# LSTM: Stock Market Prediction
Output Result

Overview

In this project we have used the concepts of **LSTM**(Long short term memory) and **RNN**(Recurrent Neural Networks) and tried to propose a model that predicts the opening price for a stock using the LSTM algorithm.

Output for Google Stock Prediction

While building the regressor for our model, we have to set some parameters like the number of epochs to train our model, The units which are used to vary the layers in LSTM, The Dropout rate which is set for managing underfitting / overfitting.

Now we tweaked these values to get the optimum results (Least error percentage). The value of parameters are filled in the table followed by two graphs - Actual Predicted Price vs Predicted Stock Price followed by Error % vs the days of the prediction for the given parameters.
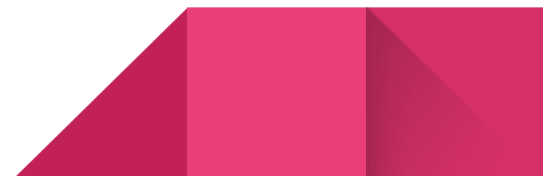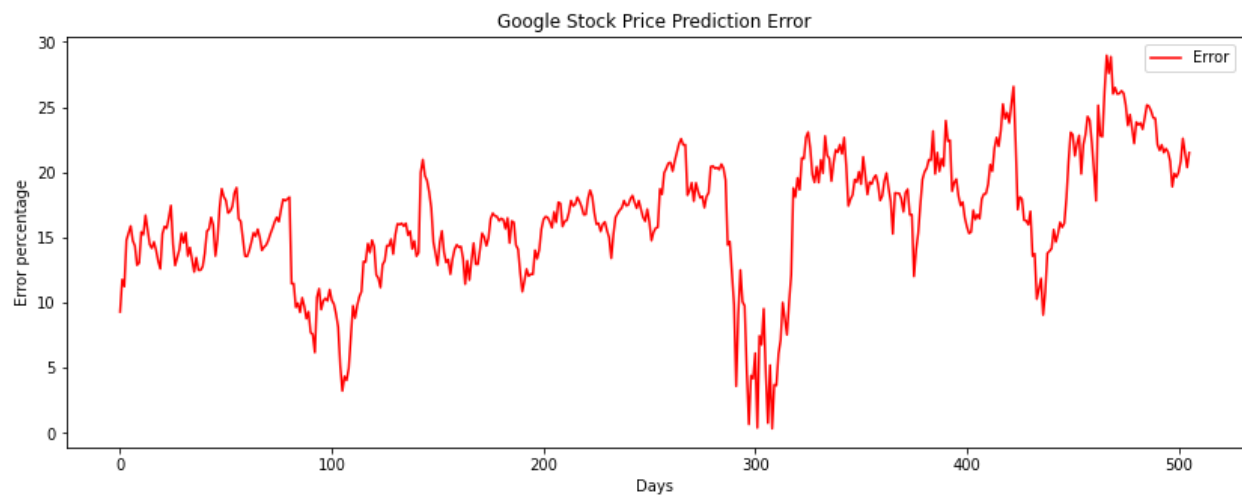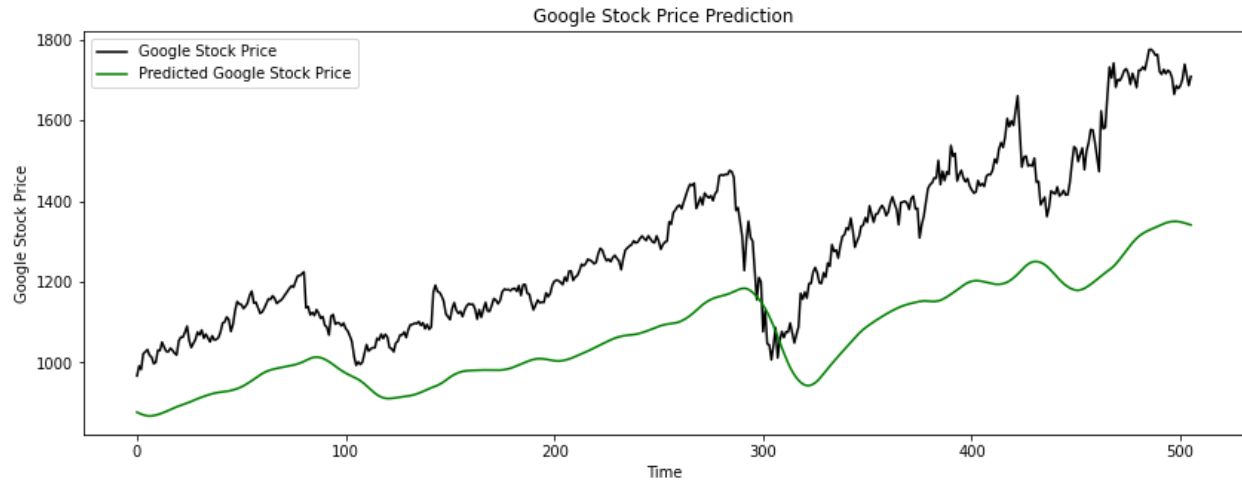
Epoch	10
1st layer unit	50
Dropout Rate	0.2
2nd layer unit	70
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	15.59%

