Predicting Standard and Poor's 500 Equity Index ($SPY/NYSE)

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- Mission Statement

Using SKlearn we are concerned with writing a predictive model that attempts to quote the daily closing prices for the $SPY index.

We used the Alphavantage® API to receive the historical daily close price and daily volume of the $SPY Index, as well as the historical daily close price of the $VIX volatility index for fiscal year 2023. These were given as CSV’s to parse.

- Implementation/Libraries

Made usage of Principal Component Analysis method to allow for simplification of data points, as well as Long Short-term Memory Neural Network for prediction.

Pandas

Numpy

Sklearn

Keras

Matplotlib

Blake’s LSTM

With LSTM approach, Trained 100 epochs to receive:

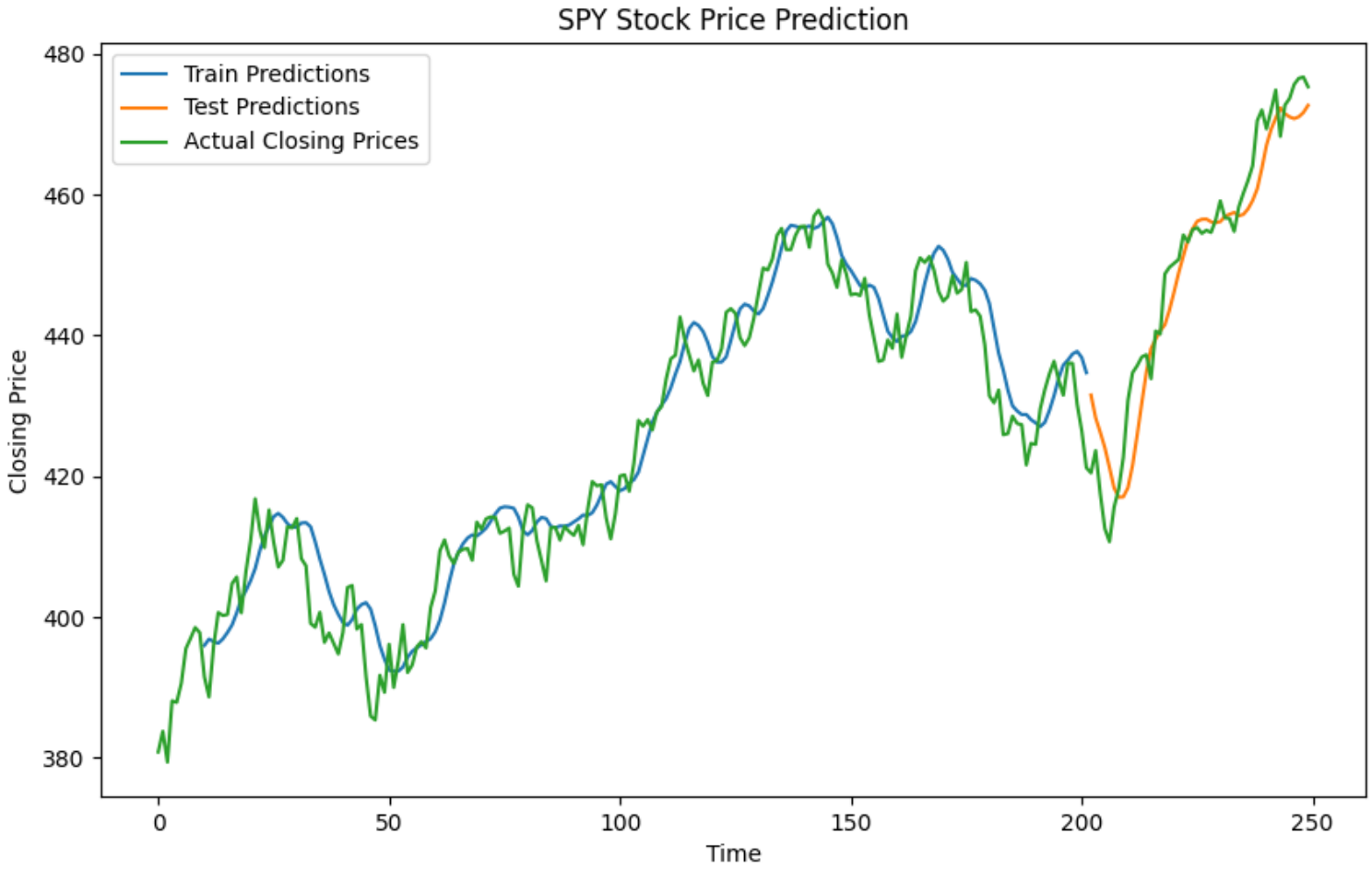
Train loss: 0.0027

Test Loss: 0.0032

Cont.

