EURUSD price prediction

Import Libraries

In [30]:

```
import pandas as pd                    # dataframe library
import matplotlib.pyplot as plt        # plot data
import numpy as np                     # N-dim object support

# do ploting inline
%matplotlib inline
```

Load and review data

In [31]:

```
df = pd.read_csv(".\EU_1H_1.1.16_1.2.17.csv")      # load data
```

In [32]:

```
df.shape
```

Out[32]:

```
(6362, 13)
```

In [33]:

```
df.head(3)
```

Out[33]:

	OpenTime	DayHour	DayWeek	Bar1OC	Bar1HL	Bar1Shape	Oscilator	ShortTrend	LongTr
0	2016.01.26 12:00:00	13	2	1.1	12.0	3.55	8.90188	-41.75933	2.73
1	2016.01.26 13:00:00	14	2	0.9	17.3	7.90	13.85928	-41.41867	2.54
2	2016.01.26 14:00:00	15	2	10.1	18.1	-0.10	29.01745	-40.70200	2.40

In [34]:

```
df.tail(3)
```

Out[34]:

	OpenTime	DayHour	DayWeek	Bar1OC	Bar1HL	Bar1Shape	Oscilator	ShortTrend	Lon
6359	2017.01.31 12:00:00	13	2	-1.9	17.6	6.85	76.89352	-18.99000	7‘
6360	2017.01.31 13:00:00	14	2	7.0	20.3	0.85	86.99074	-17.84400	7(
6361	2017.01.31 15:00:00	16	2	17.9	30.9	-5.80	95.05162	-14.25733	7(

