# 4.ML_models

March 24, 2019

In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import re
import time
import warnings
import sqlite3
from sqlalchemy import create_engine # database connection
import csv
import os
warnings.filterwarnings("ignore")
import datetime as dt
import numpy as np
from nltk.corpus import stopwords
from sklearn.decomposition import TruncatedSVD
from sklearn.preprocessing import normalize
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.manifold import TSNE
import seaborn as sns
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import confusion_matrix
from sklearn.metrics.classification import accuracy_score, log_loss
from sklearn.feature_extraction.text import TfidfVectorizer
from collections import Counter
from scipy.sparse import hstack
from sklearn.multiclass import OneVsRestClassifier
from sklearn.svm import SVC
from sklearn.model_selection import StratifiedKFold
from collections import Counter, defaultdict
from sklearn.calibration import CalibratedClassifierCV
from sklearn.naive_bayes import MultinomialNB
from sklearn.naive_bayes import GaussianNB
from sklearn.model_selection import train_test_split
from sklearn.model_selection import GridSearchCV
import math
from sklearn.metrics import normalized_mutual_info_score
from sklearn.ensemble import RandomForestClassifier
```

```
from sklearn.model_selection import cross_val_score
from sklearn.linear_model import SGDClassifier
from mlxtend.classifier import StackingClassifier

from sklearn import model_selection
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import precision_recall_curve, auc, roc_curve
```

## 4. Machine Learning Models

### 4.1 Reading data from file and storing into sql table

```
In [5]: #Creating db file from csv
        if not os.path.isfile('train.db'):
            disk_engine = create_engine('sqlite:///train.db')
            start = dt.datetime.now()
            chunksize = 10000
            j = 0
            index_start = 1
            for df in pd.read_csv('final_features.csv', names=['Unnamed: 0','id','is_duplicate
                df.index += index_start
                j+=1
                print('{} rows'.format(j*chunksize))
                df.to_sql('data', disk_engine, if_exists='append')
                index_start = df.index[-1] + 1
```

```
In [2]: #http://www.sqlitetutorial.net/sqlite-python/create-tables/
        def create_connection(db_file):
            """ create a database connection to the SQLite database
                specified by db_file
            :param db_file: database file
            :return: Connection object or None
            """
            try:
                conn = sqlite3.connect(db_file)
                return conn
            except Error as e:
                print(e)

            return None


        def checkTableExists(dbcon):
            cursr = dbcon.cursor()
            str = "select name from sqlite_master where type='table'"
            table_names = cursr.execute(str)
            print("Tables in the databse:")
            tables =table_names.fetchall()
```

```
            print(tables[0][0])
            return(len(tables))
```

```
In [3]: read_db = 'train.db'
        conn_r = create_connection(read_db)
        checkTableExists(conn_r)
        conn_r.close()
```

```
Tables in the databse:
data
```

```
In [4]: # try to sample data according to the computing power you have
        if os.path.isfile(read_db):
            conn_r = create_connection(read_db)
            if conn_r is not None:
                # for selecting first 1M rows
                # data = pd.read_sql_query("""SELECT * FROM data LIMIT 100001;""", conn_r)

                # for selecting random points
                data = pd.read_sql_query("SELECT * From data ORDER BY RANDOM() LIMIT 60001;", c
                conn_r.commit()
                conn_r.close()
```

```
In [5]: data.head()
```

Out[5]:

| | index | Unnamed: 0 | id | is_duplicate | cwc_min | \ |
|---|---|---|---|---|---|---|
| 0 | 88097 | 88095.0 | 88095 | 1 | 0.999975000624984 | |
| 1 | 148005 | 148003.0 | 148003 | 1 | 0.749981250468738 | |
| 2 | 131751 | 131749.0 | 131749 | 1 | 0.999966667777741 | |
| 3 | 9871 | 9869.0 | 9869 | 0 | 0.999975000624984 | |
| 4 | 99079 | 99077.0 | 99077 | 1 | 0.749981250468738 | |

| | cwc_max | csc_min | csc_max | ctc_min | \ |
|---|---|---|---|---|---|
| 0 | 0.999975000624984 | 0.833319444675922 | 0.714275510349852 | 0.899991000089999 | |
| 1 | 0.499991666805553 | 0.999985714489793 | 0.999985714489793 | 0.90908264470323 | |
| 2 | 0.999966667777741 | 0.499987500312492 | 0.499987500312492 | 0.714275510349852 | |
| 3 | 0.799984000319994 | 0.749981250468738 | 0.599988000239995 | 0.874989062636717 | |
| 4 | 0.374995312558593 | 0.249993750156246 | 0.199996000079998 | 0.499993750078124 | |

| | ctc_max | ... | 374_y | 375_y | \ |
|---|---|---|---|---|---|
| 0 | 0.818174380232907 | ... | -5.00604896806181 | 16.8518334776163 | |
| 1 | 0.769224852116522 | ... | 5.2621960863471 | 10.3345596343279 | |
| 2 | 0.714275510349852 | ... | 10.4113432234153 | 5.65417674463242 | |
| 3 | 0.699993000069999 | ... | 6.19151087105274 | 0.710954058915377 | |
| 4 | 0.285712244912536 | ... | 8.12903142347932 | 6.92441907152534 | |

| | 376_y | 377_y | 378_y | 379_y | \ |
|---|---|---|---|---|---|
| 0 | -5.37091588228941 | -3.26178657100536 | 12.1312550008297 | 7.41904079914093 | |

