detect the fake profiles in online social networks using Neural Network

In [1]:
```
import sys
import csv
import os
import datetime
import math
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from datetime import datetime
import sexmachine.detector as gender
from sklearn.preprocessing import Imputer
from sklearn import cross_validation
from sklearn import metrics
from sklearn import preprocessing
from sklearn.linear_model import LinearRegression
from  sklearn.ensemble import RandomForestClassifier
from sklearn.decomposition import PCA
from sklearn.cross_validation import StratifiedKFold, train_test_split
from sklearn.grid_search import GridSearchCV
from sklearn.metrics import accuracy_score
from sklearn.learning_curve import learning_curve
from sklearn.metrics import roc_curve, auc ,roc_auc_score
from sklearn.metrics import confusion_matrix
from sklearn.metrics import classification_report
%matplotlib inline
from pybrain.structure import SigmoidLayer
from pybrain.datasets import ClassificationDataSet
from pybrain.utilities import percentError
from pybrain.tools.shortcuts import buildNetwork
from pybrain.supervised.trainers import BackpropTrainer
from pybrain.structure.modules import SoftmaxLayer
from pybrain.tools.xml.networkwriter import NetworkWriter
from pybrain.tools.xml.networkreader import NetworkReader
```

function for reading dataset from csv files

In [2]:
```
def read_datasets():
    """ Reads users profile from csv files """
    genuine_users = pd.read_csv("data/users.csv")
    fake_users = pd.read_csv("data/fusers.csv")
    # print genuine_users.columns
    # print genuine_users.describe()
    #print fake_users.describe()
    x=pd.concat([genuine_users,fake_users])
    y=len(fake_users)*[0] + len(genuine_users)*[1]
    return x,y
```

function for predicting sex using name of person

In [3]:
```
def predict_sex(name):
    sex_predictor = gender.Detector(unknown_value=u"unknown",case_sensitiv
e=False)
    first_name= name.str.split(' ').str.get(0)
    sex= first_name.apply(sex_predictor.get_gender)
    sex_dict={'female': -2, 'mostly_female': -1,'unknown':0,'mostly_mal
e':1, 'male': 2}
    sex_code = sex.map(sex_dict).astype(int)
    return sex_code
```

function for feature engineering

In [4]:
```
def extract_features(x):
    lang_list = list(enumerate(np.unique(x['lang'])))
    lang_dict = { name : i for i, name in lang_list }
    x.loc[:,'lang_code'] = x['lang'].map( lambda x: lang_dict[x]).astype(i
nt)
    x.loc[:,'sex_code']=predict_sex(x['name'])
    feature_columns_to_use = ['statuses_count','followers_count','friend
s_count','favourites_count','listed_count','sex_code','lang_code']
    x=x.loc[:,feature_columns_to_use]
    return x
```

function for plotting confusion matrix

In [5]:
```
def plot_confusion_matrix(cm, title='Confusion matrix', cmap=plt.cm.Blue
s):
    target_names=['Fake','Genuine']
    plt.imshow(cm, interpolation='nearest', cmap=cmap)
    plt.title(title)
    plt.colorbar()
    tick_marks = np.arange(len(target_names))
    plt.xticks(tick_marks, target_names, rotation=45)
    plt.yticks(tick_marks, target_names)
    plt.tight_layout()
    plt.ylabel('True label')
    plt.xlabel('Predicted label')
```

function for plotting ROC curve

In [6]:
```
def plot_roc_curve(y_test, y_pred):
    false_positive_rate, true_positive_rate, thresholds = roc_curve(y_tes
t, y_pred)

    print "False Positive rate: ",false_positive_rate
    print "True Positive rate: ",true_positive_rate


    roc_auc = auc(false_positive_rate, true_positive_rate)

    plt.title('Receiver Operating Characteristic')
    plt.plot(false_positive_rate, true_positive_rate, 'b',
    label='AUC = %0.2f'% roc_auc)
    plt.legend(loc='lower right')
    plt.plot([0,1],[0,1],'r--')
    plt.xlim([-0.1,1.2])
    plt.ylim([-0.1,1.2])
    plt.ylabel('True Positive Rate')
    plt.xlabel('False Positive Rate')
    plt.show()
```