In [35]:

```
df.isnull().values.any()
```

Out[35]:

```
False
```

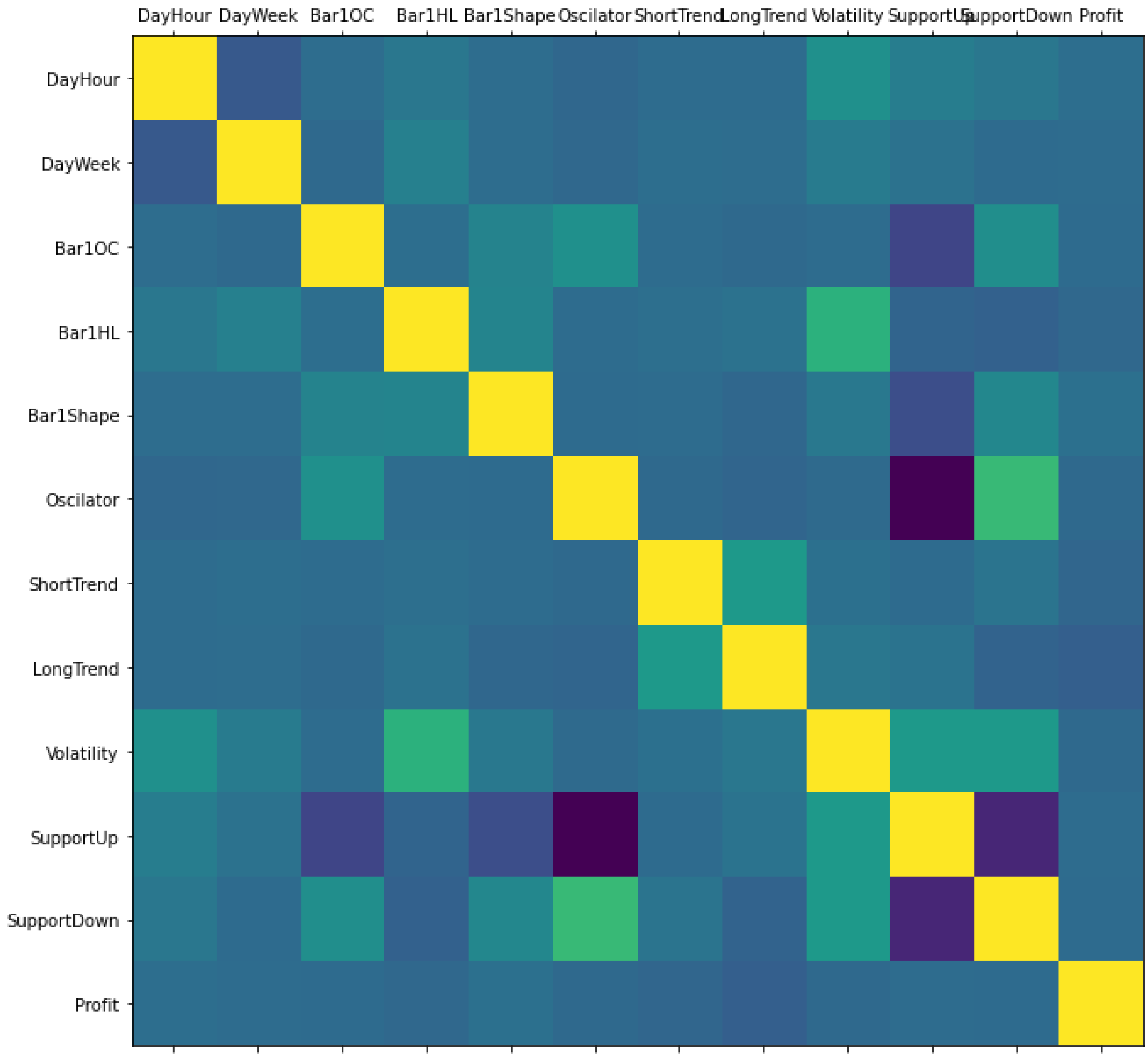
Check for correlations

In [36]:

```
def plot_corr(df, size=11):
    corr = df.corr()
    fig, ax =plt.subplots(figsize=(size, size))
    ax.matshow(corr)
    plt.xticks(range(len(corr.columns)), corr.columns)
    plt.yticks(range(len(corr.columns)), corr.columns)
```

In [37]:

```
plot_corr(df)
```



In [38]:

```
c = df.corr().abs()
s = c.unstack()
so = s.sort_values(kind="quicksort")
```

Delete unecesary columns

In [39]:

```
del df['OpenTime']
del df['DayWeek']
del df['Bar1Shape']
```

In [40]:

```
df.head(3)
```

Out[40]:

	DayHour	Bar1OC	Bar1HL	Oscilator	ShortTrend	LongTrend	Volatility	SupportUp	Support
0	13	1.1	12.0	8.90188	-41.75933	2.73622	0.00142	40.1	
1	14	0.9	17.3	13.85928	-41.41867	2.54689	0.00147	32.0	
2	15	10.1	18.1	29.01745	-40.70200	2.40756	0.00150	2.1	

Check data Types

Change False to 0 and True to 1

In [41]:

```
profit_map = {False : 0, True : 1}
```

In [42]:

```
df['Profit'] = df['Profit'].map(profit_map)
```

In [43]:

```
df.head(3)
```

Out[43]:

	DayHour	Bar1OC	Bar1HL	Oscilator	ShortTrend	LongTrend	Volatility	SupportUp	Support
0	13	1.1	12.0	8.90188	-41.75933	2.73622	0.00142	40.1	
1	14	0.9	17.3	13.85928	-41.41867	2.54689	0.00147	32.0	
2	15	10.1	18.1	29.01745	-40.70200	2.40756	0.00150	2.1	

TBD: Change profit from 1.0 and 0.0 to 1 and 0

Check true/false ratio

In [44]:

```
num_true = len(df.loc[df['Profit'] == 1])
num_false = len(df.loc[df['Profit'] == 0])
print("Num true: {0} ({1:2.2f})".format(num_true, (num_true/(num_true + num_false)) * 100))
print("Num false: {0} ({1:2.2f})".format(num_true, (num_false/(num_true + num_false)) * 100
```

```
Num true: 3413 (53.65)
Num false: 3413 (46.35)
```

Split Data

Split 70% for training, 30% for testing

In [45]:

```
from sklearn.model_selection import train_test_split
feature_col_names = ['DayHour','Bar1OC','Bar1HL','Oscilator','ShortTrend','LongTrend','Vola
predicted_class_names = ['Profit']

x = df[feature_col_names].values
y = df[predicted_class_names].values
split_test_size = 0.30

X_train, X_test, Y_train, Y_test = train_test_split(x, y, test_size=split_test_size,random_
```