```
1   24.0024595782161  -0.733043350279331  15.7177833020687  6.26007471210323
2   10.6767095029354   -11.5996008403599  6.16212257742882   4.318210542202
3   6.83794537186623  -0.607464585453272  12.0138160921633  5.9918103441596
4   16.8435802906752   -10.6461466807523  4.99954917468131  -4.2941911816597

                380_y             381_y             382_y             383_y
0  -6.07296107709408   4.85085135698319   9.19919856637717   5.88767864555121
1   10.8977920934558  0.311331823468208   26.6197788715362  -6.09706179052591
2  -4.39765763282776   8.52527767419815   7.5825545489788   3.14942193031311
3  -7.41477456688881   5.32388159632683  0.883917570114136   9.15121423825622
4  -12.0200691521168   11.6374632790685   10.7902968525887   4.13943130895495

[5 rows x 798 columns]
```

```
In [6]: # remove the first row
        data.drop(data.index[0], inplace=True)
        y_true = data['is_duplicate']
        data.drop(['Unnamed: 0', 'id','index','is_duplicate'], axis=1, inplace=True)

In [7]: data.head()
```

Out[7]:

```
             cwc_min           cwc_max           csc_min           csc_max  \
1  0.749981250468738  0.499991666805553  0.999985714489793  0.999985714489793
2  0.999966667777741  0.999966667777741  0.499987500312492  0.499987500312492
3  0.999975000624984  0.799984000319994  0.749981250468738  0.599988000239995
4  0.749981250468738  0.374995312558593  0.249993750156246  0.199996000079998
5  0.307689940846609  0.249998437509766   0.14285510206997  0.124998437519531

             ctc_min           ctc_max last_word_eq first_word_eq  \
1   0.90908264470323  0.769224852116522         0.0           1.0
2  0.714275510349852  0.714275510349852         1.0           1.0
3  0.874989062636717  0.699993000069999         0.0           1.0
4  0.499993750078124  0.285712244912536         1.0           0.0
5  0.238094104313789  0.192306952665567         0.0           0.0

  abs_len_diff mean_len       ...                  374_y  \
1          2.0     12.0       ...          5.2621960863471
2          0.0      7.0       ...         10.4113432234153
3          2.0      9.0       ...         6.19151087105274
4          6.0     11.0       ...         8.12903142347932
5          5.0     23.5       ...        -12.3651023469865

              375_y             376_y             377_y             378_y  \
1  10.3345596343279  24.0024595782161  -0.733043350279331  15.7177833020687
2  5.65417674463242  10.6767095029354   -11.5996008403599  6.16212257742882
3  0.710954058915377  6.83794537186623  -0.607464585453272  12.0138160921633
4  6.92441907152534  16.8435802906752   -10.6461466807523  4.99954917468131
5  16.2649692818522   21.639226064086    23.0527893770486  36.2669450156391
```

```
                379_y             380_y             381_y             382_y  \
1   6.26007471210323   10.8977920934558  0.311331823468208   26.6197788715362
2     4.318210542202  -4.39765763282776   8.52527767419815    7.5825545489788
3    5.9918103441596  -7.41477456688881   5.32388159632683  0.883917570114136
4   -4.2941911816597  -12.0200691521168   11.6374632790685   10.7902968525887
5  -26.5054575204849  -1.08090314269066   9.41618685470894  -2.49915977194905

                383_y
1  -6.09706179052591
2   3.14942193031311
3   9.15121423825622
4   4.13943130895495
5   3.66466497443616

[5 rows x 794 columns]
```

4.2 Converting strings to numerics

```
In [8]: # after we read from sql table each entry was read it as a string
        # we convert all the features into numaric before we apply any model
        cols = list(data.columns)
        for i in cols:
            data[i] = data[i].apply(pd.to_numeric)
            print(i)
```

