated
[03:46:42] 28831x59 matrix with 1701029 entries loaded from /opt/ml/input/data/train?format=csv&label_column=0&delimiter=,
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra nodes, 14 pruned nodes, max_depth=5
[0]#011train-error:0.100482
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra nodes, 14 pruned nodes, max_depth=5
[1]#011train-error:0.099858
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 28 extra nodes, 22 pruned nodes, max_depth=5
[2]#011train-error:0.099754
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra nodes, 14 pruned nodes, max_depth=5
[3]#011train-error:0.099095
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 28 extra nodes, 12 pruned nodes, max_depth=5
[4]#011train-error:0.098991
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 32 extra nodes, 14 pruned nodes, max_depth=5
[5]#011train-error:0.099303
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 24 extra nodes, 18 pruned nodes, max_depth=5
[6]#011train-error:0.099684
[03:46:42] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra nodes, 22 pruned nodes, max_depth=5
[7]#011train-error:0.09906
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 28 extra nodes, 20 pruned nodes, max_depth=5
[8]#011train-error:0.098852
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 36 extra nodes, 8 pruned nodes, max_depth=5
[9]#011train-error:0.098679
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra nodes, 16 pruned nodes, max_depth=5
[10]#011train-error:0.098748
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 28 extra nodes, 24 pruned nodes, max_depth=5
[11]#011train-error:0.098748
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra nodes, 22 pruned nodes, max_depth=5
[12]#011train-error:0.098748
```

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[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra
nodes, 10 pruned nodes, max_depth=5
[13]#011train-error:0.09854
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra
nodes, 20 pruned nodes, max_depth=5
[14]#011train-error:0.098574
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 24 extra
nodes, 20 pruned nodes, max_depth=5
[15]#011train-error:0.098609
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 32 extra
nodes, 16 pruned nodes, max_depth=5
[16]#011train-error:0.098817
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 18 extra
nodes, 16 pruned nodes, max_depth=5
[17]#011train-error:0.098817
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra
nodes, 18 pruned nodes, max_depth=5
[18]#011train-error:0.098679
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra
nodes, 16 pruned nodes, max_depth=5
[19]#011train-error:0.098679
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra
nodes, 12 pruned nodes, max_depth=5
[20]#011train-error:0.098713
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra
nodes, 10 pruned nodes, max_depth=5
[21]#011train-error:0.098505
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra
nodes, 14 pruned nodes, max_depth=5
[22]#011train-error:0.098401
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 26 extra
nodes, 8 pruned nodes, max_depth=5
[23]#011train-error:0.098332
[03:46:43] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 34 extra
nodes, 6 pruned nodes, max_depth=5
[24]#011train-error:0.098332
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 24 extra
nodes, 6 pruned nodes, max_depth=5
[25]#011train-error:0.09795
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra
nodes, 12 pruned nodes, max_depth=5
[26]#011train-error:0.098262
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra
nodes, 24 pruned nodes, max_depth=5
[27]#011train-error:0.098193
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 8 extra n
odes, 24 pruned nodes, max_depth=3
[28]#011train-error:0.097985
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra
nodes, 10 pruned nodes, max_depth=5
[29]#011train-error:0.097499
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 28 extra
nodes, 10 pruned nodes, max_depth=5
[30]#011train-error:0.097638
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 18 extra
nodes, 22 pruned nodes, max_depth=5
```