Check split 70% train and 30% test

In [46]:

```
print("({0:0.2f}) - {1}".format((len(X_train)/len(df.index)) * 100, len(X_train)))
print("({0:0.2f}) - {1}".format((len(X_test)/len(df.index)) * 100, len(X_test)))
```

```
(69.99) - 4453
(30.01) - 1909
```

Verify predicted values were split correctly

In [47]:

```
print("Training true: {0:0.2f}%".format(len(Y_train[Y_train[:] == 1])/len(Y_train) * 100))
print("Training false: {0:0.2f}%".format(len(Y_train[Y_train[:] == 0])/len(Y_train) * 100))
```

```
Training true: 53.54%
Training false: 46.46%
```

In [48]:

```
print("Test true: {0:0.2f}% - {1}".format(len(Y_test[Y_test[:] == 1])/len(Y_test) * 100,len
print("Test false: {0:0.2f}% - {1}".format(len(Y_test[Y_test[:] == 0])/len(Y_test) * 100,le
```

```
Test true: 53.90% - 1029
Test false: 46.10% - 880
```

Train Algorithm - NaiveBayes

In [49]:

```
from sklearn.naive_bayes import GaussianNB

nb_model = GaussianNB()
nb_model.fit(X_train,Y_train.ravel())
```

Out[49]:

```
GaussianNB()
```

Performance on Training data

In [50]:

```
nb_predict_train = nb_model.predict(X_train)

from sklearn import metrics

print("Accuracy: {0:.4f}".format(metrics.accuracy_score(Y_train,nb_predict_train)))
```

```
Accuracy: 0.5401
```

Performance on Testing data

In [51]:

```
nb_predict_test = nb_model.predict(X_test)

from sklearn import metrics

print("Accuracy: {0:.4f}".format(metrics.accuracy_score(Y_test,nb_predict_test)))
```

```
Accuracy: 0.5443
```

Metrics

In [52]:

```
print("confusion Metrix")
print("TP  FP")
print("TN  FN")
print("{0}".format(metrics.confusion_matrix(Y_test, nb_predict_test, labels=[1,0])))

print("\nClasification report")
print(metrics.classification_report(Y_test,nb_predict_test,labels=[1,0]))
```

```
confusion Metrix
TP  FP
TN  FN
[[794 235]
 [635 245]]

Clasification report
              precision    recall  f1-score   support

           1       0.56      0.77      0.65      1029
           0       0.51      0.28      0.36       880

    accuracy                           0.54      1909
   macro avg       0.53      0.53      0.50      1909
weighted avg       0.53      0.54      0.51      1909
```

recall - how well predits the model if people have diabetes (in our case wining trades) = TP/(TP + FN)

precision = TP/(TP + FP)

Random Forest

In [53]:

```
from sklearn.ensemble import RandomForestClassifier
rf_model = RandomForestClassifier(random_state=42,n_estimators=100)
rf_model.fit(X_train,Y_train.ravel())
```

Out[53]:

```
RandomForestClassifier(random_state=42)
```

Predict training data

In [54]:

```
rf_predict_train = rf_model.predict(X_train)
print("Accuracy: {0}".format(metrics.accuracy_score(Y_train,rf_predict_train)))
```

```
Accuracy: 1.0
```

Predict test data

In [55]:

```
rf_predict_test = rf_model.predict(X_test)
print("Accuracy: {0}".format(metrics.accuracy_score(Y_test,rf_predict_test)))
```

```
Accuracy: 0.7370350969093766
```

In [56]:

```
print("confusion Metrix")
print("TP  FP")
print("TN  FN")
print("{0}".format(metrics.confusion_matrix(Y_test, rf_predict_test, labels=[1,0])))


print("\nClasification report")
print(metrics.classification_report(Y_test,rf_predict_test,labels=[1,0]))
```

```
confusion Metrix
TP  FP
TN  FN
[[826 203]
 [299 581]]

Clasification report
              precision    recall  f1-score   support

           1       0.73      0.80      0.77      1029
           0       0.74      0.66      0.70       880

    accuracy                           0.74      1909
   macro avg       0.74      0.73      0.73      1909
weighted avg       0.74      0.74      0.74      1909
```