Google Stock Price Prediction

Google Stock Price Prediction Error
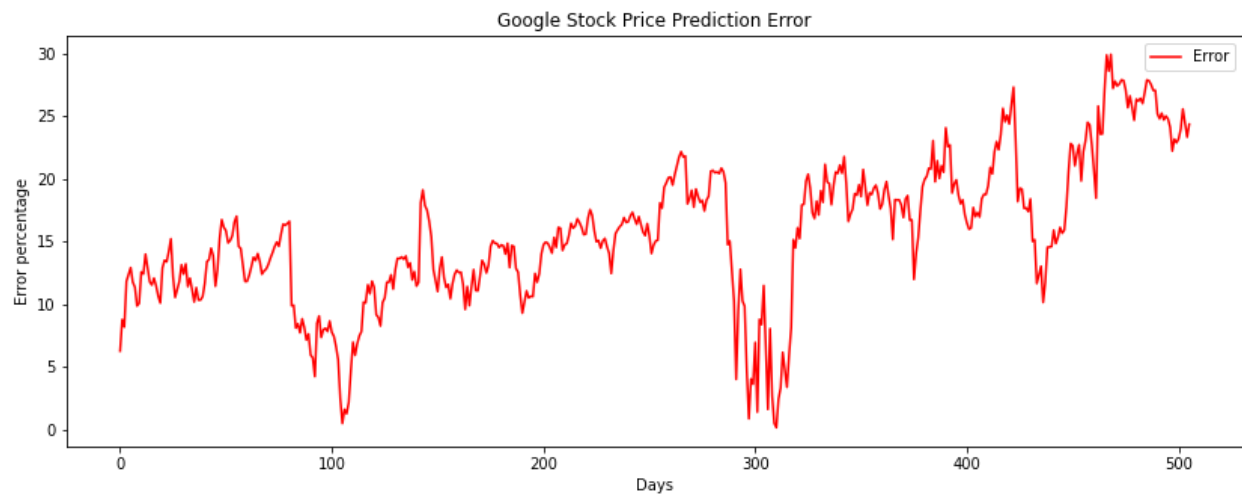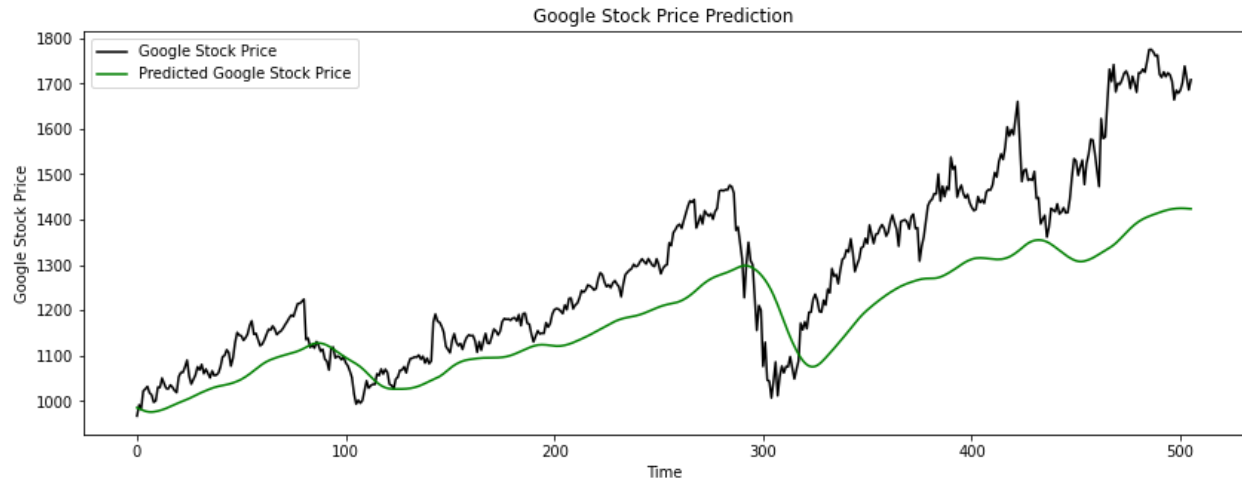
First we change some units:

Epoch	10
1st layer unit	100
Dropout Rate	0.2
2nd layer unit	70
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	16.43%

Google Stock Price Prediction

Google Stock Price Prediction Error

Now, we use epoch =11 instead of 10 which drastically improves our error %.

Epoch	11
1st layer unit	100
Dropout Rate	0.2
2nd layer unit	70
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	10.05%

Google Stock Price Prediction

Google Stock Price Prediction Error
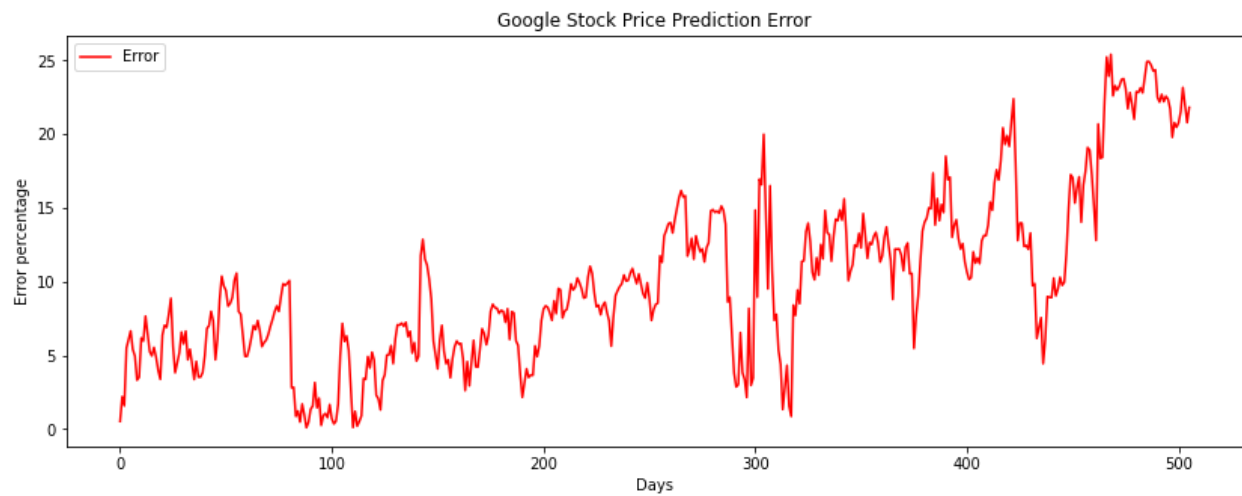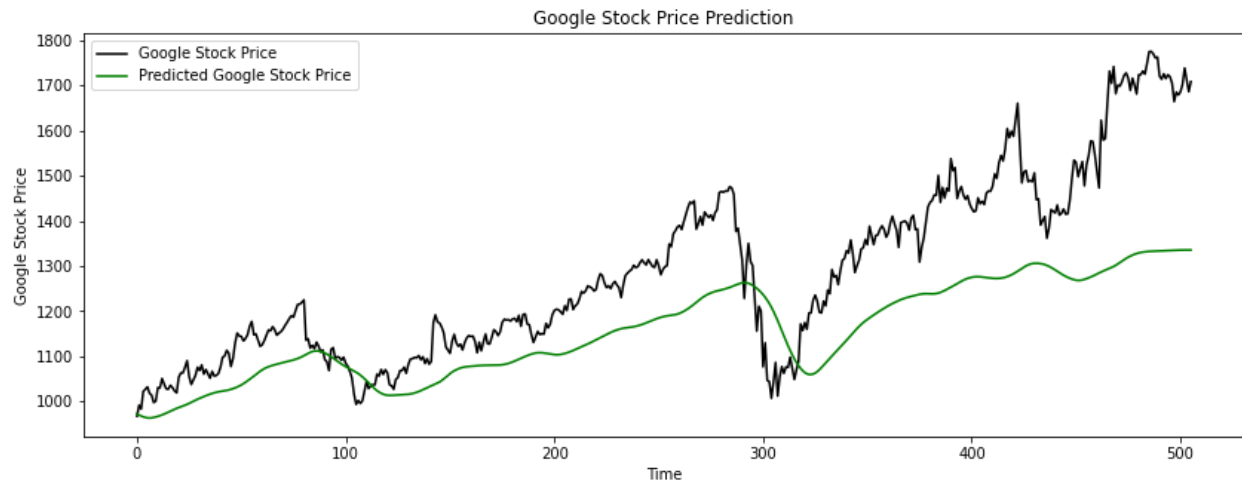
Now, since we saw increasing the Epoch increases our accuracy, we further increased Epoch to 20.

