Prediction of Stock Price for United Airlines via Sentiment Analytics

In [1]:
```python
import pandas as pd
import numpy as np
import datetime
import pandas_datareader.data as web
import re
```

Get Stock Price

In [2]:
```python
start = datetime.datetime(2017,3,1)
end = datetime.datetime(2017,4,28)
UAL = web.DataReader("UAL", "yahoo", start, end)
```

In [3]:
```python
UAL_price=UAL.loc[:,['Open','Close']]
UAL_price['price']=list(map(lambda x,y: x-y, UAL_price.loc[:,'Open'], UAL_price.loc[:,'Close']))
```

In [4]:
```python
UAL_price['trend']=1
i=[]
for i in np.arange(len(UAL_price.loc[:,'price'])):
    if UAL_price.iloc[i,2] > 0:
        UAL_price.iloc[i,3]='up'
    elif UAL_price.iloc[i,2] == 0:
        UAL_price.iloc[i,3]='-'
    else:
        UAL_price.iloc[i,3]='dwon'
    i +=1
```

In [5]:
```python
UAL_price.head()
```

Out[5]:

	Open	Close	price	trend
Date				
2017-03-01	74.639999	75.389999	-0.750000	dwon
2017-03-02	74.349998	73.279999	1.069999	up
2017-03-03	73.699997	75.589996	-1.889999	dwon
2017-03-06	74.849998	73.139999	1.709999	up
2017-03-07	72.690002	72.639999	0.050003	up

In [6]:
```python
UAL_price.trend.value_counts()
```

Out[6]:
```
dwon    22
up      20
Name: trend, dtype: int64
```

Import Tweets

In [7]:
```python
#import the tweets file
tweets_table_428 =  pd.read_csv(r'C://Users//adminstrator//Google Drive//660//chromedriver_win32//tweets_try_ua_0428_formal.txt',encoding='utf-8', error_bad_lines=False,sep='\t',header=None)
tweets_table_420 =  pd.read_csv(r'C://Users//adminstrator//Google Drive//660//chromedriver_win32//tweets_try_ua.txt',encoding='utf-8', error_bad_lines=False,sep='\t',header=None)
```

In [8]:
```python
def dataclean(tweets_table):
    tweets_table=tweets_table.iloc[:,[0,2,4,6,8]]
    tweets_table=tweets_table.rename(columns={0:'tweets',2:'retweet',4:'favorites',6:'replies',8:'date'})

    g = lambda x: str(int(x))
    tweets_table=tweets_table.dropna(subset=['date'])
    tweets_table.replies = tweets_table.replies.fillna("0").apply(g)

    f = lambda x: float(x.replace("K",""))*1000 if "K" in x else int(x)
    tweets_table.retweet = tweets_table.retweet.fillna("0").apply(f)
    tweets_table.favorites = tweets_table.favorites.fillna("0").apply(f)
    tweets_table.replies = tweets_table.replies.fillna("0").apply(f)

    print(tweets_table.isnull().sum())
    return tweets_table
```

In [9]:
```python
tweets_table_428 = dataclean(tweets_table_428)
```

```
tweets       0
retweet      0
favorites    0
replies      0
date         0
dtype: int64
```

In [10]:
```python
tweets_table_420 = dataclean(tweets_table_420)
```

```
tweets       0
retweet      0
favorites    0
replies      0
date         0
dtype: int64
```

In [11]:
```python
import codecs
#function that loads a lexicon of positive words to a set and returns the set
def loadLexicon(fname):
    newLex=set()
    lex_conn=codecs.open(fname, encoding='utf-8')
    #add every word in the file to the set
    for line in lex_conn:
        newLex.add(line.strip())# remember to strip to remove the lin-change character
    lex_conn.close()

    return newLex
```

In [12]:
```python
def sentiment(line):
    #load the positive and negative lexicons
    posLex=loadLexicon('positive-words.txt')
    negLex=loadLexicon('negative-words.txt')


    posList=[] #list of positive words in the review
    negList=[] #list of negative words in the review


    line=line.lower().strip()

    words=line.split(' ') # slit on the space to get list of words

    for word in words: #for every word in the review
        if word in posLex: # if the word is in the positive lexicon
                posList.append(word) #update the positive list for this review
        if word in negLex: # if the word is in the negative lexicon
                negList.append(word) #update the negative list for this review

        # 0 for neutral
    if len(posList)>len(negList): # more pos words than neg
            decision='positive' # 1 for positiv
    elif len(negList)>len(posList):  # more neg than pos
            decision='negative' # -1 for negative
    else:
            decision = 'neutral'

    return decision
```