Function for training data using Neural Network

In [7]:
```
def train(X,y):
    """ Trains and predicts dataset with a Neural Network classifier """

    ds = ClassificationDataSet( len(X.columns), 1,nb_classes=2)
    for k in xrange(len(X)):
        ds.addSample(X.iloc[k],np.array(y[k]))
    tstdata, trndata = ds.splitWithProportion( 0.20 )
    trndata._convertToOneOfMany( )
    tstdata._convertToOneOfMany( )
    input_size=len(X.columns)
    target_size=1
    hidden_size = 5
    fnn=None
    if  os.path.isfile('fnn.xml'):
        fnn = NetworkReader.readFrom('fnn.xml')
    else:
        fnn = buildNetwork( trndata.indim, hidden_size , trndata.outdim, o
utclass=SoftmaxLayer )
    trainer = BackpropTrainer( fnn, dataset=trndata,momentum=0.05, learnin
grate=0.1 , verbose=False, weightdecay=0.01)


    trainer.trainUntilConvergence(verbose = False, validationProportion =
0.15, maxEpochs = 100, continueEpochs = 10 )
    NetworkWriter.writeToFile(fnn, 'oliv.xml')
    predictions=trainer.testOnClassData (dataset=tstdata)
    return tstdata['class'],predictions
```

In [8]:
```
print "reading datasets.....\n"
x,y=read_datasets()
x.describe()
```

```
reading datasets.....
```

Out[8]:

	id	statuses_count	followers_count	friends_count	favourites_co
count	2.818000e+03	2818.000000	2818.000000	2818.000000	2818.000000
mean	5.374889e+08	1672.198368	371.105039	395.363023	234.541164
std	2.977005e+08	4884.669157	8022.631339	465.694322	1445.847248
min	3.610511e+06	0.000000	0.000000	0.000000	0.000000
25%	3.620867e+08	35.000000	17.000000	168.000000	0.000000
50%	6.162253e+08	77.000000	26.000000	306.000000	0.000000
75%	6.177673e+08	1087.750000	111.000000	519.000000	37.000000
max	1.391998e+09	79876.000000	408372.000000	12773.000000	44349.000000

In [9]:
```
print "extracting featues.....\n"
x=extract_features(x)
print x.columns
print x.describe()
```

```
extracting featues.....

Index([u'statuses_count', u'followers_count', u'friends_count',
       u'favourites_count', u'listed_count', u'sex_code', u'lang_code'],
      dtype='object')
       statuses_count  followers_count  friends_count  favourites_count  \
count     2818.000000      2818.000000    2818.000000       2818.000000
mean      1672.198368       371.105039     395.363023        234.541164
std       4884.669157      8022.631339     465.694322       1445.847248
min          0.000000         0.000000       0.000000          0.000000
25%         35.000000        17.000000     168.000000          0.000000
50%         77.000000        26.000000     306.000000          0.000000
75%       1087.750000       111.000000     519.000000         37.000000
max      79876.000000    408372.000000   12773.000000      44349.000000

       listed_count     sex_code    lang_code
count   2818.000000  2818.000000  2818.000000
mean       2.818666    -0.180270     2.851313
std       23.480430     1.679125     1.992950
min        0.000000    -2.000000     0.000000
25%        0.000000    -2.000000     1.000000
50%        0.000000     0.000000     1.000000
75%        1.000000     2.000000     5.000000
max      744.000000     2.000000     7.000000
```

In [10]:
```
print "training datasets.......\n"
y_test,y_pred =train(x,y)
```

```
training datasets.......
```

In [11]:
```
print 'Classification Accuracy on Test dataset: ' ,accuracy_score(y_test,
y_pred)
```