Epoch	20
1st layer unit	100
Dropout Rate	0.2
2nd layer unit	70
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	11.76%

Google Stock Price Prediction

Google Stock Price Prediction Error
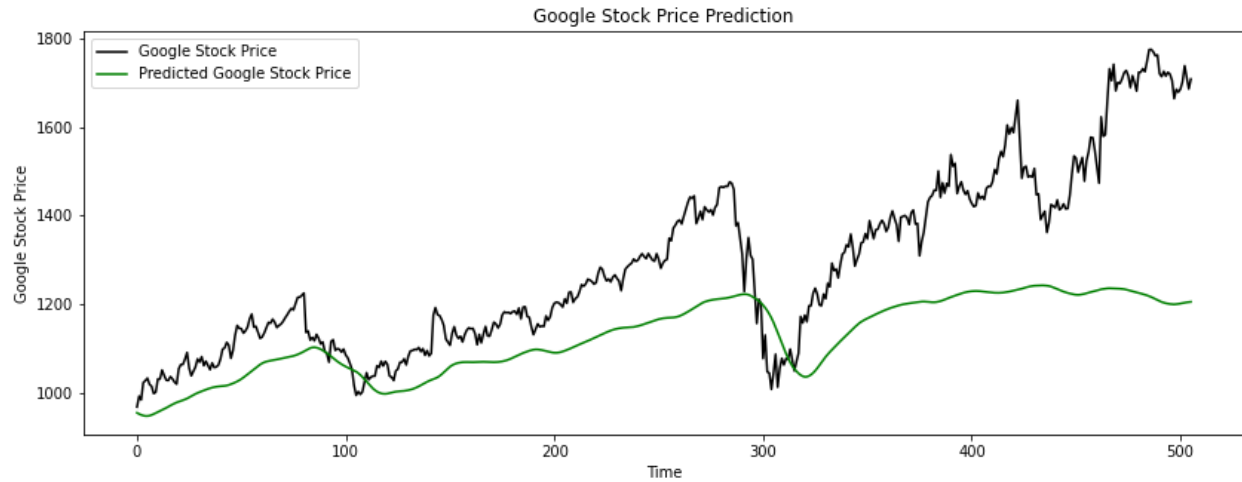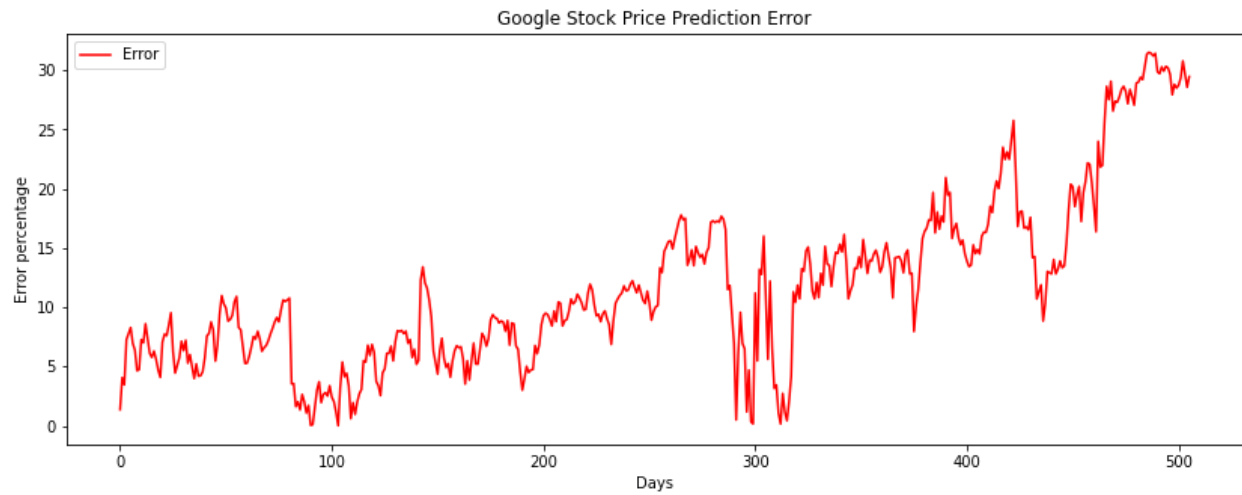
Now, it was little indecisive so we further increased the Epoch to 25. The result got better but something unusual was observed in the accuracy graph.

Epoch	25
1st layer unit	100
Dropout Rate	0.2
2nd layer unit	70
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	9.83%

Google Stock Price Prediction
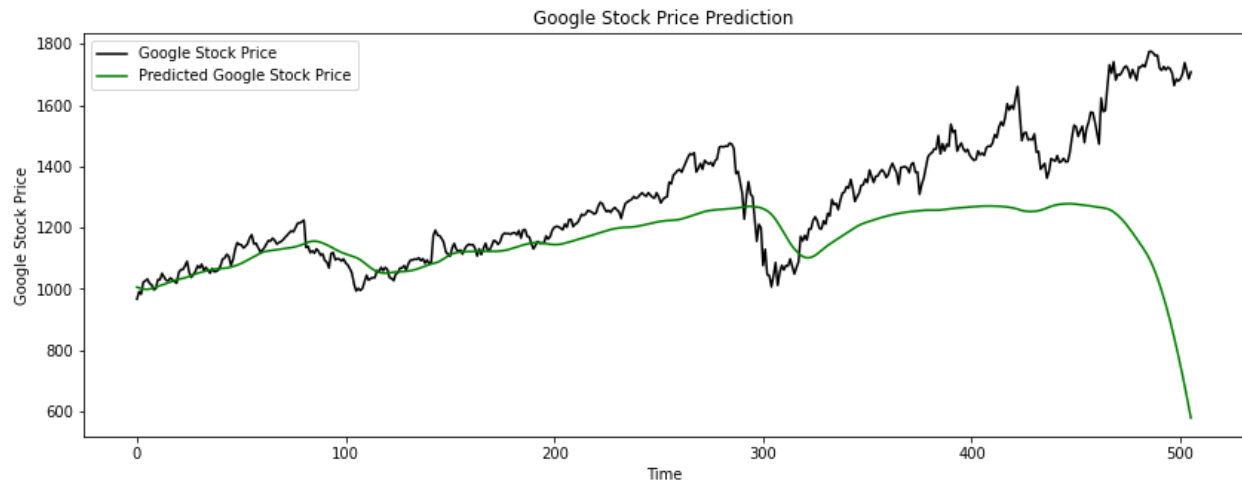
Initially, the error % were low but in the longer interval, it shot up.

