Stock prediction ARIMA vs LSTM

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- As technology rapidly increases with computational efficiency the functioning of deep learning algorithms improves and the prediction of stock has been very difficult due to the volatile and non-linear nature of stock price. In this study we would like to compare traditional stock prediction algorithms (ARIMA) to deep learning algorithms to see if this technology is effective for stock prediction.

- Objective of this study is to investigate which forecasting model produce the best predictions with respect to lower forecast errors using MSE and MAE as determining metrics.

Data used in the project was the daily closing price dates ranged from 2012-01-05 to 2019-12-31.

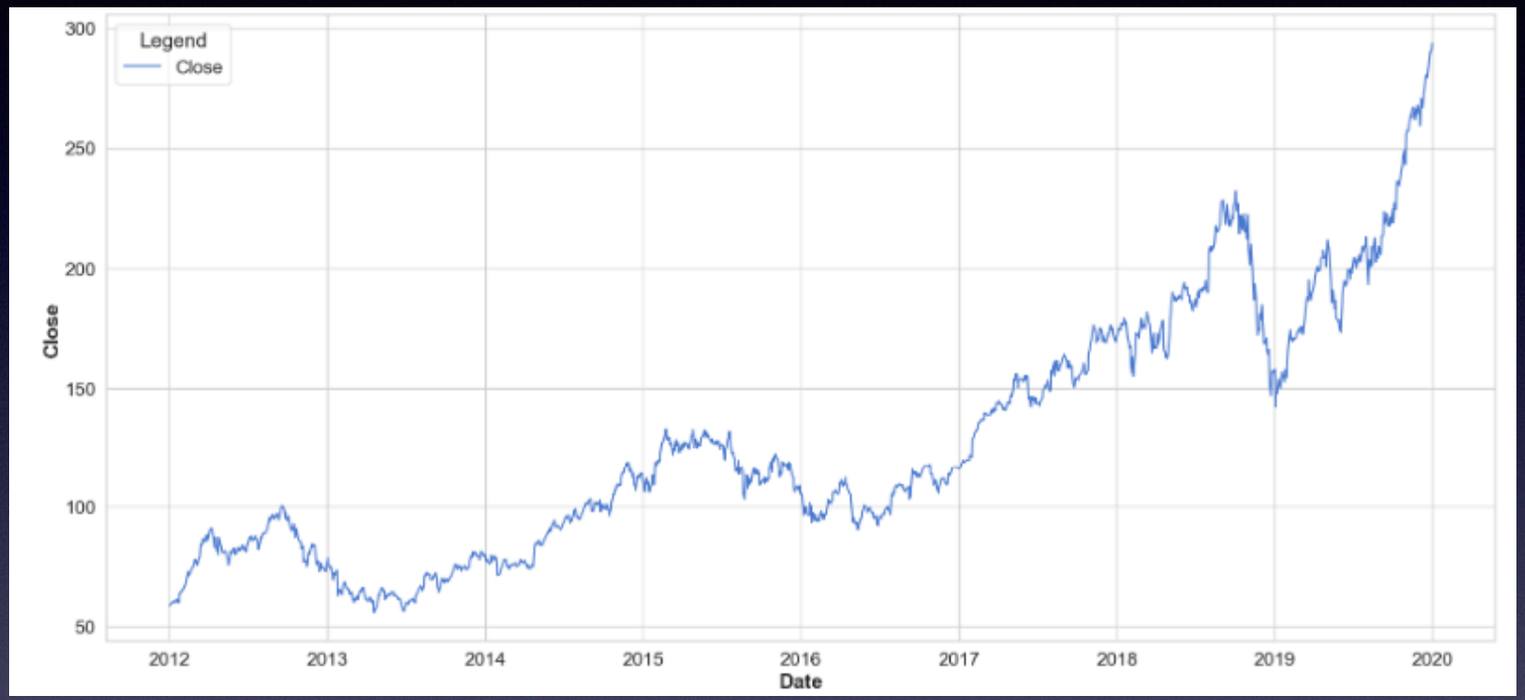


Figure2: close price 2012 - 2019

Date	High	Low	Open	Close	Volume	Adj Close
2012-01-03	58.928570	58.428570	58.485714	58.747143	75555200.0	50.765709
2012-01-04	59.240002	58.468571	58.571430	59.062859	65005500.0	51.038536
2012-01-05	59.792858	58.952858	59.278572	59.718571	67817400.0	51.605175
2012-01-06	60.392857	59.888573	59.967144	60.342857	79573200.0	52.144630
2012-01-09	61.107143	60.192856	60.785713	60.247143	98506100.0	52.061932