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[31]#011train-error:0.097395
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 28 extra
nodes, 24 pruned nodes, max_depth=5
[32]#011train-error:0.097222
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 24 extra
nodes, 14 pruned nodes, max_depth=5
[33]#011train-error:0.097118
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 20 pruned nodes, max_depth=5
[34]#011train-error:0.097014
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 24 extra
nodes, 18 pruned nodes, max_depth=5
[35]#011train-error:0.09684
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra
nodes, 10 pruned nodes, max_depth=5
[36]#011train-error:0.096667
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra
nodes, 18 pruned nodes, max_depth=5
[37]#011train-error:0.096736
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 30 extra
nodes, 22 pruned nodes, max_depth=5
[38]#011train-error:0.096563
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra
nodes, 24 pruned nodes, max_depth=5
[39]#011train-error:0.096355
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 36 pruned nodes, max_depth=3
[40]#011train-error:0.096285
[03:46:44] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 12 extra
nodes, 38 pruned nodes, max_depth=4
[41]#011train-error:0.096528
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 8 extra n
odes, 16 pruned nodes, max_depth=4
[42]#011train-error:0.096355
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra
nodes, 26 pruned nodes, max_depth=5
[43]#011train-error:0.096459
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 36 pruned nodes, max_depth=5
[44]#011train-error:0.096355
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 4 extra n
odes, 34 pruned nodes, max_depth=2
[45]#011train-error:0.096216
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 24 extra
nodes, 20 pruned nodes, max_depth=5
[46]#011train-error:0.096077
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 18 extra
nodes, 14 pruned nodes, max_depth=5
[47]#011train-error:0.0958
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 10 pruned nodes, max_depth=5
[48]#011train-error:0.095904
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 16 pruned nodes, max_depth=5
[49]#011train-error:0.095904
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
```

```
nodes, 34 pruned nodes, max_depth=4
[50]#011train-error:0.095834
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 16 pruned nodes, max_depth=5
[51]#011train-error:0.095765
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 8 pruned nodes, max_depth=5
[52]#011train-error:0.095904
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 6 pruned nodes, max_depth=5
[53]#011train-error:0.095834
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 18 extra
nodes, 22 pruned nodes, max_depth=5
[54]#011train-error:0.095834
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 22 pruned nodes, max_depth=5
[55]#011train-error:0.09573
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 30 pruned nodes, max_depth=5
[56]#011train-error:0.095626
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 16 extra
nodes, 14 pruned nodes, max_depth=5
[57]#011train-error:0.095696
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 28 pruned nodes, max_depth=5
[58]#011train-error:0.095661
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 24 pruned nodes, max_depth=4
[59]#011train-error:0.095592
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 24 extra
nodes, 16 pruned nodes, max_depth=5
[60]#011train-error:0.095522
[03:46:45] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 16 pruned nodes, max_depth=4
[61]#011train-error:0.095383
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 8 extra n
odes, 20 pruned nodes, max_depth=4
[62]#011train-error:0.095314
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra
nodes, 26 pruned nodes, max_depth=5
[63]#011train-error:0.095661
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 8 extra n
odes, 32 pruned nodes, max_depth=4
[64]#011train-error:0.095661
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 32 extra
nodes, 18 pruned nodes, max_depth=5
[65]#011train-error:0.095418
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 36 pruned nodes, max_depth=3
[66]#011train-error:0.095314
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra
nodes, 14 pruned nodes, max_depth=5
[67]#011train-error:0.095349
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 6 extra n
odes, 28 pruned nodes, max_depth=3
[68]#011train-error:0.095314
```



```
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 0 extra nodes, 28 pruned nodes, max_depth=0
[69]#011train-error:0.095314
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra nodes, 32 pruned nodes, max_depth=3
[70]#011train-error:0.095383
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra nodes, 12 pruned nodes, max_depth=5
[71]#011train-error:0.095453
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 16 extra nodes, 12 pruned nodes, max_depth=5
[72]#011train-error:0.095349
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 8 extra nodes, 24 pruned nodes, max_depth=4
[73]#011train-error:0.095245
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra nodes, 14 pruned nodes, max_depth=5
[74]#011train-error:0.095175
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 8 extra nodes, 18 pruned nodes, max_depth=4
[75]#011train-error:0.095071
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra nodes, 22 pruned nodes, max_depth=5
[76]#011train-error:0.095175
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 18 extra nodes, 30 pruned nodes, max_depth=5
[77]#011train-error:0.095002
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra nodes, 20 pruned nodes, max_depth=4
[78]#011train-error:0.095037
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra nodes, 32 pruned nodes, max_depth=5
[79]#011train-error:0.095037
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra nodes, 24 pruned nodes, max_depth=5
[80]#011train-error:0.095002
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra nodes, 20 pruned nodes, max_depth=5
[81]#011train-error:0.094794
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra nodes, 24 pruned nodes, max_depth=5
[82]#011train-error:0.094759
[03:46:46] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra nodes, 20 pruned nodes, max_depth=5
[83]#011train-error:0.094933
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 20 extra nodes, 10 pruned nodes, max_depth=5
[84]#011train-error:0.09469
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra nodes, 22 pruned nodes, max_depth=5
[85]#011train-error:0.094759
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 22 extra nodes, 24 pruned nodes, max_depth=5
[86]#011train-error:0.094482
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra nodes, 16 pruned nodes, max_depth=5
```