```
cwc_min
cwc_max
csc_min
csc_max
ctc_min
ctc_max
last_word_eq
first_word_eq
abs_len_diff
mean_len
token_set_ratio
token_sort_ratio
fuzz_ratio
fuzz_partial_ratio
longest_substr_ratio
freq_qid1
freq_qid2
q1len
q2len
q1_n_words
q2_n_words
word_Common
```

```
word_Total
word_share
freq_q1+q2
freq_q1-q2
0_x
1_x
2_x
3_x
4_x
5_x
6_x
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8_x
9_x
10_x
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```
In [9]: # https://stackoverflow.com/questions/7368789/convert-all-strings-in-a-list-to-int
        y_true = list(map(int, y_true.values))
```

4.3 Random train test split( 70:30)

```
In [10]: X_train,X_test, y_train, y_test = train_test_split(data, y_true, stratify=y_true, test
```

```
In [11]: print("Number of data points in train data :",X_train.shape)
         print("Number of data points in test data :",X_test.shape)
```

```
Number of data points in train data : (42000, 794)
Number of data points in test data : (18000, 794)
```

```
In [12]: print("-"*10, "Distribution of output variable in train data", "-"*10)
         train_distr = Counter(y_train)
         train_len = len(y_train)
         print("Class 0: ",int(train_distr[0])/train_len,"Class 1: ", int(train_distr[1])/train
         print("-"*10, "Distribution of output variable in train data", "-"*10)
         test_distr = Counter(y_test)
         test_len = len(y_test)
         print("Class 0: ",int(test_distr[1])/test_len, "Class 1: ",int(test_distr[1])/test_len
```

```
---------- Distribution of output variable in train data ----------
Class 0:  0.6306428571428572 Class 1:  0.3693571428571429
---------- Distribution of output variable in train data ----------
Class 0:  0.36933333333333335 Class 1:  0.36933333333333335
```

```
In [13]: # This function plots the confusion matrices given y_i, y_i_hat.
         def plot_confusion_matrix(test_y, predict_y):
             C = confusion_matrix(test_y, predict_y)
             # C = 9,9 matrix, each cell (i,j) represents number of points of class i are pred

             A =(((C.T)/(C.sum(axis=1))).T)
             #divid each element of the confusion matrix with the sum of elements in that colu

             # C = [[1, 2],
             #     [3, 4]]
             # C.T = [[1, 3],
             #        [2, 4]]
             # C.sum(axis = 1)  axis=0 corresonds to columns and axis=1 corresponds to rows in
             # C.sum(axix =1) = [[3, 7]]
```

```
    # ((C.T)/(C.sum(axis=1))) = [[1/3, 3/7]
    #                           [2/3, 4/7]]

    # ((C.T)/(C.sum(axis=1))).T = [[1/3, 2/3]
    #                           [3/7, 4/7]]
    # sum of row elements = 1

    B =(C/C.sum(axis=0))
    #divid each element of the confusion matrix with the sum of elements in that row
    # C = [[1, 2],
    #     [3, 4]]
    # C.sum(axis = 0)  axis=0 corresonds to columns and axis=1 corresponds to rows in
    # C.sum(axix =0) = [[4, 6]]
    # (C/C.sum(axis=0)) = [[1/4, 2/6],
    #                      [3/4, 4/6]]
    plt.figure(figsize=(20,4))

    labels = [1,2]
    # representing A in heatmap format
    cmap=sns.light_palette("blue")
    plt.subplot(1, 3, 1)
    sns.heatmap(C, annot=True, cmap=cmap, fmt=".3f", xticklabels=labels, yticklabels=
    plt.xlabel('Predicted Class')
    plt.ylabel('Original Class')
    plt.title("Confusion matrix")

    plt.subplot(1, 3, 2)
    sns.heatmap(B, annot=True, cmap=cmap, fmt=".3f", xticklabels=labels, yticklabels=
    plt.xlabel('Predicted Class')
    plt.ylabel('Original Class')
    plt.title("Precision matrix")

    plt.subplot(1, 3, 3)
    # representing B in heatmap format
    sns.heatmap(A, annot=True, cmap=cmap, fmt=".3f", xticklabels=labels, yticklabels=
    plt.xlabel('Predicted Class')
    plt.ylabel('Original Class')
    plt.title("Recall matrix")