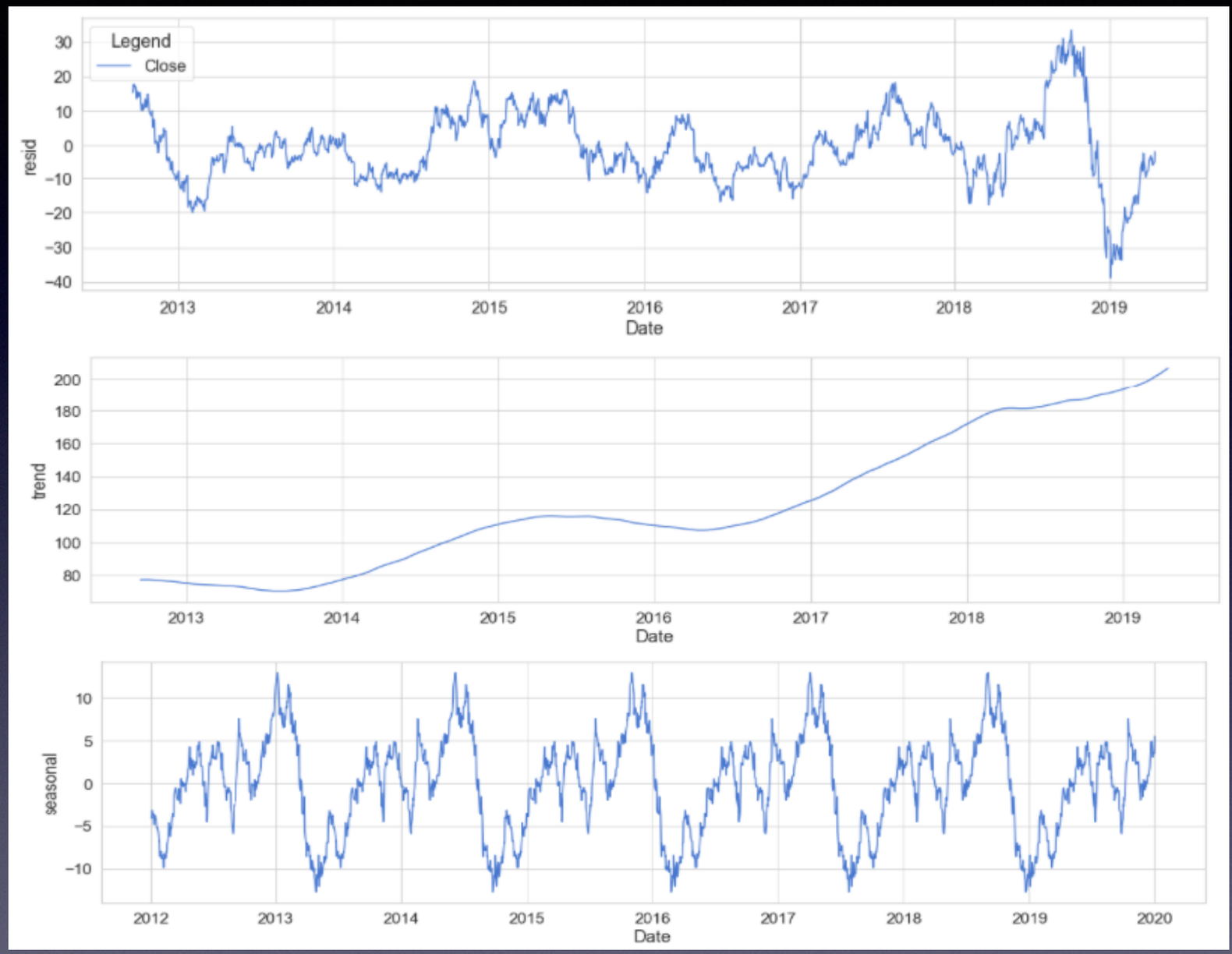
figure1: sample apple stock head

Decomposition of Time series

- Seasonal Chart from this chart we can see a cyclic pattern that occurs but over the a period of a year