Train Predictions:
[395.95715]
[396.85263]
[396.50003]
[396.26282]
[396.87833]
Test Predictions:
[431.5172]
[428.293]
[426.2334]
[424.0384]
[421.2292]

Cont.


SPY Stock Price Prediction
Train Predictions
Test Predictions
Actual Closing Prices
Closing Price
Time
480
460
440
420
400
380
0
50
100
150
200
250

Hunter’s PCA--->LSTM

Used:

from sklearn.decomposition import PCA

from sklearn.preprocessing import MinMaxScaler

As well as PCA to receive corresponding eigenvalues and eigenvectors

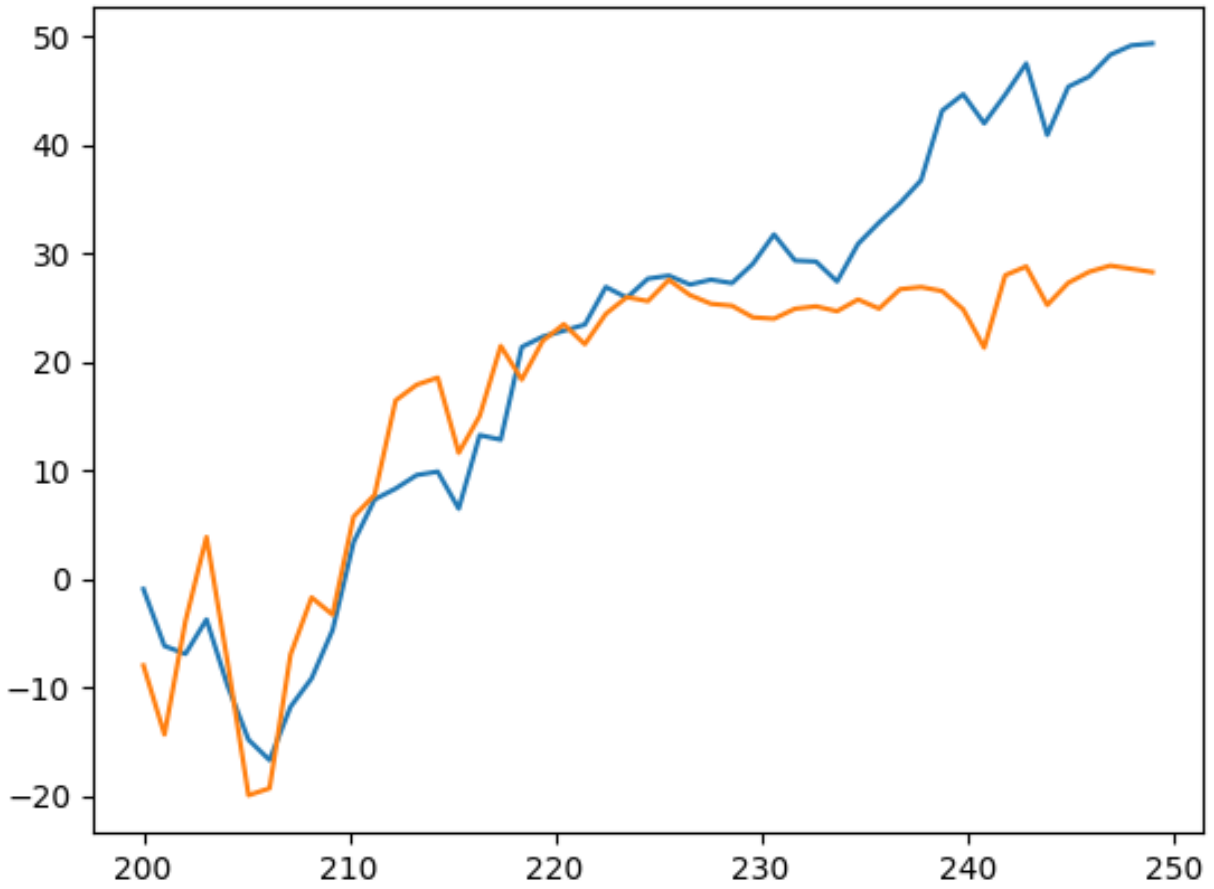
Cont.