    plt.show()
```

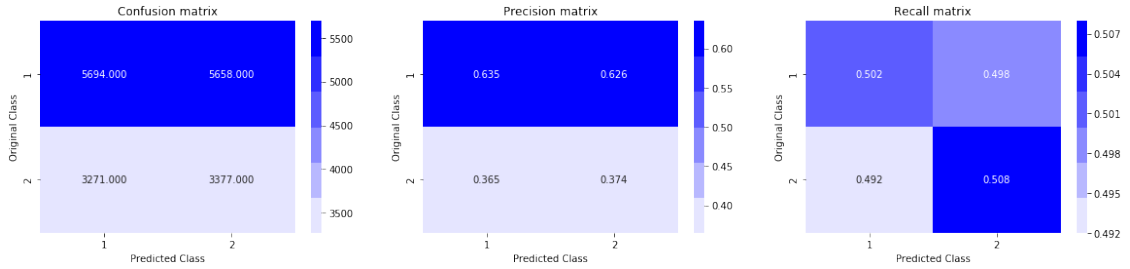
4.4 Building a random model (Finding worst-case log-loss)

```
In [14]: # we need to generate 9 numbers and the sum of numbers should be 1
         # one solution is to genarate 9 numbers and divide each of the numbers by their sum
         # ref: https://stackoverflow.com/a/18662466/4084039
         # we create a output array that has exactly same size as the CV data
         predicted_y = np.zeros((test_len,2))
```

```
        for i in range(test_len):
            rand_probs = np.random.rand(1,2)
            predicted_y[i] = ((rand_probs/sum(sum(rand_probs)))[0])
        print("Log loss on Test Data using Random Model",log_loss(y_test, predicted_y, eps=1e-

        predicted_y =np.argmax(predicted_y, axis=1)
        plot_confusion_matrix(y_test, predicted_y)
```

```
Log loss on Test Data using Random Model 0.8858467472564963
```




### 4.4 Logistic Regression with hyperparameter tuning

```
In [17]: from tqdm.auto import tqdm
         alpha = [10 ** x for x in range(-5, 2)] # hyperparam for SGD classifier.

         # read more about SGDClassifier() at http://scikit-learn.org/stable/modules/generated/
         # ------------------------------
         # default parameters
         # SGDClassifier(loss=hinge, penalty=l2, alpha=0.0001, l1_ratio=0.15, fit_intercept=Tr
         # shuffle=True, verbose=0, epsilon=0.1, n_jobs=1, random_state=None, learning_rate=op
         # class_weight=None, warm_start=False, average=False, n_iter=None)

         # some of methods
         # fit(X, y[, coef_init, intercept_init, ])        Fit linear model with Stochastic Gr
         # predict(X)        Predict class labels for samples in X.

         #-------------------------------
         # video link:
         #-------------------------------


         log_error_array=[]
         for i in tqdm(alpha):
             clf = SGDClassifier(alpha=i, penalty='l2', loss='log', random_state=42)
             clf.fit(X_train, y_train)
             sig_clf = CalibratedClassifierCV(clf, method="sigmoid")
             sig_clf.fit(X_train, y_train)
```

```
        predict_y = sig_clf.predict_proba(X_test)
        log_error_array.append(log_loss(y_test, predict_y, labels=clf.classes_, eps=1e-15)
        print('For values of alpha = ', i, "The log loss is:",log_loss(y_test, predict_y,

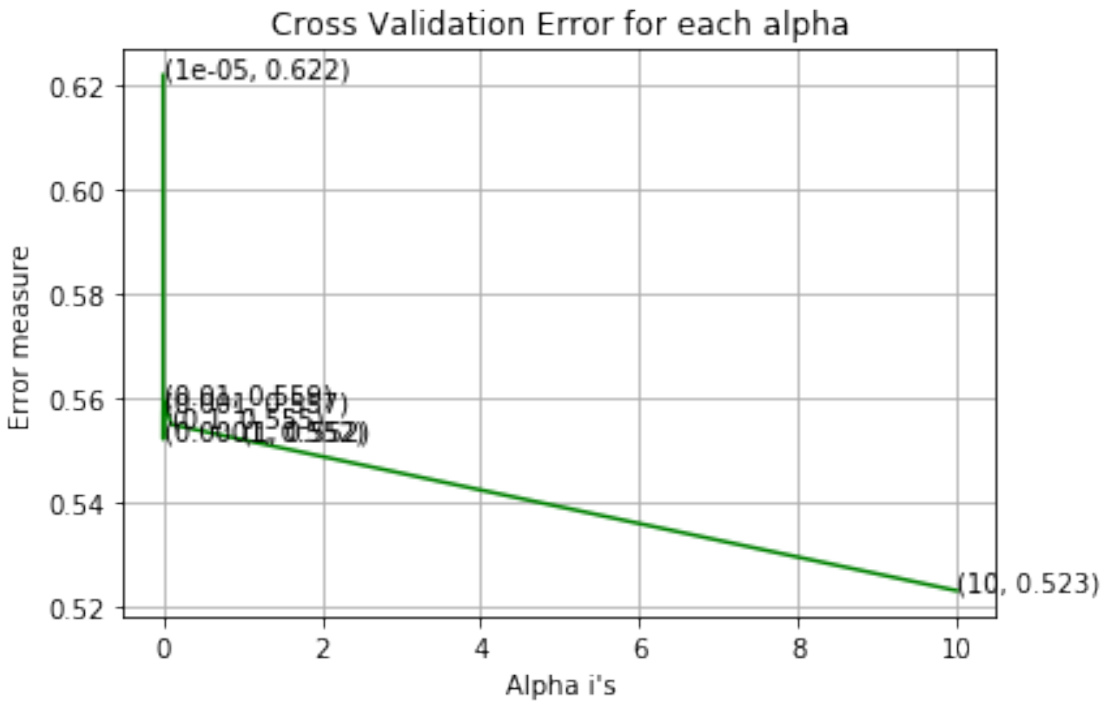
    fig, ax = plt.subplots()
    ax.plot(alpha, log_error_array,c='g')
    for i, txt in enumerate(np.round(log_error_array,3)):
        ax.annotate((alpha[i],np.round(txt,3)), (alpha[i],log_error_array[i]))
    plt.grid()
    plt.title("Cross Validation Error for each alpha")
    plt.xlabel("Alpha i's")
    plt.ylabel("Error measure")
    plt.show()