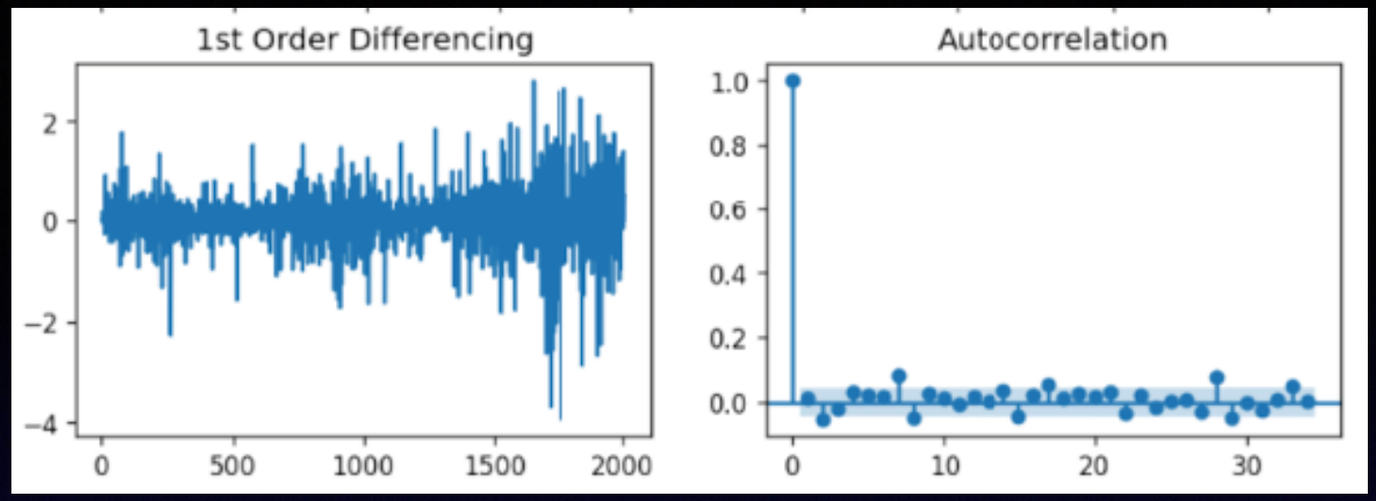
- Trend: shows the overall direction of the apple stock price over the course of years

- Residuals this is the unexplained noise that is found in the data, over those number of years after you remove the effect of the trend and the seasonality.



ARIMA

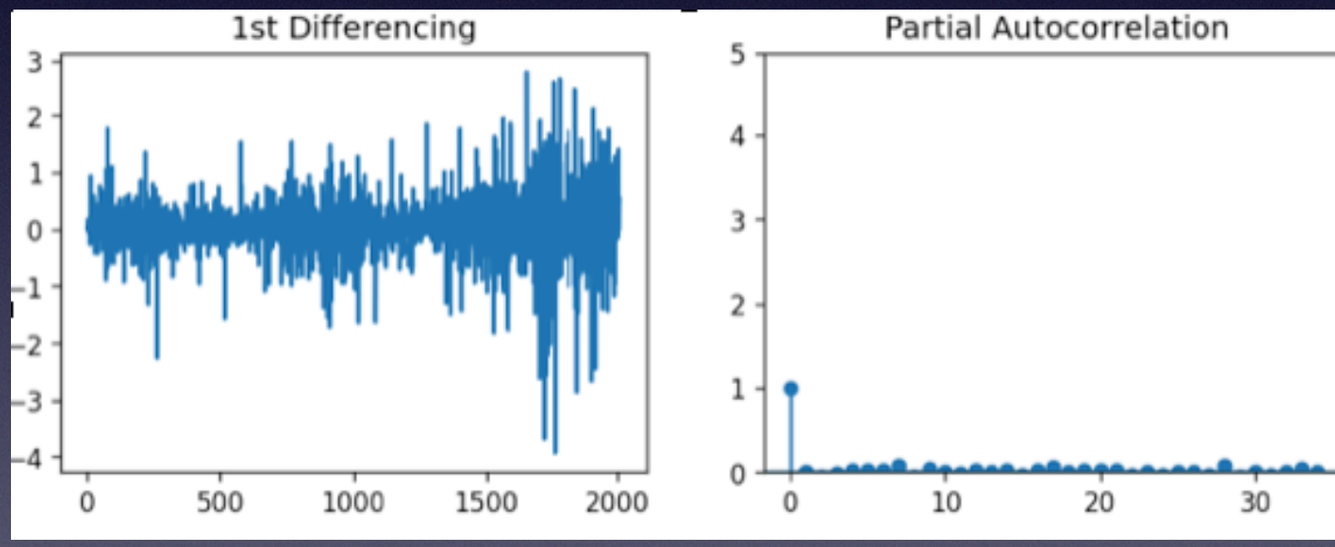
ARIMA stands for ‘AutoRegressive Integrated Moving Average’, is a forecasting algorithm based on the idea that the information in the past values of the time series can alone be used to predict the future values.