In [57]:

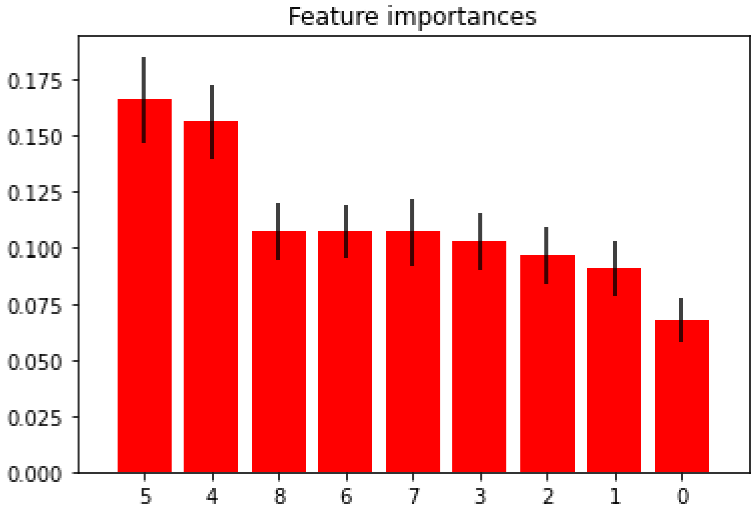
```
num_true = len(rf_predict_test)
```

Get most important inputs

In [63]:

```
importances = rf_model.feature_importances_

std = np.std([tree.feature_importances_ for tree in rf_model.estimators_],
             axis=0)
indices = np.argsort(importances)[::-1]

# Print the feature ranking
print("Feature ranking:")

for f in range(X_train.shape[1]):
    print("%d. %s (index = %d) (%f)" % (f + 1, feature_col_names[indices[f]],indices[f], im

# Plot the feature importances of the forest
plt.figure()
plt.title("Feature importances")
plt.bar(range(X_train.shape[1]), importances[indices],
       color="r", yerr=std[indices], align="center")
plt.xticks(range(X_train.shape[1]), indices)
plt.xlim([-1, X_train.shape[1]])
plt.show()
```

```
Feature ranking:
1. LongTrend (index = 5) (0.165552)
2. ShortTrend (index = 4) (0.155711)
3. SupportDown (index = 8) (0.107214)
4. Volatility (index = 6) (0.106882)
5. SupportUp (index = 7) (0.106731)
6. Oscilator (index = 3) (0.102675)
7. Bar1HL (index = 2) (0.096446)
8. Bar1OC (index = 1) (0.090919)
9. DayHour (index = 0) (0.067869)
```



In [ ]:

Logistic Regression

In [30]:

```
from sklearn.linear_model import LogisticRegression

lr_model = LogisticRegression(C=0.7, random_state=42)
lr_model.fit(X_train,Y_train.ravel())

lr_predict_test = lr_model.predict(X_test)

print("confusion Metrix")
print("TP  FP")
print("TN  FN")
print("{0}".format(metrics.confusion_matrix(Y_test, lr_predict_test, labels=[1,0])))


print("\nClasification report")
print(metrics.classification_report(Y_test,lr_predict_test,labels=[1,0]))
```

```
confusion Metrix
TP  FP
TN  FN
[[857 172]
 [672 208]]

Clasification report
             precision    recall  f1-score   support

          1       0.56      0.83      0.67      1029
          0       0.55      0.24      0.33       880

avg / total       0.55      0.56      0.51      1909
```