    best_alpha = np.argmin(log_error_array)
    clf = SGDClassifier(alpha=alpha[best_alpha], penalty='l2', loss='log', random_state=42
    clf.fit(X_train, y_train)
    sig_clf = CalibratedClassifierCV(clf, method="sigmoid")
    sig_clf.fit(X_train, y_train)

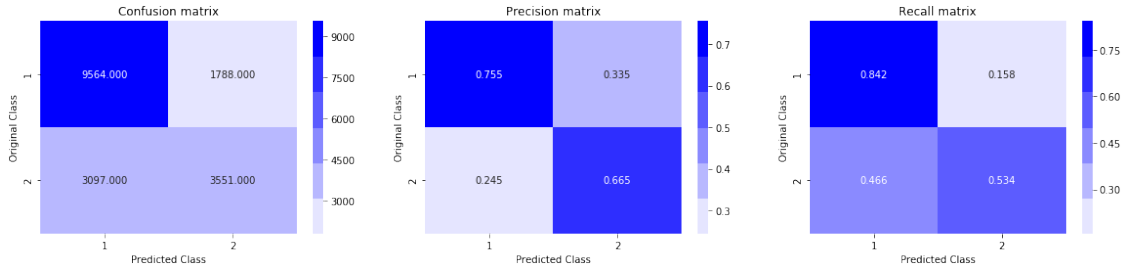
    predict_y = sig_clf.predict_proba(X_train)
    print('For values of best alpha = ', alpha[best_alpha], "The train log loss is:",log_l
    predict_y = sig_clf.predict_proba(X_test)
    print('For values of best alpha = ', alpha[best_alpha], "The test log loss is:",log_lo
    predicted_y =np.argmax(predict_y,axis=1)
    print("Total number of data points :", len(predicted_y))
    plot_confusion_matrix(y_test, predicted_y)
```

```
HBox(children=(IntProgress(value=0, max=7), HTML(value='')))


For values of alpha =  1e-05 The log loss is: 0.6220434819250116
For values of alpha =  0.0001 The log loss is: 0.5520418910381882
For values of alpha =  0.001 The log loss is: 0.5573915480798847
For values of alpha =  0.01 The log loss is: 0.5593118711520558
For values of alpha =  0.1 The log loss is: 0.5548563446875912
For values of alpha =  1 The log loss is: 0.5519260464527921
For values of alpha =  10 The log loss is: 0.5228888292938616
```




```
For values of best alpha =  10 The train log loss is: 0.5139749163644576
For values of best alpha =  10 The test log loss is: 0.5228888292938616
Total number of data points : 18000
```




### 4.5 Linear SVM with hyperparameter tuning

```
In [19]: alpha = [10 ** x for x in range(-5, 2)] # hyperparam for SGD classifier.

         # read more about SGDClassifier() at http://scikit-learn.org/stable/modules/generated/
         # ------------------------------
         # default parameters
         # SGDClassifier(loss=hinge, penalty=l2, alpha=0.0001, l1_ratio=0.15, fit_intercept=Tr
         # shuffle=True, verbose=0, epsilon=0.1, n_jobs=1, random_state=None, learning_rate=op
```

```
        # class_weight=None, warm_start=False, average=False, n_iter=None)

        # some of methods
        # fit(X, y[, coef_init, intercept_init, ])        Fit linear model with Stochastic Gr
        # predict(X)        Predict class labels for samples in X.