1st order differencing d=1, m=1

Methodology

In this project the main idea is to find the adequate p, q, d terms using the ACF, PACF plots. This should be done after the series is found to be or made stationary. We use the augmented Dickey–Fuller test (ADF) test to check if the time series is stationary. The summary of the process is as follows



1st order differencing p=1

LSTM

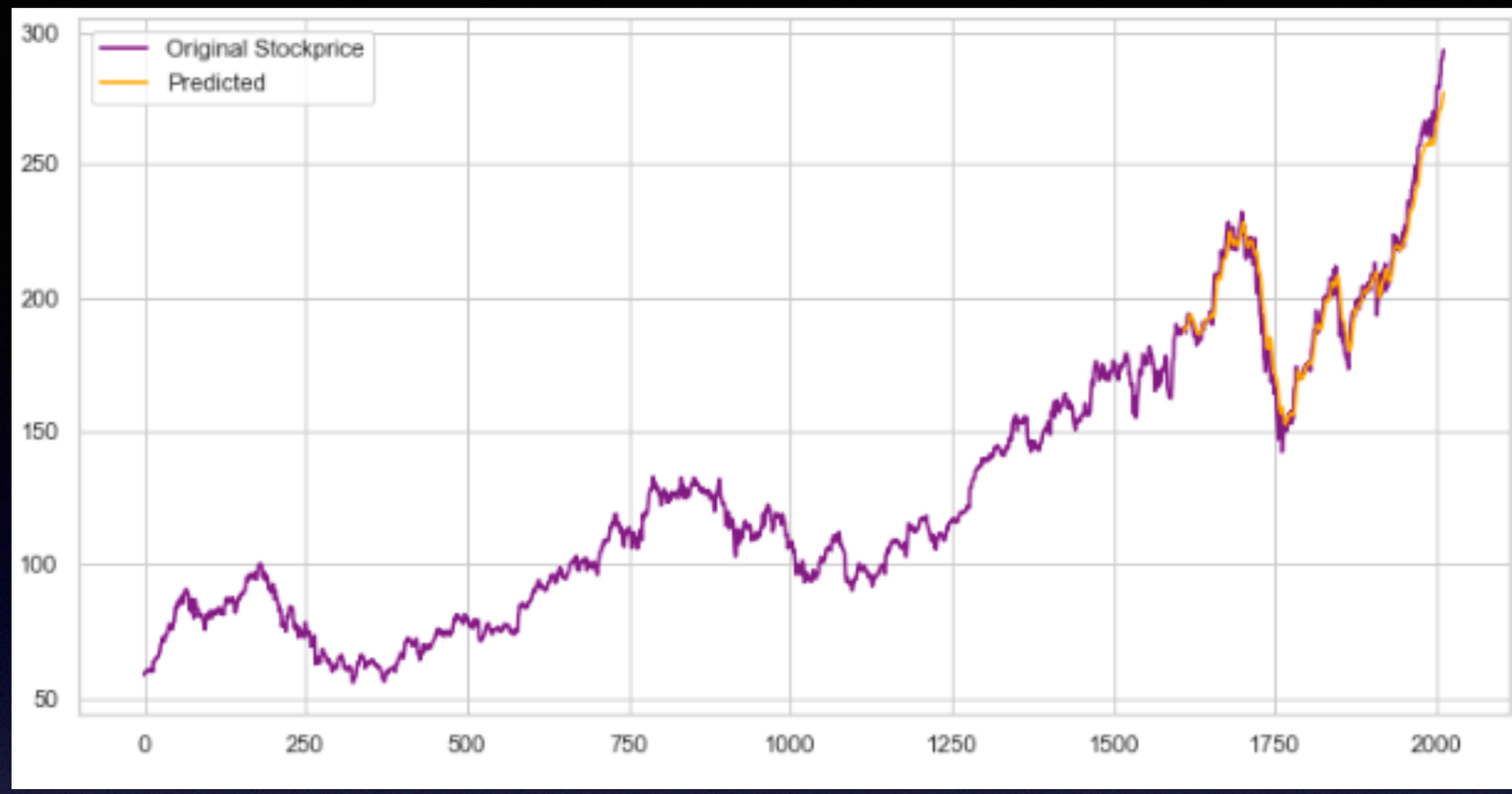
The Long Short-Term Memory network, or LSTM network, is a recurrent neural network (RNN) that is trained using sequential observations learned from the earlier stages to forecast future trends.

