Stock Market Sentiment Analysis and Price Prediction 💹

Importing modules

[36]

```
# Matrix math and DataFrames
import numpy as np
import pandas as pd

# Scaling
from sklearn.preprocessing import MinMaxScaler
X_scaler = MinMaxScaler( feature_range = (-1,1))
y_scaler = MinMaxScaler( feature_range = (-1,1))

# Plotting
import plotly as py
import plotly.graph_objs as go
import matplotlib.pyplot as plt

# Keras model and LSTM
from keras.models import Sequential
from keras.layers import LSTM,Dense
```

[37]

```
# plotly offline config
py.offline.init_notebook_mode(connected=True)
```

Retriving, Slicing and Dicing

Choosing the Facebook stock

Use to fetch data from quandl

```
import quandl as ql
ql.ApiConfig.api_key = "b6y7-mew_t8z5yGJijFv"
data = ql.get("WIKI/fb")
data.to_csv("Facebook", encoding='utf-8')
```

Use the following code to generate Facebook_Sentiments.csv with sentiments

```
from txtanalysis import *
tw = TweetSentiments()
sentiment_data = pd.DataFrame(index=range( df.shape[0]),\
                                          columns=['Sentiments'])
for i in range( train_limit):
    try :
        sentiment_data['Sentiments'][i] = tw.get_input( '@facebook'\
                                                        , df['Date'][i])
    except tweepy.TweepError:
        time.sleep(60 * 15)
        continue
    except StopIteration:
        break
df[:5]
sentiment_data.to_csv( 'Facebook_Sentiments', encoding='utf-8')
df.join( sentiment_data)
```

[38]

```
df = pd.read_csv("Facebook")[['Date','Open','Close','High','Low']]
train_limit = round(df.shape[0]*0.8)
print(train_limit)
df[:5]
```

```
1178
```

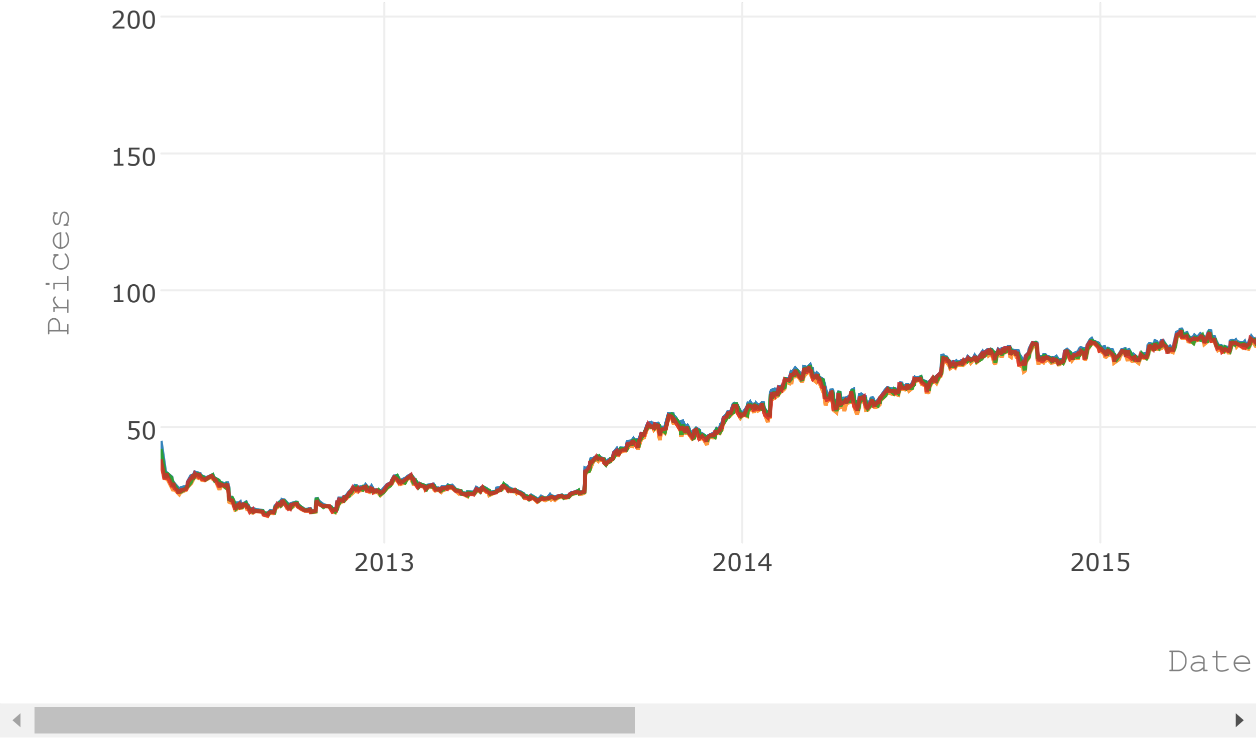
	Date	Open	Close	High	Low
0	2012-05-18	42.05	38.2318	45.00	38.00
1	2012-05-21	36.53	34.0300	36.66	33.00
2	2012-05-22	32.61	31.0000	33.59	30.94
3	2012-05-23	31.37	32.0000	32.50	31.36
4	2012-05-24	32.95	33.0300	33.21	31.77