In [13]:
```python
#Apply sentiment function for all tweets
tweets_table_420['sentiment'] = list(map(sentiment,tweets_table_420['tweets']))
tweets_table_428['sentiment'] = list(map(sentiment,tweets_table_428['tweets']))
```

In [14]:
```python
from dateutil.parser import parse
import datetime
```

In [15]:
```python
def Date_Formate(tweets_table):
#Change the format of date
    tweets_table=tweets_table.reset_index()
    i=[]
    for i in np.arange(len(tweets_table.loc[:,'date'])):
        tweets_table.loc[i,'date']=datetime.datetime.strptime(str(tweets_table.loc[i,'date']).lstrip(), '%d %b %Y').strftime('%Y-%m-%d')
        i += 1

    #Remove the the tweets before 2017-03-01 which are not target data
    tweets_table=tweets_table[tweets_table['date']>='2017-03-01']
    #tweets_table=tweets_table[tweets_table['date']<'2017-04-20']
    tweets_table_1=tweets_table.set_index(['date'])

    tweets_table_1=tweets_table_1.rename({'2017-03-04':'2017-03-06','2017-03-05':'2017-03-06',
                     '2017-03-11':'2017-03-13','2017-03-12':'2017-03-13',
                    '2017-03-18':'2017-03-20','2017-03-19':'2017-03-20',
                    '2017-03-25':'2017-03-27','2017-03-26':'2017-03-27',
                   '2017-04-01':'2017-04-03','2017-04-02':'2017-04-03',
                   '2017-04-08':'2017-04-10','2017-04-09':'2017-04-10',
                   '2017-04-14':'2017-04-17','2017-04-15':'2017-04-17','2017-04-16':'2017-04-17',
                     '2017-04-22':'2017-04-24','2017-04-23':'2017-04-24'})

    #Join the table of tweets and stock price based on the date index
    result=tweets_table_1.join(UAL_price, how='outer')

    #Remove unnecessary
    result_df=result.drop('index',1).drop('Open',1).drop('Close',1).drop('price',1).drop('tweets',1)
    result_df_1=result_df.dropna(subset=['sentiment'])

    print(result_df_1.isnull().sum())
    print(result.sentiment.value_counts())

    return result_df_1
```

In [16]:
```python
result_df_420 = Date_Formate(tweets_table_420)
```

```
retweet      0
favorites    0
replies      0
sentiment    0
trend        0
dtype: int64
neutral     509
negative    367
positive    201
Name: sentiment, dtype: int64
```

In [17]:
```python
result_df_428 = Date_Formate(tweets_table_428)
```

```
retweet      0
favorites    0
replies      0
sentiment    0
trend        0
dtype: int64
neutral     1834
negative    1287
positive     637
Name: sentiment, dtype: int64
```

Modeling and Predicting

In [34]:
```python
from sklearn import preprocessing
def encode_variable(result_df_1):
    label_encoder = preprocessing.LabelEncoder()
    result_df_1['sentiment'] = label_encoder.fit_transform(result_df_1['sentiment'])
    result_df_1['trend'] = label_encoder.fit_transform(result_df_1['trend'])
    return result_df_1
```

In [35]:
```python
df_420 = encode_variable(result_df_420)
```

In [37]:
```python
df_428 = encode_variable(result_df_428)
```

In [38]:
```python
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.grid_search import GridSearchCV
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier, VotingClassifier
from sklearn.metrics import accuracy_score
from xgboost import XGBClassifier
```

```
C:\Users\amyhu\Anaconda3\lib\site-packages\sklearn\cross_validation.py:44: DeprecationWarning: This module was deprecated in version 0.18 in favor of the model_selection module into which all the refactored classes and functions are moved. Also note that the interface of the new CV iterators are different from that of this module. This module will be removed in 0.20.
  "This module will be removed in 0.20.", DeprecationWarning)
C:\Users\amyhu\Anaconda3\lib\site-packages\sklearn\grid_search.py:43: DeprecationWarning: This module was deprecated in version 0.18 in favor of the model_selection module into which all the refactored classes and functions are moved. This module will be removed in 0.20.
  DeprecationWarning)
```