Methodology

The training and testing set was divided into 80% 20%. The data was feature scaled and normalized. and consist of 4 types of layers; a sequential layer for initialization, the LSTM layer, the dropout layer to prevent overfitting and the dense layer for adding a densely connected neural network layer is at the end of the model.

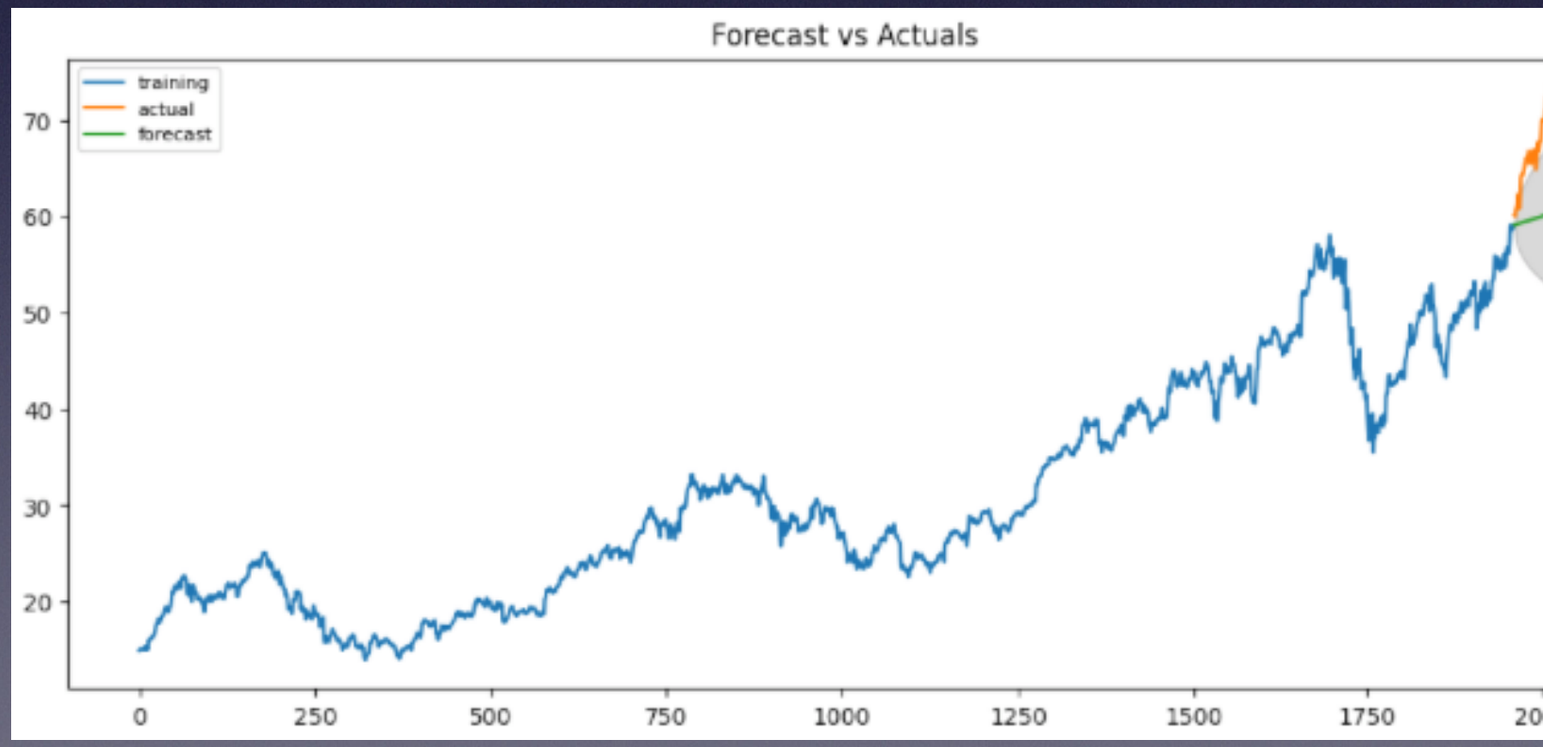
Results			
Metric	ARIMA	LSTM	% Reduction
MSE	53.24	2.9	89
MAE	6.61	1.3	67

performance with the LSTM considerable better than the ARIMA in all evaluation metrics % reduction for the MSE and MAE respectively is 89% and 67%.



Conclusion

The LSTM model is considerably better however is not accurate enough to produce prices that can be used to actually on the stock market as the predictions were not accurate enough to place market orders. Since stocks deal directly with money the predictions need to near perfect for these values to be used.



ARIMA forecast