```
[87]#011train-error:0.094447
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 0 extra nodes, 20 pruned nodes, max_depth=0
[88]#011train-error:0.094482
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 16 extra nodes, 24 pruned nodes, max_depth=5
[89]#011train-error:0.094378
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 0 extra nodes, 28 pruned nodes, max_depth=0
[90]#011train-error:0.094343
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 8 extra nodes, 28 pruned nodes, max_depth=4
[91]#011train-error:0.094274
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra nodes, 20 pruned nodes, max_depth=5
[92]#011train-error:0.094239
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 16 extra nodes, 32 pruned nodes, max_depth=5
[93]#011train-error:0.094169
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 14 extra nodes, 28 pruned nodes, max_depth=5
[94]#011train-error:0.094169
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 10 extra nodes, 14 pruned nodes, max_depth=5
[95]#011train-error:0.094204
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 0 extra nodes, 28 pruned nodes, max_depth=0
[96]#011train-error:0.094204
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 26 extra nodes, 20 pruned nodes, max_depth=5
[97]#011train-error:0.093927
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 0 extra nodes, 38 pruned nodes, max_depth=0
[98]#011train-error:0.093927
[03:46:47] src/tree/updater_prune.cc:74: tree pruning end, 1 roots, 0 extra nodes, 32 pruned nodes, max_depth=0
[99]#011train-error:0.093892
```

2022-08-16 03:47:10 Uploading - Uploading generated training model

2022-08-16 03:47:10 Completed - Training job completed

Training seconds: 127

Billable seconds: 127

```
In [9]: xgb_predictor = xgb.deploy(initial_instance_count=1,instance_type='ml.m4.xlarge')
```

-----!

```
In [10]: from sagemaker.serializers import CSVSerializer

test_data_array = test_data.drop(['y_no', 'y_yes'], axis=1).values #load the data into an array
xgb_predictor.serializer = CSVSerializer() # set the serializer type
predictions = xgb_predictor.predict(test_data_array).decode('utf-8') # predict!
predictions_array = np.fromstring(predictions[1:], sep=',') # and turn the prediction into an array
print(predictions_array.shape)
```

(12357,)

```
In [11]: cm = pd.crosstab(index=test_data['y_yes'], columns=np.round(predictions_array),
rownames=['Observed'], colnames=['Predicted'])
tn = cm.iloc[0,0]; fn = cm.iloc[1,0]; tp = cm.iloc[1,1]; fp = cm.iloc[0,1]; p = (tp+tn)/(tp+tn+fp+fn)*100
print("\n{0:<20}{1:<4.1f}%\n".format("Overall Classification Rate: ", p))
print("{0:<15}{1:<15}{2:>8}".format("Predicted", "No Purchase", "Purchase"))
print("Observed")
print("{0:<15}{1:<2.0f}% ({2:<}){3:>6.0f}% ({4:<})".format("No Purchase", tn/(tn+fn)*100, tn, fp/(tp+fp)*100, fp))
print("{0:<16}{1:<1.0f}% ({2:<}){3:>7.0f}% ({4:<}) \n".format("Purchase", fn/(tn+fn)*100, fn, tp/(tp+fp)*100, tp))
```

Overall Classification Rate: 89.5%

Predicted	No Purchase	Purchase
Observed		
No Purchase	90% (10769)	37% (167)
Purchase	10% (1133)	63% (288)

```
In [ ]: ## print to PDF before starting cleanup
```