Mean [[4.27367201e+02 8.19238916e+07 1.68700400e+01]
[5.30200000e+02 -1.51951808e+08 -6.42200000e+01]
[-1.51951808e+08 4.65531026e+14 3.17021911e+07]
[-6.42200000e+01 3.17021911e+07 9.85000000e+00]]

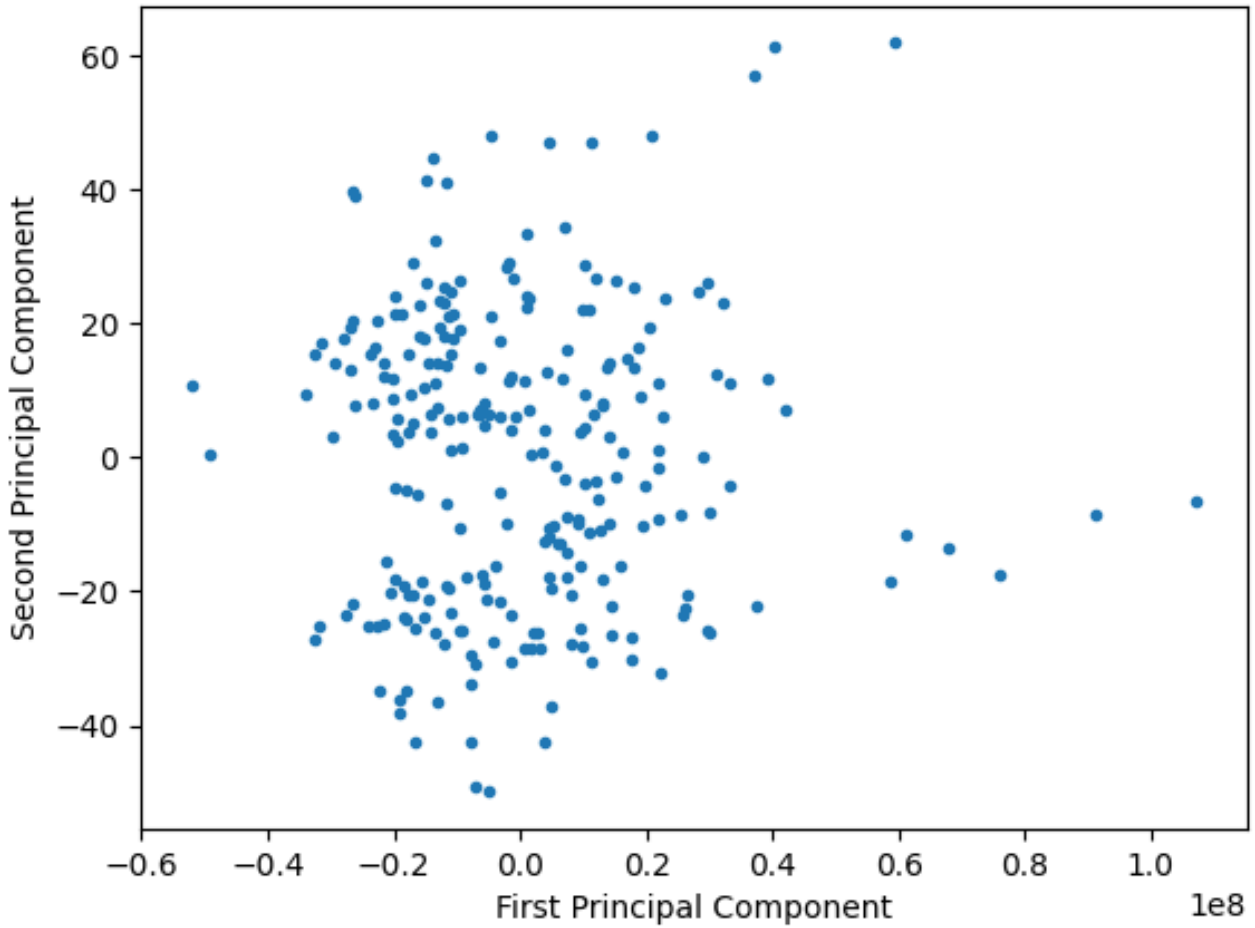
Eigen vectors [[-3.26405329e-07 9.93734064e-01 1.11770347e-01]
[1.00000000e+00 3.31971541e-07 -3.11898458e-08]
[6.80989866e-08 -1.11770347e-01 9.93734064e-01]]

Eigen values [4.65531026e+14 4.86661406e+02 1.63182731e+00]

Hunter’s Outcome(normalized)



Cont.


60
40
20
0
−20
−40
Second Principal Component
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
0.8
1.0
1e8
First Principal Component