Setting regularization parameter

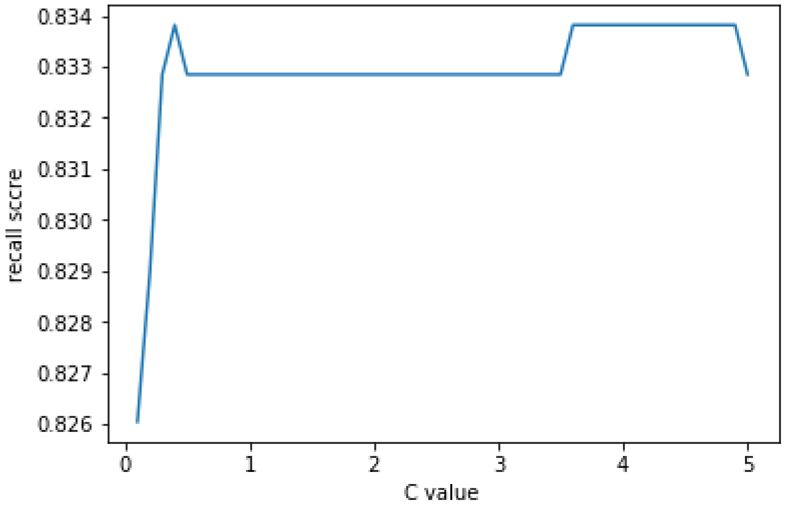
In [31]:

```
C_start = 0.1
C_end  = 5
C_inc = 0.1

C_values, recall_scores = [], []

C_val = C_start
best_recall_score = 0
while (C_val < C_end):
    C_values.append(C_val)
    lr_model_loop = LogisticRegression(C=C_val, random_state=42)
    lr_model_loop.fit(X_train, Y_train.ravel())
    lr_predict_loop_test = lr_model_loop.predict(X_test)
    recall_score = metrics.recall_score(Y_test, lr_predict_loop_test)
    recall_scores.append(recall_score)
    if (recall_score > best_recall_score):
        best_recall_score = recall_score
        best_lr_predict_test = lr_predict_loop_test
    C_val = C_val + C_inc

best_score_C_val = C_values[recall_scores.index(best_recall_score)]
print("1st max value of {0:.3f} occured at C={1:.3f}".format(best_recall_score, best_score_
%matplotlib inline
plt.plot(C_values, recall_scores, "-")
plt.xlabel("C value")
plt.ylabel("recall sccre")
```

```
1st max value of 0.834 occured at C=0.400
```

Out[31]:

```
<matplotlib.text.Text at 0x14410ecbba8>
```



Logistic Regresion with class_weight="balanced" - Worse if class is balanced

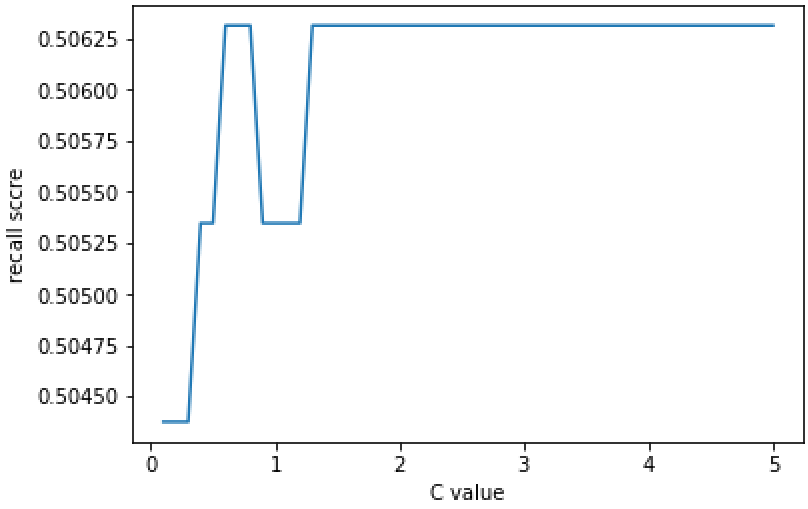
In [32]:

```
C_start = 0.1
C_end  = 5
C_inc = 0.1

C_values, recall_scores = [], []

C_val = C_start
best_recall_score = 0
while (C_val < C_end):
    C_values.append(C_val)
    lr_model_loop = LogisticRegression(C=C_val, class_weight="balanced" ,random_state=42)
    lr_model_loop.fit(X_train, Y_train.ravel())
    lr_predict_loop_test = lr_model_loop.predict(X_test)
    recall_score = metrics.recall_score(Y_test, lr_predict_loop_test)
    recall_scores.append(recall_score)
    if (recall_score > best_recall_score):
        best_recall_score = recall_score
        best_lr_predict_test = lr_predict_loop_test
    C_val = C_val + C_inc

best_score_C_val = C_values[recall_scores.index(best_recall_score)]
print("1st max value of {0:.3f} occured at C={1:.3f}".format(best_recall_score, best_score_
%matplotlib inline
plt.plot(C_values, recall_scores, "-")
plt.xlabel("C value")
plt.ylabel("recall sccre")
```

```
1st max value of 0.506 occured at C=0.600
```

