Detect fake profiles in online social networks using Support Vector Machine

In [57]:
```
import sys
import csv
import datetime
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.svm import SVC
from sklearn.metrics import roc_curve, auc
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 classification_report
from sklearn.metrics import confusion_matrix
%matplotlib inline
```

function for reading dataset from csv files

In [58]:
```
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 [59]:
```
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 [62]:
```
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 ploting learning curve

In [63]:
```
def plot_learning_curve(estimator, title, X, y, ylim=None, cv=None,
                        n_jobs=1, train_sizes=np.linspace(.1, 1.0, 5)):
    plt.figure()
    plt.title(title)
    if ylim is not None:
        plt.ylim(*ylim)
    plt.xlabel("Training examples")
    plt.ylabel("Score")
    train_sizes, train_scores, test_scores = learning_curve(
        estimator, X, y, cv=cv, n_jobs=n_jobs, train_sizes=train_sizes)
    train_scores_mean = np.mean(train_scores, axis=1)
    train_scores_std = np.std(train_scores, axis=1)
    test_scores_mean = np.mean(test_scores, axis=1)
    test_scores_std = np.std(test_scores, axis=1)
    plt.grid()

    plt.fill_between(train_sizes, train_scores_mean - train_scores_std,
                     train_scores_mean + train_scores_std, alpha=0.1,
                     color="r")
    plt.fill_between(train_sizes, test_scores_mean - test_scores_std,
                     test_scores_mean + test_scores_std, alpha=0.1, colo
r="g")
    plt.plot(train_sizes, train_scores_mean, 'o-', color="r",
             label="Training score")
    plt.plot(train_sizes, test_scores_mean, 'o-', color="g",
             label="Cross-validation score")

    plt.legend(loc="best")
    return plt
```

function for plotting confusion matrix

In [65]:
```
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 [71]:
```
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 Support Vector Machine

In [72]:
```
def train(X_train,y_train,X_test):
    """ Trains and predicts dataset with a SVM classifier """
    # Scaling features
    X_train=preprocessing.scale(X_train)
    X_test=preprocessing.scale(X_test)

    Cs = 10.0 ** np.arange(-2,3,.5)
    gammas = 10.0 ** np.arange(-2,3,.5)
    param = [{'gamma': gammas, 'C': Cs}]
    cvk = StratifiedKFold(y_train,n_folds=5)
    classifier = SVC()
    clf = GridSearchCV(classifier,param_grid=param,cv=cvk)
    clf.fit(X_train,y_train)
    print("The best classifier is: ",clf.best_estimator_)
    clf.best_estimator_.fit(X_train,y_train)
    # Estimate score
    scores = cross_validation.cross_val_score(clf.best_estimator_, X_trai
n,y_train, cv=5)
    print scores
    print('Estimated score: %0.5f (+/- %0.5f)' % (scores.mean(), scores.st
d() / 2))
    title = 'Learning Curves (SVM, rbf kernel, $\gamma=%.6f$)' %clf.best_e
stimator_.gamma
    plot_learning_curve(clf.best_estimator_, title, X_train, y_train, c
v=5)
    plt.show()
    # Predict class
    y_pred = clf.best_estimator_.predict(X_test)
    return y_test,y_pred
```

In [76]:
```
print "reading datasets.....\n"
x,y=read_datasets()
```

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

In [77]:
```
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
```

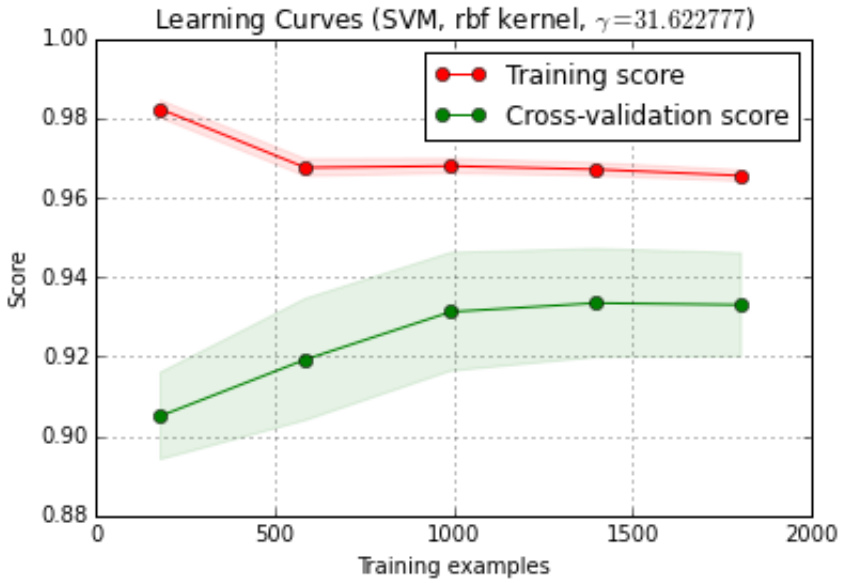
In [78]:
```
print "spliting datasets in train and test dataset...\n"
X_train,X_test,y_train,y_test = train_test_split(x, y, test_size=0.20, ran
dom_state=44)
```