Plotting as a TimeSeries

[39]

```
trace_high = go.Scatter(
    x=df['Date'],
    y=df['High'],
    name = "High",
#     line = dict(color = '#17BECF'),
    opacity = 0.9)

trace_low = go.Scatter(
    x=df['Date'],
    y=df['Low'],
    name = "Low",
#     line = dict(color = '#7F7F7F'),
    opacity = 0.8)

trace_open = go.Scatter(
    x=df['Date'],
    y=df['Open'],
    name = "Open",
#     line = dict(color = '#17BECF'),
    opacity = 0.9)

trace_close = go.Scatter(
    x=df['Date'],
    y=df['Close'],
    name = "Close",
#     line = dict(color = '#7F7F7F'),
    opacity = 0.8)

plot_data = [ trace_high, trace_low, trace_open, trace_close]

layout = go.Layout(
    title='Facebook',
    xaxis=dict(
        title='Date',
        titlefont=dict(
            family='Courier New, monospace',
            size=18,
            color='#7f7f7f'
        )
    ),
    yaxis=dict(
        title='Prices',
        titlefont=dict(
            family='Courier New, monospace',
            size=18,
            color='#7f7f7f'
        )
    )
)

fig = dict(data=plot_data, layout=layout)
py.offline.iplot(fig, filename = "Facebook Plot")
```

Faceb



Data transformation

Scaling

Warning! DataFrames will be changed after this...

[40]

```
df = pd.read_csv('Facebook_Sentiments')
df = df[['Open','Close','High','Low','Sentiments']]
df[['Open','High','Low','Sentiments']] = X_scaler.fit_transform(df[['Open
df[['Close']] = y_scaler.fit_transform(df[['Close']])
```

Splitting into train, validate and test sets

[41]

```
sequence_len = 20 # choose sequence length

train_data = pd.DataFrame( columns = ['Open','Close','High','Low','Sentim
valid_limit = train_limit + round(df.shape[0]*0.1)
test_limit = -1*round(df.shape[0]*0.1)

# create all possible sequences of length sequence_len
```

```
validate_data = df[train_limit: valid_limit]
test_data = df[ test_limit :-1 ]

df = df[:train_limit]

for index in range( train_limit - sequence_len):
    train_data = train_data.append( df[index: index + sequence_len])

print( train_data[:5], validate_data[-5:-1] ,test_data[:5])

# no_sequences_train = int(train_data.shape[0]/sequence_len)
# no_sequences_valid = int(validate_data.shape[0]/sequence_len)
# no_sequences_test = int(test_data.shape[0]/sequence_len)

X_train = train_data[['Open','High','Low','Sentiments']].as_matrix().resh
y_train = train_data[['Close']].as_matrix().flatten()

X_valid = validate_data[['Open','High','Low','Sentiments']].as_matrix().r
y_valid = validate_data[['Close']].as_matrix().flatten()
# .reshape( 1, validate_data.shape[0], 1)

X_test = test_data[['Open','High','Low','Sentiments']].as_matrix().reshap
y_test = test_data[['Close']].as_matrix().flatten()
# .reshape( 1, test_data.shape[0], 1)
print(X_train.shape, y_train.shape)

# y_train = np.hstack(np.asarray(df.output_vector)).reshape(len(df), 1)
```

```
       Open     Close      High       Low  Sentiments
0 -0.724419 -0.766165 -0.698051 -0.762802    0.173529
1 -0.787882 -0.814086 -0.792262 -0.820797    0.047549
2 -0.832950 -0.848644 -0.826942 -0.844691   -0.146465
3 -0.847206 -0.837239 -0.839254 -0.839819    0.267974
4 -0.829041 -0.825491 -0.831234 -0.835064    0.235294           Open
Close      High       Low  Sentiments
1320  0.739020  0.701416  0.712398  0.731717    0.038429
1321  0.710278  0.707118  0.698955  0.724294   -0.002748
1322  0.713957  0.711338  0.691387  0.719770    0.066176
1323  0.726834  0.732552  0.712511  0.735197    0.228848           Open
Close      High       Low  Sentiments
1325  0.733732  0.710882  0.705959  0.726614    0.324955
1326  0.722005  0.694687  0.695679  0.723946    0.035762
1327  0.711083  0.705180  0.687998  0.725686    0.151738
1328  0.691998  0.714418  0.696188  0.710259    0.108957
1329  0.725569  0.735745  0.716012  0.740764    0.126931
(23160, 1, 4) (23160,)
```