Google Stock Price Prediction Error
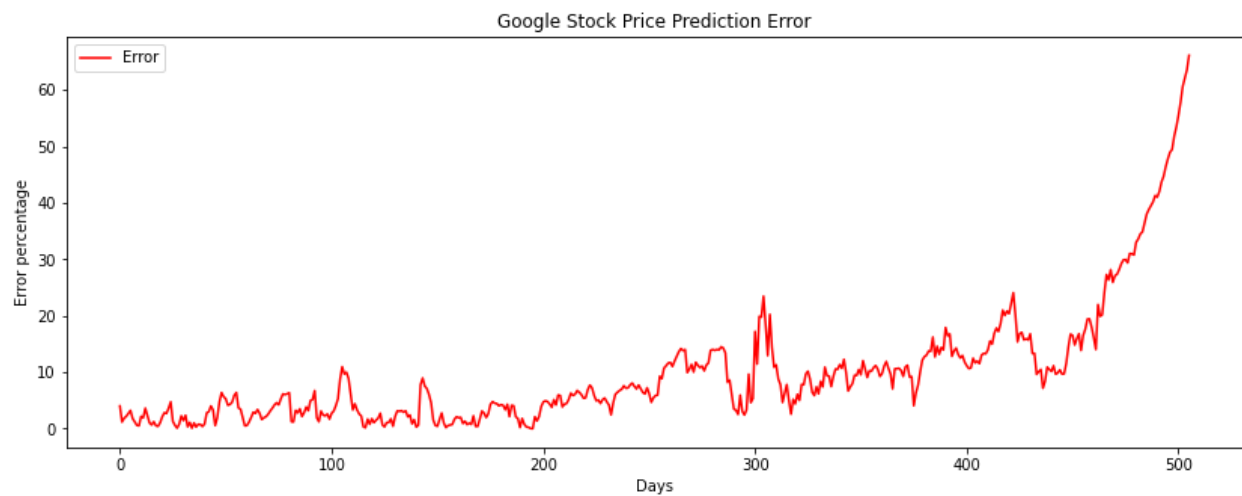
To confirm the above trend, we further increased the Epochs to 30 and observes similar pattern.

Epoch	30
1st layer unit	100
Dropout Rate	0.2
2nd layer unit	70
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	10.78%

Google Stock Price Prediction
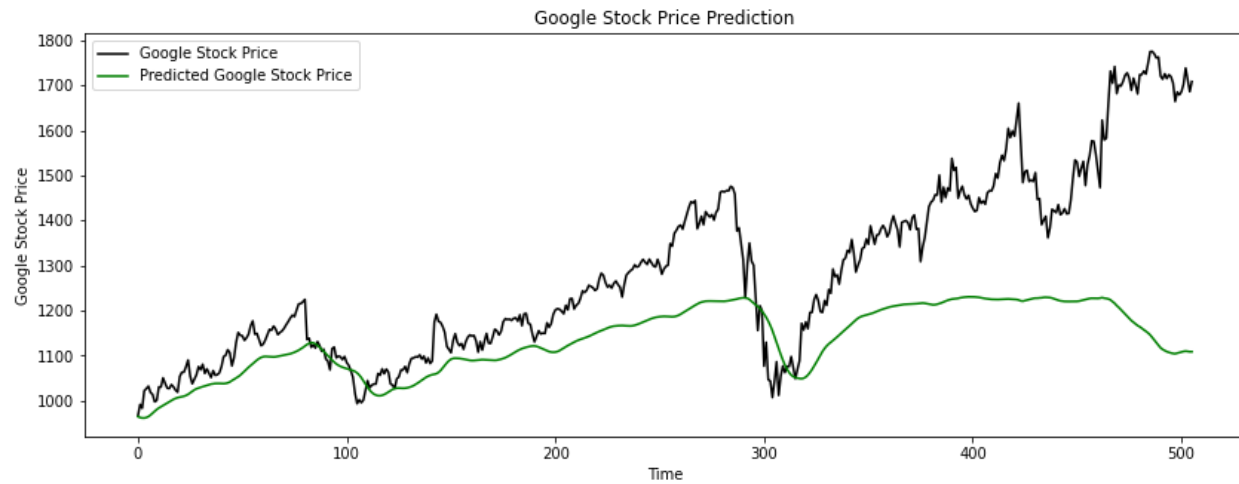
This is due to the effect of **overfitting**.

Google Stock Price Prediction Error
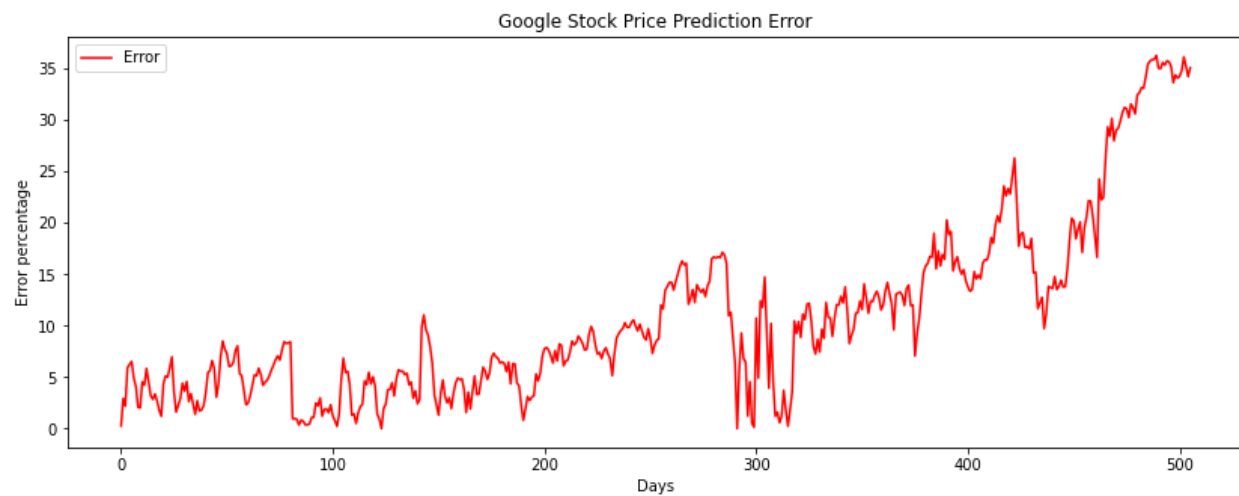
Now for optimal results, we changed back epoch to 11 and changed units furthermore.