```
spliting datasets in train and test dataset...
```

In [79]:
```
print "training datasets.......\n"
y_test,y_pred = train(X_train,y_train,X_test)
```

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

('The best classifier is: ', SVC(C=1.0, cache_size=200, class_weight=None,
coef0=0.0,
  decision_function_shape=None, degree=3, gamma=31.622776601683793,
  kernel='rbf', max_iter=-1, probability=False, random_state=None,
  shrinking=True, tol=0.001, verbose=False))
[ 0.91796009  0.92904656  0.92461197  0.9556541   0.93777778]
Estimated score: 0.93301 (+/- 0.00651)
```

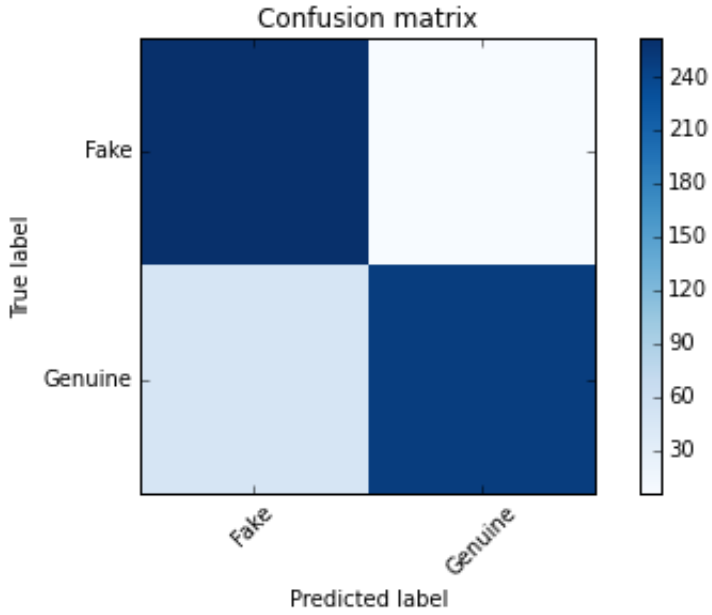


In [80]:
```
print 'Classification Accuracy on Test dataset: ' ,accuracy_score(y_test,
y_pred)
```

```
Classification Accuracy on Test dataset:  0.904255319149
```

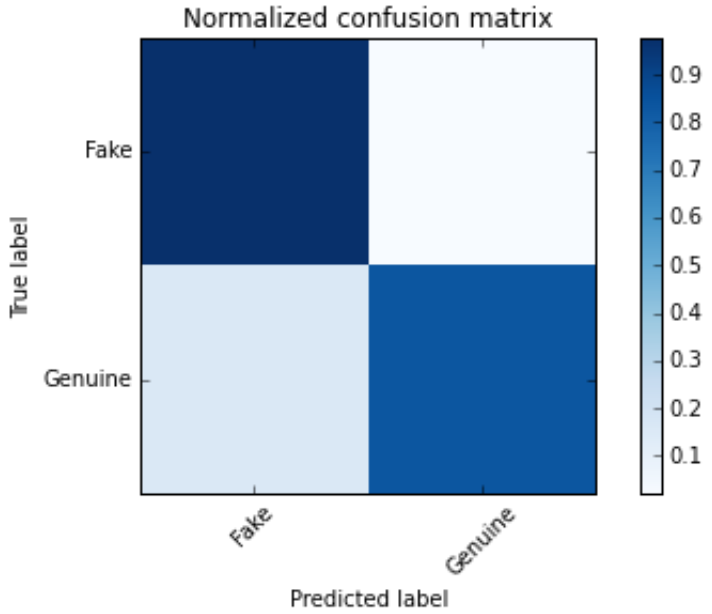
In [82]:
```
cm=confusion_matrix(y_test, y_pred)
print('Confusion matrix, without normalization')
print(cm)
plot_confusion_matrix(cm)
```

```
 Confusion matrix, without normalization
[[262   6]
 [ 48 248]]
```



In [83]:
```
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
[[ 0.97761194  0.02238806]
 [ 0.16216216  0.83783784]]
```



In [84]:
```
print(classification_report(y_test, y_pred, target_names=['Fake','Genuine']))
```

```
             precision    recall  f1-score   support

       Fake       0.85      0.98      0.91       268
    Genuine       0.98      0.84      0.90       296

avg / total       0.91      0.90      0.90       564
```

In [85]:
```
plot_roc_curve(y_test, y_pred)
```

```
False Positive rate:  [ 0.          0.02238806  1.        ]
True Positive rate:  [ 0.          0.83783784  1.        ]
```