Out[32]:

```
<matplotlib.text.Text at 0x14410d30b70>
```



LogisticRegressionCV

In [33]:

```
from sklearn.linear_model import LogisticRegressionCV
lr_cv_model = LogisticRegressionCV(n_jobs=-1, random_state=42, Cs=3, cv=10, refit=True)
lr_cv_model.fit(X_train, Y_train.ravel())
```

Out[33]:

```
LogisticRegressionCV(Cs=3, class_weight=None, cv=10, dual=False,
           fit_intercept=True, intercept_scaling=1.0, max_iter=100,
           multi_class='ovr', n_jobs=-1, penalty='l2', random_state=42,
           refit=True, scoring=None, solver='lbfgs', tol=0.0001, verbose=0)
```

Predict on Test Data

In [34]:

```
lr_cv_predict_test = lr_cv_model.predict(X_test)
print("Accuracy: {0:.4f})".format(metrics.accuracy_score(Y_test, lr_cv_predict_test)))
print("TP  FP")
print("TN  FN")
print(metrics.confusion_matrix(Y_test, lr_cv_predict_test, labels=[1, 0]) )
print("")
print("Classification Report")
print(metrics.classification_report(Y_test, lr_cv_predict_test, labels=[1,0]))
```

```
Accuracy: 0.5574)
TP  FP
TN  FN
[[861 168]
 [677 203]]

Classification Report
             precision    recall  f1-score   support

          1       0.56      0.84      0.67      1029
          0       0.55      0.23      0.32       880

avg / total       0.55      0.56      0.51      1909
```

Save model

In [35]:

```
from sklearn.externals import joblib

filename = 'LogisticRegressionCV_EURUSD.sav'
joblib.dump(lr_cv_model, filename)

# load the model
#loaded_model = joblib.load(filename)
```

Out[35]:

```
['LogisticRegressionCV_EURUSD.sav']
```

Prediction on all data

In [36]:

```
lr_cv_predict_all = lr_cv_model.predict(x)
print("Accuracy: {0:.4f})".format(metrics.accuracy_score(y, lr_cv_predict_all)))
print("TP  FP")
print("TN  FN")
print(metrics.confusion_matrix(y, lr_cv_predict_all, labels=[1, 0]) )
print("")
print("Classification Report")
print(metrics.classification_report(y, lr_cv_predict_all, labels=[1,0]))
```

```
Accuracy: 0.5564)
TP  FP
TN  FN
[[2815  598]
 [2224  725]]

Classification Report
             precision    recall  f1-score   support

          1       0.56      0.82      0.67      3413
          0       0.55      0.25      0.34      2949

avg / total       0.55      0.56      0.51      6362
```

Prediction on second test data

In [37]:

```
df2 = pd.read_csv(".\EU_1H_1.1.17_22.4.17.csv")
df2.shape
```

Out[37]:

```
(1367, 13)
```

In [38]:

```
df2.isnull().values.any()
```

Out[38]:

```
False
```

In [39]:

```
del df2['OpenTime']
del df2['DayWeek']
del df2['Bar1Shape']

df2['Profit'] = df2['Profit'].map(profit_map)
```

In [40]:

```
df2.shape
```

Out[40]:

```
(1367, 10)
```

In [41]:

```
df2.head(3)
```

Out[41]:

	DayHour	Bar1OC	Bar1HL	Oscilator	ShortTrend	LongTrend	Volatility	SupportUp	Support
0	13	-1.2	8.3	42.32614	48.16000	95.57978	0.00133	23.0	
1	14	5.5	16.5	65.09217	49.44400	95.72178	0.00139	13.8	
2	15	13.9	23.2	74.47657	50.93333	96.12444	0.00145	4.3	

In [42]:

```
num_true2 = len(df2.loc[df2['Profit'] == 1])
num_false2 = len(df2.loc[df2['Profit'] == 0])
print("Num true: {0} ({1:2.2f})".format(num_true2, (num_true2/(num_true2 + num_false2)) * 1
print("Num false: {0} ({1:2.2f})".format(num_false2, (num_false2/(num_true2 + num_false2))
```

```
Num true: 578 (42.28)
Num false: 789 (57.72)
```

In [43]:

```
feature_col_names2 = ['DayHour','Bar1OC','Bar1HL','Oscilator','ShortTrend','LongTrend','Vol
predicted_class_names2 = ['Profit']

x2 = df2[feature_col_names2].values
y2 = df2[predicted_class_names2].values
```

In [44]:

```
rf_predict_train2 = rf_model.predict(x2)
print("TP  FP")
print("TN  FN")
print("Accuracy: {0}".format(metrics.accuracy_score(y2,rf_predict_train2)))
cf2 = metrics.confusion_matrix(y2, rf_predict_train2, labels=[1,0])
print("{0}".format(cf2))
# explained
print("true negatives : {0}".format(cf2[0,0]))
print("false negatives: {0}".format(cf2[1,0]))
print("true positives : {0}".format(cf2[1,1]))
print("false positives: {0}".format(cf2[0,1]))
print("Predict Num true: {0}".format(len(rf_predict_train2[rf_predict_train2[:] == 1])))
print("Predict Num false: {0}".format(len(rf_predict_train2[rf_predict_train2[:] == 0])))

tp = 0
tn = 0
fp = 0
fn = 0


for idx in range(0,len(rf_predict_train2)):
    if(rf_predict_train2[idx] == 1 and y2[idx] == 1):
        tp = tp + 1
    if(rf_predict_train2[idx] == 1 and y2[idx] == 0):
        tn = tn + 1
    if(rf_predict_train2[idx] == 0 and y2[idx] == 1):
        fp = fp + 1
    if(rf_predict_train2[idx] == 0 and y2[idx] == 0):
        fn = fn + 1
print("TP = {}".format(tp))
print("TN = {}".format(tn))
print("FP = {}".format(fp))
print("FN = {}".format(fn))
```

```
TP  FP
TN  FN
Accuracy: 0.5259692757863935
[[364 214]
 [434 355]]
true negatives : 364
false negatives: 434
true positives : 355
false positives: 214
Predict Num true: 798
Predict Num false: 569
TP = 364
TN = 434
FP = 214
FN = 355
```

In [45]:

```
count = 0
for index in range(len(rf_predict_train2)):
    if (rf_predict_train2[index] == 0 and y2[index] == 1):
        count += 1
print("Count:{0}".format(count))
```

```
Count:214
```

In [46]:

```
lr_cv_predict_test2 = lr_cv_model.predict(x2)
print("TP  FP")
print("TN  FN")
print("Accuracy: {0}".format(metrics.accuracy_score(y2,lr_cv_predict_test2)))
print("{0}".format(metrics.confusion_matrix(y2, lr_cv_predict_test2, labels=[1,0])))
print("Num true: {0}".format(len(lr_cv_predict_test2[lr_cv_predict_test2[:] == 1])))
print("Num false: {0}".format(len(lr_cv_predict_test2[lr_cv_predict_test2[:] == 0])))

print("Classification Report")
print(metrics.classification_report(y2, lr_cv_predict_test2, labels=[1,0]))
```

```
TP  FP
TN  FN
Accuracy: 0.4725676664228237
[[462 116]
 [605 184]]
Num true: 1067
Num false: 300
Classification Report
             precision    recall  f1-score   support

          1       0.43      0.80      0.56       578
          0       0.61      0.23      0.34       789

avg / total       0.54      0.47      0.43      1367
```

In [ ]:

```

```