Epoch	11
1st layer unit	100
Dropout Rate	0.2
2nd layer unit	140
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	8.87%

Google Stock Price Prediction

The results were better.

Google Stock Price Prediction Error
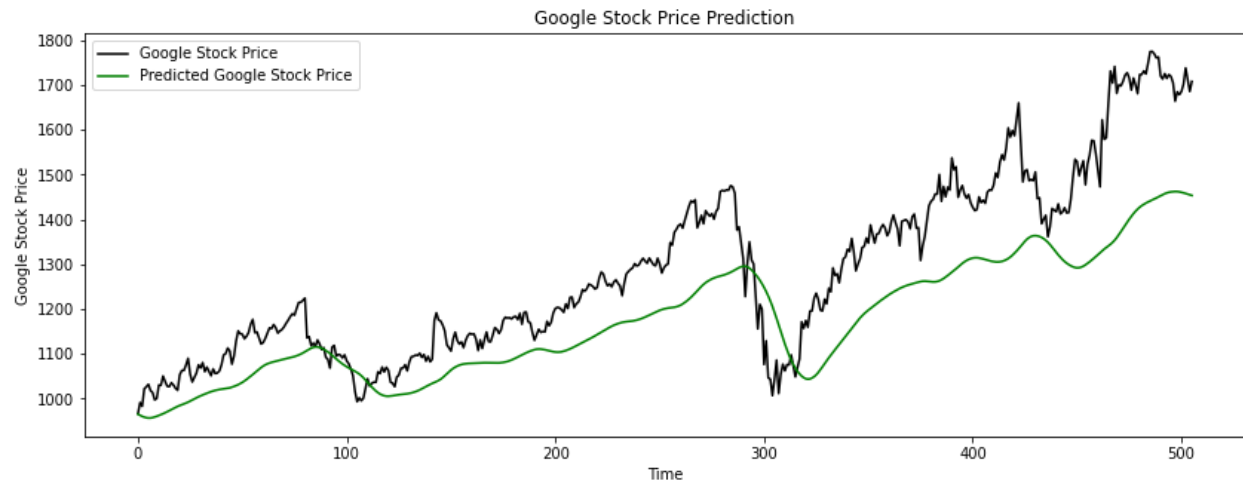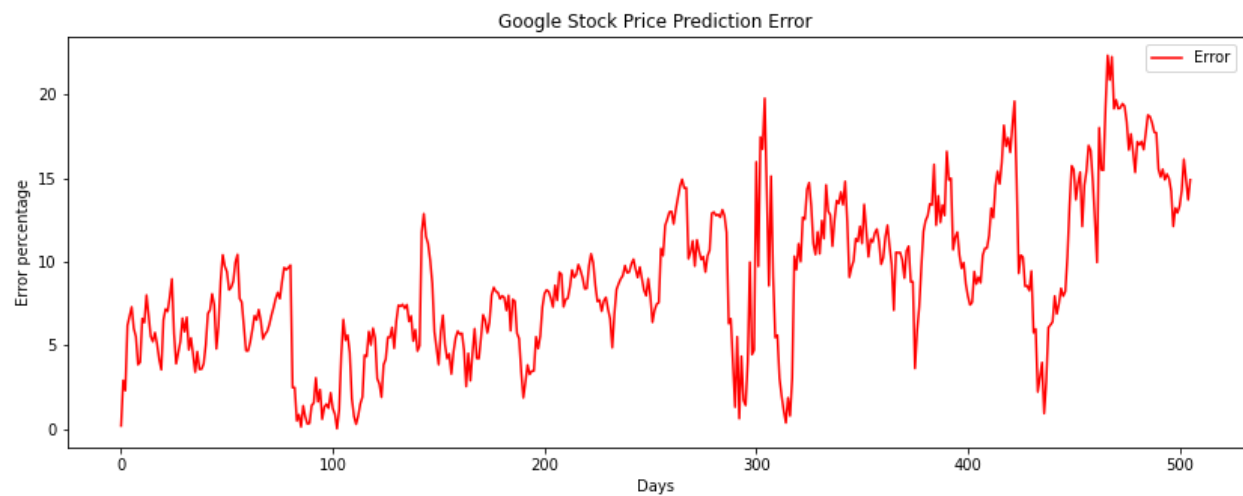
Now changing more units for better results:

Epoch	11
1st layer unit	100
Dropout Rate	0.2
2nd layer unit	140
Dropout Rate	0.3
3rd layer unit	45
Dropout Rate	0.4
4th layer unit	60
Dropout Rate	0.2
Avg. Error %	10.11%