        #--------------------------------
        # video link:
        #--------------------------------


        log_error_array=[]
        for i in tqdm(alpha):
            clf = SGDClassifier(alpha=i, penalty='l1', loss='hinge', random_state=42)
            clf.fit(X_train, y_train)
            sig_clf = CalibratedClassifierCV(clf, method="sigmoid")
            sig_clf.fit(X_train, y_train)
            predict_y = sig_clf.predict_proba(X_test)
            log_error_array.append(log_loss(y_test, predict_y, labels=clf.classes_, eps=1e-15)
            print('For values of alpha = ', i, "The log loss is:",log_loss(y_test, predict_y,

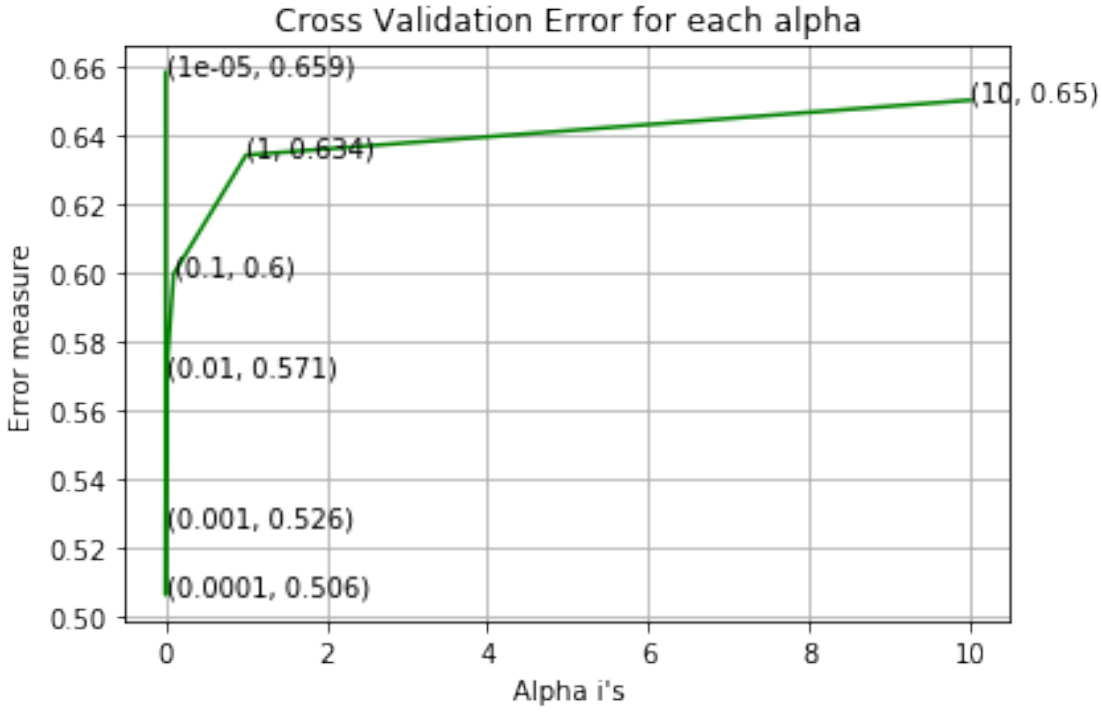
        fig, ax = plt.subplots()
        ax.plot(alpha, log_error_array,c='g')
        for i, txt in enumerate(np.round(log_error_array,3)):
            ax.annotate((alpha[i],np.round(txt,3)), (alpha[i],log_error_array[i]))
        plt.grid()
        plt.title("Cross Validation Error for each alpha")
        plt.xlabel("Alpha i's")
        plt.ylabel("Error measure")
        plt.show()


        best_alpha = np.argmin(log_error_array)
        clf = SGDClassifier(alpha=alpha[best_alpha], penalty='l1', loss='hinge', random_state=
        clf.fit(X_train, y_train)
        sig_clf = CalibratedClassifierCV(clf, method="sigmoid")
        sig_clf.fit(X_train, y_train)