Building and training the LSTM

[52]

```
#Build the model
model = Sequential()
model.add(LSTM(256,input_shape=( 1, 4)))
model.add(Dense(1))
model.compile(optimizer='adam',loss='mse')
#Fit model with history to check for overfitting
history = model.fit( X_train, y_train, epochs=30, validation_data=(X_vali
```

```
Epoch 3/30
23160/23160 [==============================] - 11s 457us/step - loss:
7.9210e-05 - val_loss: 1.6764e-
04□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
Epoch 4/30
23160/23160 [==============================] - 12s 529us/step - loss:
7.8553e-05 - val_loss: 1.5383e-
04□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
Epoch 5/30
23160/23160 [==============================] - 12s 521us/step - loss:
7.6319e-05 - val_loss: 2.5607e-
04□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
Epoch 6/30
23160/23160 [==============================] - 10s 441us/step - loss:
7.6629e-05 - val_loss: 1.8497e-
04□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
Epoch 7/30
23160/23160 [==============================] - 10s 443us/step - loss:
7.2552e-05 - val_loss: 1.4016e-
04□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
Epoch 8/30
23160/23160 [==============================] - 10s 443us/step - loss:
7.0471e-05 - val_loss: 1.3015e-
04□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
Epoch 9/30
23160/23160 [==============================] - 10s 445us/step - loss:
6.8417e-05 - val_loss: 1.9135e-
04□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
Epoch 10/30
23160/23160 [==============================] - 10s 445us/step - loss:
```

> Training observations
>
> - Overfitting occurs at approx. 20 epochs with shuffle
> - 4e-4 to 6e-5 validation loss with shuffle ✓
> - 0.0322 to 4e-4 validation loss without shuffle ✗