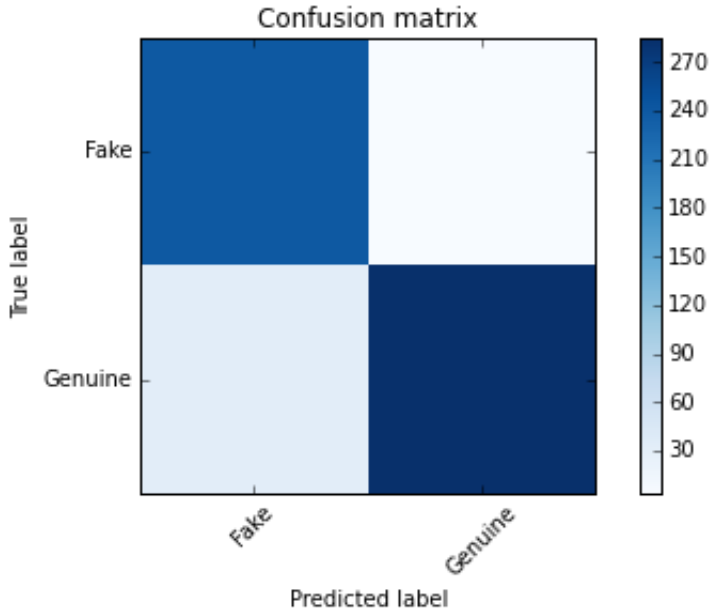
```
Classification Accuracy on Test dataset:  0.934280639432
```

In [12]:
```
print 'Percent Error on Test dataset: ' ,percentError(y_pred,y_test)
```

```
Percent Error on Test dataset:  6.57193605684
```

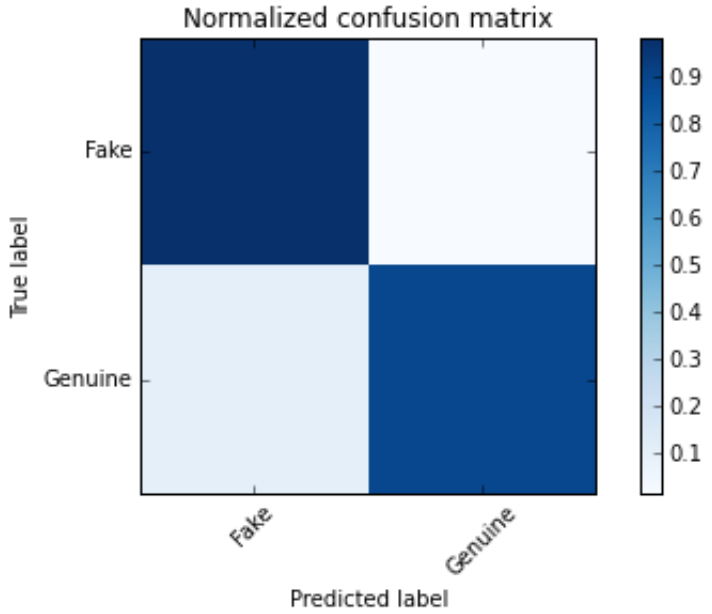
In [13]:
```
cm=confusion_matrix(y_test, y_pred)
print('Confusion matrix, without normalization')
print(cm)
plot_confusion_matrix(cm)
```

```
Confusion matrix, without normalization
[[241   4]
 [ 33 285]]
```



In [14]:
```
cm_normalized = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
print('Normalized confusion matrix')
print(cm_normalized)
plot_confusion_matrix(cm_normalized, title='Normalized confusion matrix')
```

```
Normalized confusion matrix
[[ 0.98367347  0.01632653]
 [ 0.10377358  0.89622642]]
```



In [15]:
```
print(classification_report(y_test, y_pred, target_names=['Fake','Genuine']))
```

```
             precision    recall  f1-score   support

       Fake       0.88      0.98      0.93       245
    Genuine       0.99      0.90      0.94       318

avg / total       0.94      0.93      0.93       563
```

In [16]:
```
s=roc_auc_score(y_test, y_pred)
print "roc_auc_score : ",s
```

```
roc_auc_score :  0.939949942241
```

In [17]:
```
plot_roc_curve(y_test, y_pred)
```

```
False Positive rate:  [ 0.          0.01632653  1.        ]
True Positive rate:  [ 0.          0.89622642  1.        ]
```