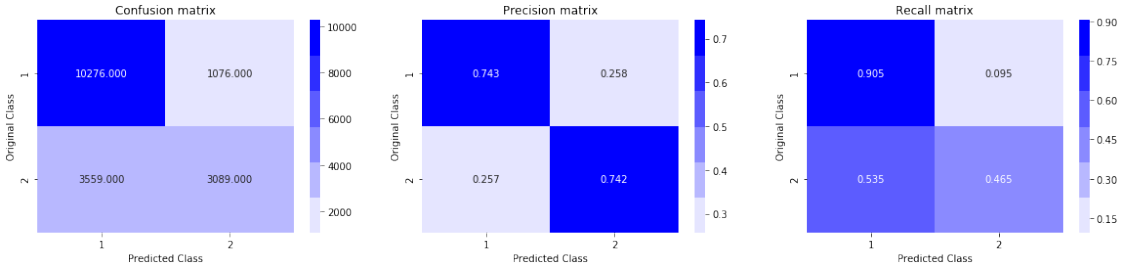
        predict_y = sig_clf.predict_proba(X_train)
        print('For values of best alpha = ', alpha[best_alpha], "The train log loss is:",log_l
        predict_y = sig_clf.predict_proba(X_test)
        print('For values of best alpha = ', alpha[best_alpha], "The test log loss is:",log_lo
        predicted_y =np.argmax(predict_y,axis=1)
        print("Total number of data points :", len(predicted_y))
        plot_confusion_matrix(y_test, predicted_y)
```

```
HBox(children=(IntProgress(value=0, max=7), HTML(value='')))
```

```
For values of alpha =  1e-05 The log loss is: 0.6585999197746482
For values of alpha =  0.0001 The log loss is: 0.5063896242672866
For values of alpha =  0.001 The log loss is: 0.5264735997478815
For values of alpha =  0.01 The log loss is: 0.5707068580328858
For values of alpha =  0.1 The log loss is: 0.5998146952530511
For values of alpha =  1 The log loss is: 0.6344824538860115
For values of alpha =  10 The log loss is: 0.6504648900469024
```




```
For values of best alpha =  0.0001 The train log loss is: 0.49823810184033107
For values of best alpha =  0.0001 The test log loss is: 0.5063896242672866
Total number of data points : 18000
```



### 4.6 XGBoost

```
In [20]: import xgboost as xgb
         params = {}
         params['objective'] = 'binary:logistic'
         params['eval_metric'] = 'logloss'
         params['eta'] = 0.02
         params['max_depth'] = 4

         d_train = xgb.DMatrix(X_train, label=y_train)
         d_test = xgb.DMatrix(X_test, label=y_test)

         watchlist = [(d_train, 'train'), (d_test, 'valid')]

         bst = xgb.train(params, d_train, 400, watchlist, early_stopping_rounds=20, verbose_eva

         xgdmat = xgb.DMatrix(X_train,y_train)
         predict_y = bst.predict(d_test)
         print("The test log loss is:",log_loss(y_test, predict_y, labels=clf.classes_, eps=1e-

[19:30:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[0]        train-logloss:0.684636        valid-logloss:0.684557
Multiple eval metrics have been passed: 'valid-logloss' will be used for early stopping.

Will train until valid-logloss hasn't improved in 20 rounds.
[19:30:30] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:31] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:31] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:33] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:35] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[10]        train-logloss:0.614818        valid-logloss:0.614144
[19:30:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:40] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:41] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:46] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:47] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[20]        train-logloss:0.5635        valid-logloss:0.562454
[19:30:48] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
```

```
[19:30:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:50] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:51] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:52] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:55] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:57] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:30:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[30]        train-logloss:0.524701        valid-logloss:0.523436
[19:30:59] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:01] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:02] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:03] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:04] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:07] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:08] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[40]        train-logloss:0.495398        valid-logloss:0.494132
[19:31:10] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:12] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:13] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:15] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:16] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:17] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:18] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:19] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[50]        train-logloss:0.471901        valid-logloss:0.470644
[19:31:20] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:21] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:22] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:23] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:24] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:26] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:27] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:28] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:30] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[60]        train-logloss:0.453229        valid-logloss:0.452107
[19:31:31] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:33] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:35] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
```