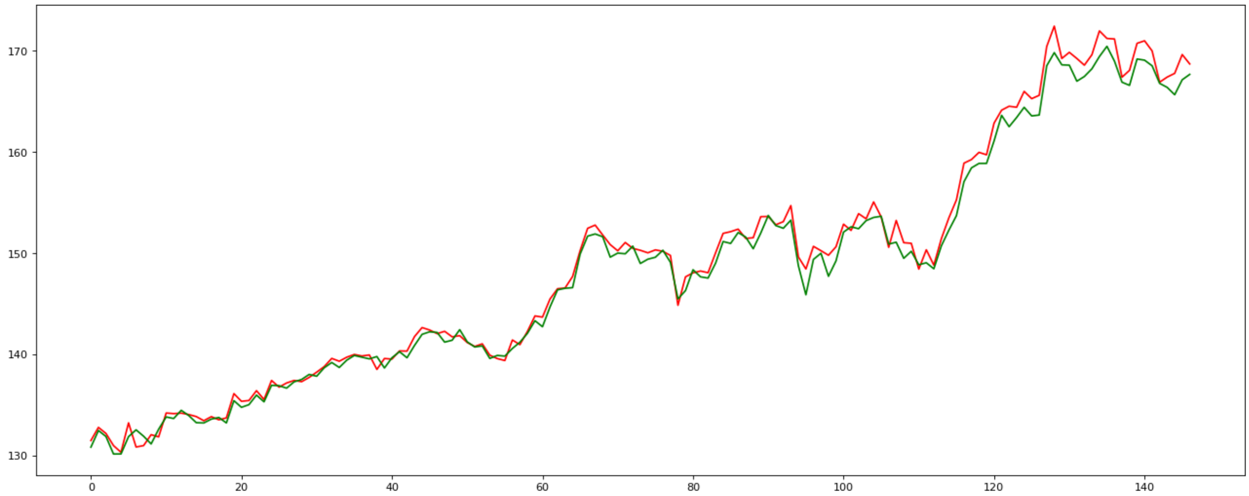
Validation data vs Predicted data

Red -> Real

Green -> Predicted

```
[53]
predicted = model.predict(X_valid)
real = list(y_scaler.inverse_transform(y_valid.reshape(-1,1)))
predicted = list(y_scaler.inverse_transform(predicted.reshape(-1,1)))

plt.figure(num=None, figsize=(20, 8), dpi=80, facecolor='w', edgecolor='k
plt.plot(real, color = 'r' )
plt.plot(predicted, color = 'g')
```

```
[<matplotlib.lines.Line2D at 0x1c4a03302e8>]
```



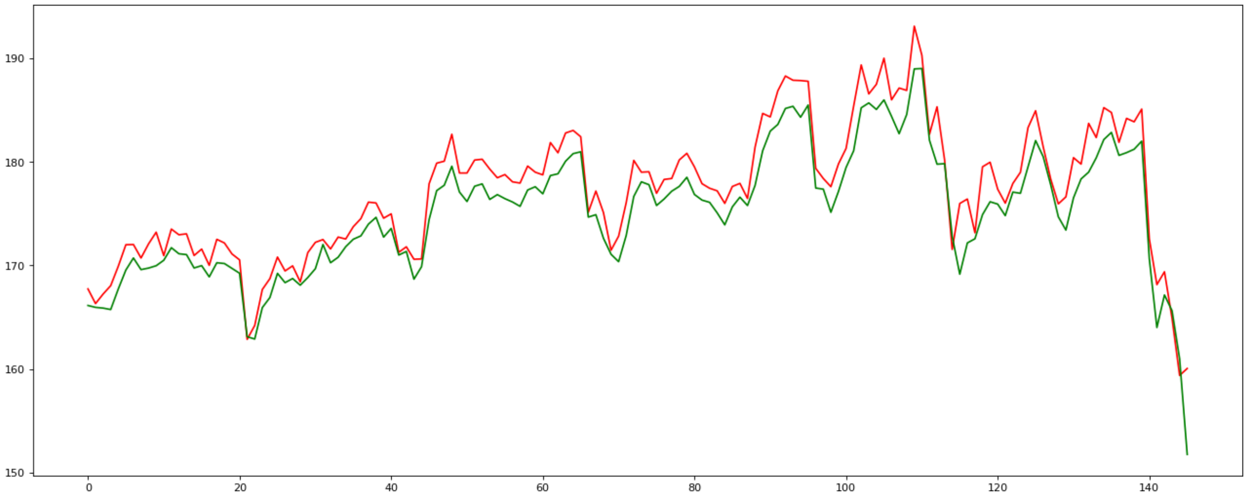
Test data vs Predicted data

Red -> Real

Green -> Predicted

```
[54]
predicted = model.predict(X_test)
real = list(y_scaler.inverse_transform(y_test.reshape(-1,1)))
predicted = list(y_scaler.inverse_transform(predicted.reshape(-1,1)))

plt.figure(num=None, figsize=(20, 8), dpi=80, facecolor='w', edgecolor='k
plt.plot(real, color = 'r' )
plt.plot(predicted, color = 'g')
```

```
[<matplotlib.lines.Line2D at 0x1c49e16f6d8>]
```


190
180
170
160
150
0
20
40
60
80
100
120
140