In [39]:
```python
random_state = 367
```

In [40]:
```python
def model_accarucy(x):
    train, test = train_test_split(x, train_size = 0.6)

    x_train = train.iloc[:,0:4]
    y_train = train.iloc[:,-1]

    x_test = test.iloc[:,0:4]
    y_test = test.iloc[:,-1]

    LREG_grid = [ {'C':[0.5,1,1.5,2],'penalty':['l1','l2']}]
    LREG_classifier=LogisticRegression()
    gridsearchLREG  = GridSearchCV(LREG_classifier, LREG_grid, cv=5)
    gridsearchLREG.fit(x_train,y_train)

    KNN_grid = [{'n_neighbors': [1,3,5,7,9,11,13,15,17], 'weights':['uniform','distance']}]
    KNN=KNeighborsClassifier()
    gridsearchKNN = GridSearchCV(KNN, KNN_grid, cv=5)
    gridsearchKNN.fit(x_train, y_train)

    RF_grid = [{'max_depth': [3,4,5,6,7,8,9,10,11,12],'criterion':['gini','entropy']}]
    RF = RandomForestClassifier(n_estimators=250, criterion='entropy',  n_jobs = -1,  random_state=random_state)
    gridsearchRF = GridSearchCV(RF, RF_grid, cv=5)
    gridsearchRF.fit(x_train, y_train)

    GBC_grid = [{'n_estimators':[1,2,3,4,5,6,7],'max_depth':[10,20,30,40,50], 'min_samples_split':[200,300,400,500]}]
    GBC = GradientBoostingClassifier()
    gridsearchGBC = GridSearchCV(GBC, GBC_grid, cv=5,scoring='roc_auc',n_jobs=4,iid=False,)
    gridsearchGBC.fit(x_train, y_train)

    XGB_grid = [{'max_depth':[10,20,30,40,50],'min_child_weight':[1,2,3,4,5,6,7]}]
    XGB = XGBClassifier(seed=random_state)
    gridsearchXGB = GridSearchCV(XGB, XGB_grid, cv=5)
    gridsearchXGB.fit(x_train, y_train)

    eclf_1 = VotingClassifier(estimators=[
    ('KNN', gridsearchKNN), ('RF', gridsearchRF), ('GBC', gridsearchGBC), ('XGB',gridsearchXGB),('LREG',gridsearchLREG)], voting='soft')
    eclf_1.fit(x_train, y_train)
    y_pred_1 = eclf_1.predict(x_test)
    return accuracy_score(y_test,y_pred_1)
```

In [41]:
```python
model_accarucy(df_420)
```

Out[41]:
```
0.92343387470997684
```

Keywords visualization with WordCloud

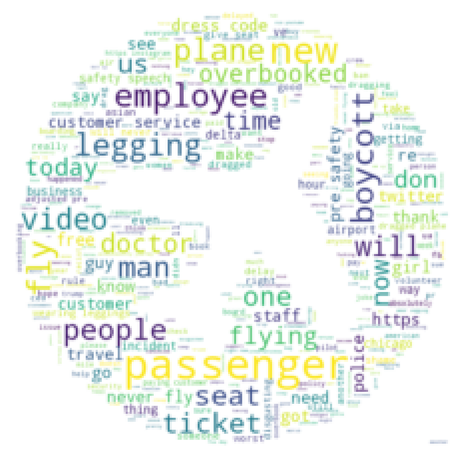
In [18]:
```python
from os import path
from PIL import Image
import matplotlib.pyplot as plt

from wordcloud import WordCloud, STOPWORDS, ImageColorGenerator
```

In [89]:
```python
def wordcloud(tweets_table):
    text=[]
    for i in tweets_table.tweets:
        text += [i]

    text = str(text).lower()

    text = re.sub('[^a-z]',' ',text)

    text = re.sub('united airlines',' ',text)

    text = re.sub('united airline',' ',text)

    text = re.sub('unitedairline',' ',text)

    text = re.sub('united',' ',text)

    text = re.sub('flight',' ',text)

    text = re.sub('airline',' ',text)

    return text
```

In [90]:
```python
text_1 = wordcloud(tweets_table_420)
text_2 = wordcloud(tweets_table_428)
```

In [93]:
```python
def wordscloud(text):
    d = path.dirname("C://Users//adminstrator//Google Drive//660//chromedriver_win32")

    # read the mask image
    mask = np.array(Image.open(path.join(d, "C://Users//adminstrator//Google Drive//660//chromedriver_win32//airplane_2.jpg")))

    stopwords = set(STOPWORDS)
    stopwords.add("said")

    wc = WordCloud(background_color="white", max_words=2000, mask=mask,
               stopwords=stopwords)

    # generate word cloud
    wc.generate(text)

    # store to file
    wc.to_file(path.join(d, "C://Users//adminstrator//Google Drive//660//chromedriver_win32//UA_2.png"))

    # show
    plt.imshow(wc, interpolation='bilinear')
    plt.axis("off")
    plt.figure()
    plt.imshow(mask, cmap=plt.cm.gray, interpolation='bilinear')
    plt.axis("off")
    return plt.show()
```

In [92]:
```python
wordscloud(text_1)
```



In [94]:
```python
wordscloud(text_2)
```