Google Stock Price Prediction

Google Stock Price Prediction Error
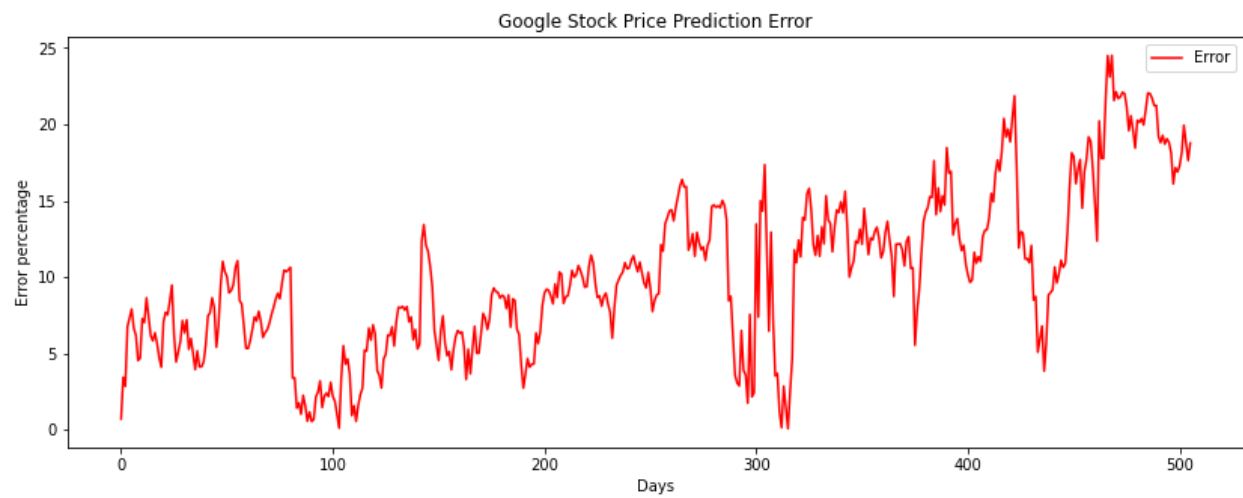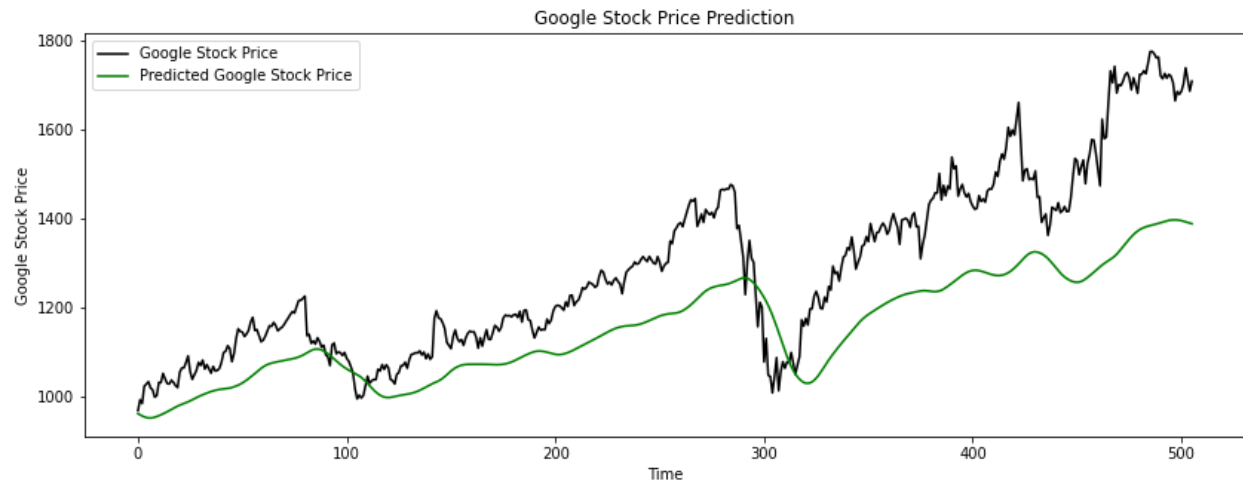
Some combination of the unit gave poor results as compared to previous models:

Epoch	11
1st layer unit	50
Dropout Rate	0.2
2nd layer unit	70
Dropout Rate	0.3
3rd layer unit	45
Dropout Rate	0.4
4th layer unit	60
Dropout Rate	0.2
Avg. Error %	16.56%

Google Stock Price Prediction

Google Stock Price Prediction Error
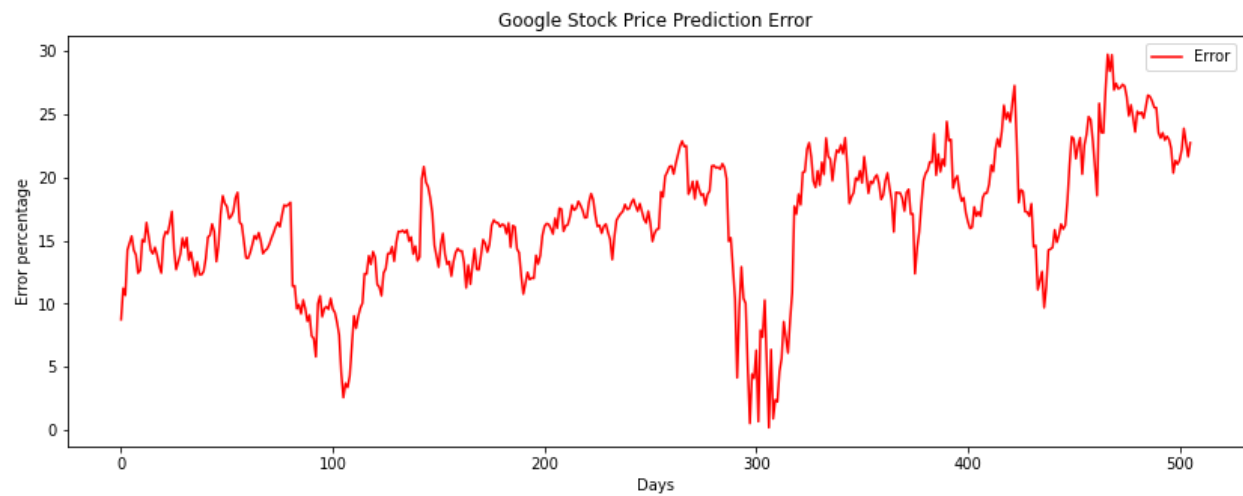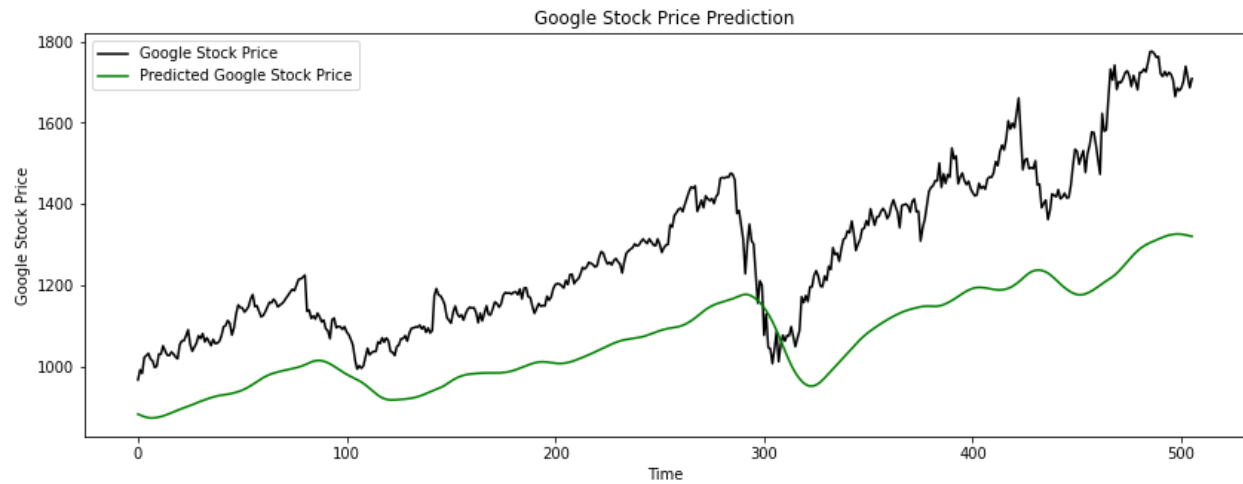
Now since we did some combinations for units, we change Dropout rates for better results:

Epoch	11
1st layer unit	100
Dropout Rate	0.5
2nd layer unit	140
Dropout Rate	0.3
3rd layer unit	90
Dropout Rate	0.4
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	13.99%