```
[19:31:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:40] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[70]        train-logloss:0.438258        valid-logloss:0.437297
[19:31:41] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:46] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:47] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:48] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:51] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[80]        train-logloss:0.426262        valid-logloss:0.425469
[19:31:52] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:55] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:56] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:57] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:31:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:01] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:02] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[90]        train-logloss:0.416647        valid-logloss:0.416078
[19:32:03] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:07] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:08] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:10] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:12] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:13] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[100]        train-logloss:0.408542        valid-logloss:0.408144
[19:32:15] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:16] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:18] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:19] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:21] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:22] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:24] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:25] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:26] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
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[19:32:28] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[110]	train-logloss:0.401721	valid-logloss:0.401597
[19:32:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:30] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:33] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:35] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[120]	train-logloss:0.395957	valid-logloss:0.39605
[19:32:41] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:47] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:48] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:51] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:52] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[130]	train-logloss:0.390897	valid-logloss:0.391244
[19:32:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:55] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:57] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:32:59] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:01] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:02] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:04] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[140]	train-logloss:0.386714	valid-logloss:0.387469
[19:33:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:07] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:09] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:10] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:12] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:13] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:15] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[150]	train-logloss:0.382992	valid-logloss:0.384119
[19:33:16] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:18] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
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[19:33:19] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:20] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:21] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:22] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:23] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:24] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:26] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:27] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[160]       train-logloss:0.379373       valid-logloss:0.380922
[19:33:28] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:30] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:31] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:35] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[170]       train-logloss:0.37635       valid-logloss:0.378282
[19:33:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:40] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:46] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:48] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:50] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[180]       train-logloss:0.373557       valid-logloss:0.375897
[19:33:51] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:55] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:56] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:33:59] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:01] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:02] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[190]       train-logloss:0.371119       valid-logloss:0.373921
[19:34:04] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:07] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:08] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:09] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
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[19:34:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:12] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:13] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[200]        train-logloss:0.368697        valid-logloss:0.372005
[19:34:16] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:17] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:18] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:19] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:20] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:22] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:23] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:24] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:25] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:26] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[210]        train-logloss:0.366452        valid-logloss:0.370271
[19:34:27] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:30] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:31] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:33] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[220]        train-logloss:0.364396        valid-logloss:0.36874
[19:34:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:41] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:46] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:48] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:50] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[230]        train-logloss:0.362602        valid-logloss:0.367366
[19:34:51] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:52] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:56] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:57] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:34:59] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:02] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
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[240]	train-logloss:0.360749	valid-logloss:0.365934
[19:35:03] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:04] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:08] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:09] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:10] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:13] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[250]	train-logloss:0.358986	valid-logloss:0.364631
[19:35:15] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:16] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:17] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:19] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:20] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:21] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:22] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:24] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:25] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:26] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[260]	train-logloss:0.357345	valid-logloss:0.363425
[19:35:27] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:30] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:31] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:35] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[270]	train-logloss:0.355573	valid-logloss:0.362133
[19:35:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:41] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:46] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:47] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:50] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[280]	train-logloss:0.353772	valid-logloss:0.360943
[19:35:51] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:52] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
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[19:35:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:56] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:57] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:35:59] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:02] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[290]   train-logloss:0.352186  valid-logloss:0.359906
[19:36:03] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:04] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:08] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:09] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:10] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:13] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[300]   train-logloss:0.350547  valid-logloss:0.358971
[19:36:15] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:16] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:17] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:18] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:20] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:21] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:22] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:23] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:25] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:26] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[310]   train-logloss:0.348975  valid-logloss:0.358049
[19:36:27] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:28] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:31] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:33] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:37] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[320]   train-logloss:0.347537  valid-logloss:0.357148
[19:36:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:40] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:47] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
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[19:36:48] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:50] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[330]        train-logloss:0.346117        valid-logloss:0.35629
[19:36:52] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:56] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:57] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:36:59] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:01] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:03] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[340]        train-logloss:0.344854        valid-logloss:0.355539
[19:37:04] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:08] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:09] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:10] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:13] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:15] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[350]        train-logloss:0.34344        valid-logloss:0.35478
[19:37:16] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:18] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:19] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:20] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:21] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:22] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:23] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:25] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:26] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:27] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[360]        train-logloss:0.342179        valid-logloss:0.354119
[19:37:28] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:29] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:30] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:32] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:33] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:34] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:35] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:36] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:38] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:39] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[370]        train-logloss:0.340901        valid-logloss:0.353532
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[19:37:41] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:42] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:43] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:44] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:45] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:47] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:48] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:49] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:50] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:52] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[380]        train-logloss:0.339683        valid-logloss:0.352928
[19:37:53] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:54] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:56] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:57] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:58] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:37:59] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:00] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:01] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:03] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:04] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[390]        train-logloss:0.338474        valid-logloss:0.352421
[19:38:05] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:06] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:07] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:09] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:10] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:11] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:12] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:14] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[19:38:15] C:\Users\Administrator\Desktop\xgboost\src\tree\updater_prune.cc:74: tree pruning en
[399]        train-logloss:0.337379        valid-logloss:0.351811
The test log loss is: 0.3518105491030114
```

```
In [21]: predicted_y =np.array(predict_y>0.5,dtype=int)
         print("Total number of data points :", len(predicted_y))
         plot_confusion_matrix(y_test, predicted_y)
```

```
Total number of data points : 18000
```