Google Stock Price Prediction

Google Stock Price Prediction Error
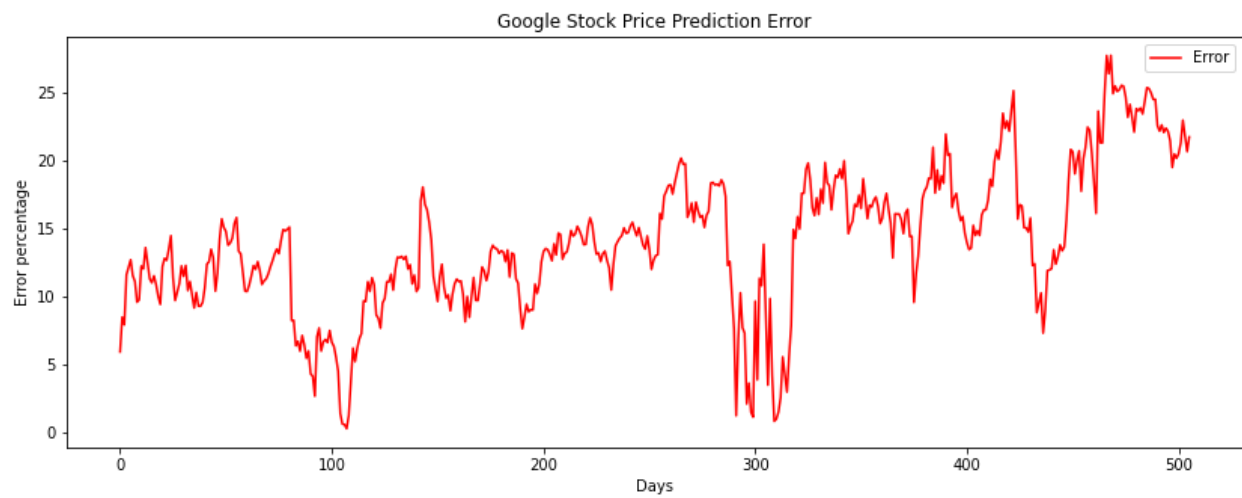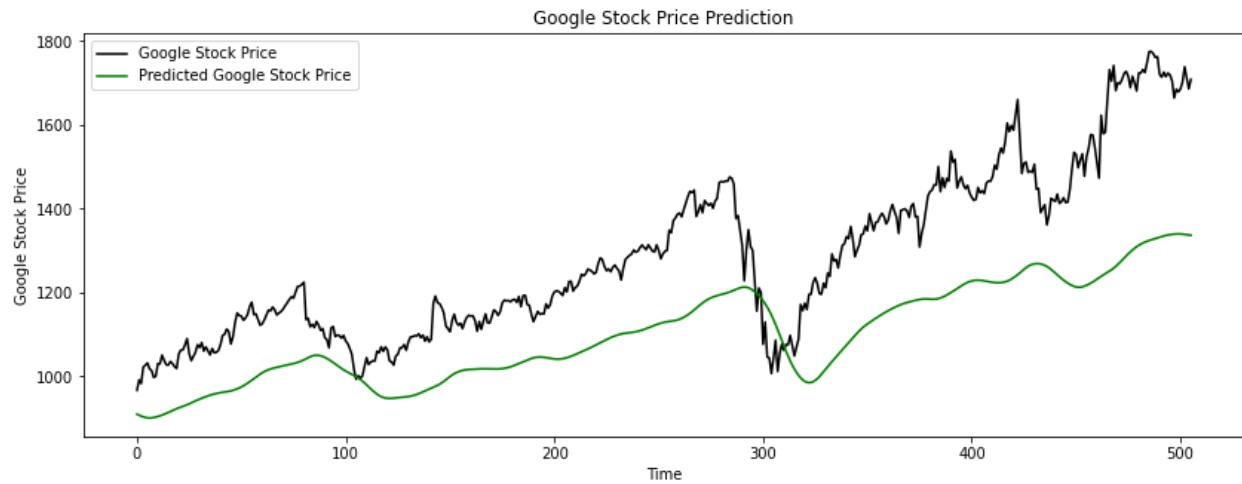
Some models gave poorer results with the tweaks:

Epoch	11
1st layer unit	100
Dropout Rate	0.5
2nd layer unit	140
Dropout Rate	0.5
3rd layer unit	90
Dropout Rate	0.5
4th layer unit	120
Dropout Rate	0.5
Avg. Error %	17.61%

Google Stock Price Prediction

Google Stock Price Prediction Error
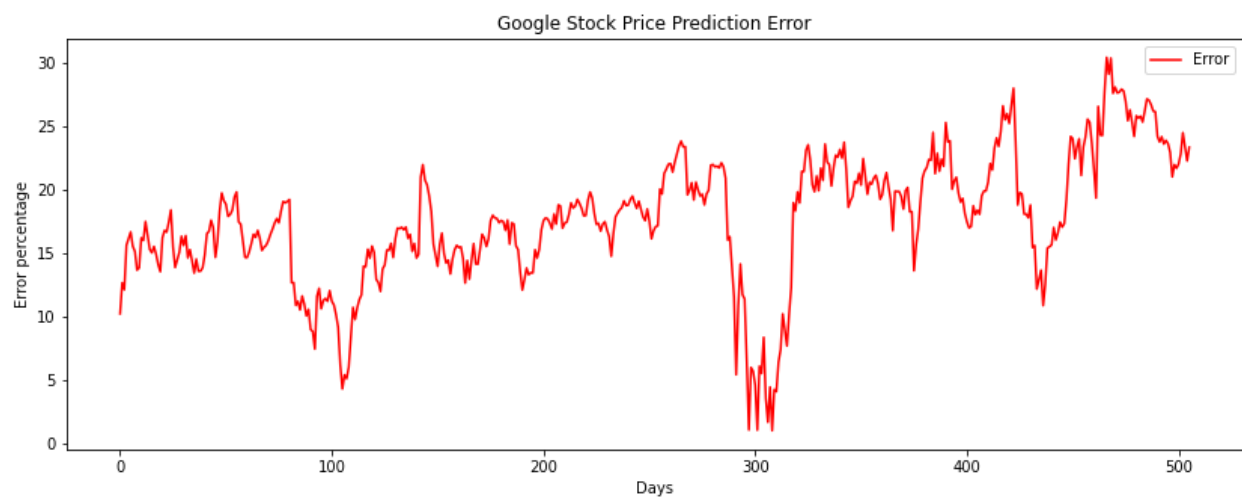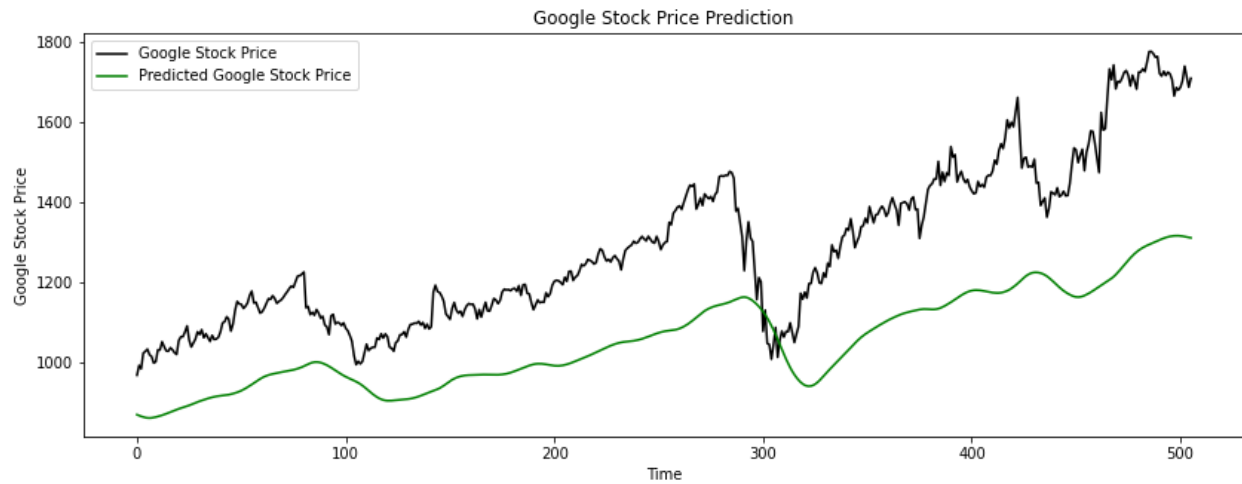
Now changing more Dropout rates for better results:

Epoch	11
1st layer unit	100
Dropout Rate	0.5
2nd layer unit	140
Dropout Rate	0.4
3rd layer unit	90
Dropout Rate	0.3
4th layer unit	120
Dropout Rate	0.2
Avg. Error %	15.45%

Google Stock Price Prediction

15.435781388207156

Google Stock Price Prediction Error
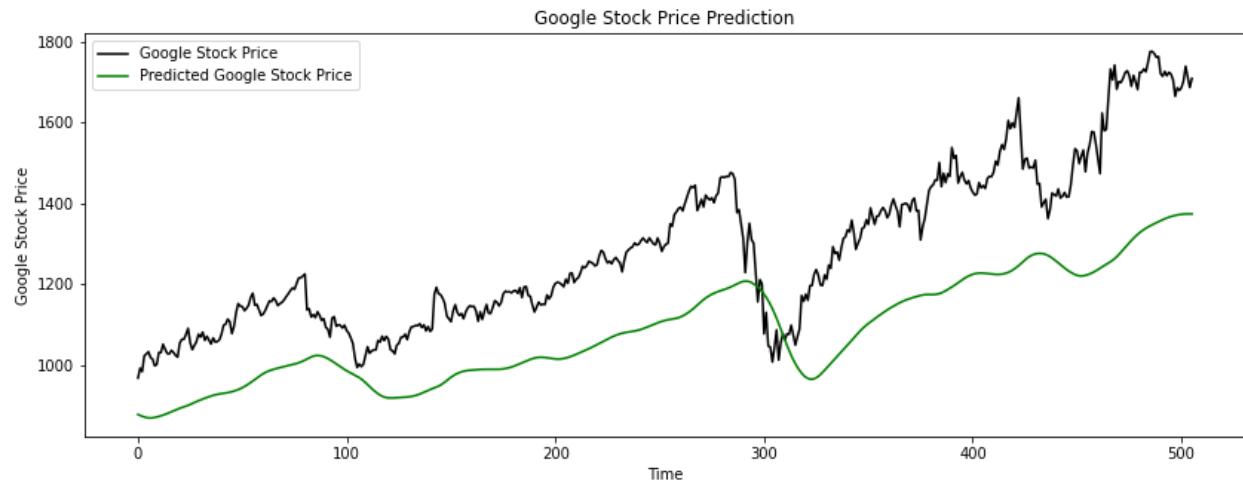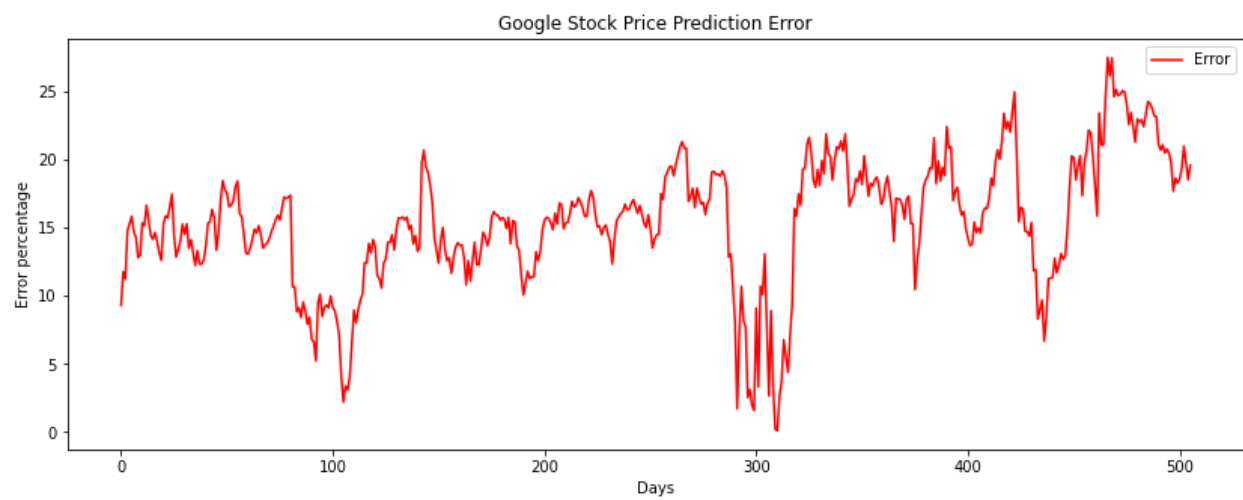
Finally, we came with a combinations of the parameters which gave very good results:

Epoch	11
1st layer unit	100
Dropout Rate	0.25
2nd layer unit	140
Dropout Rate	0.35
3rd layer unit	90
Dropout Rate	0.35
4th layer unit	120
Dropout Rate	0.25
Avg. Error %	6.59%

Google Stock Price Prediction
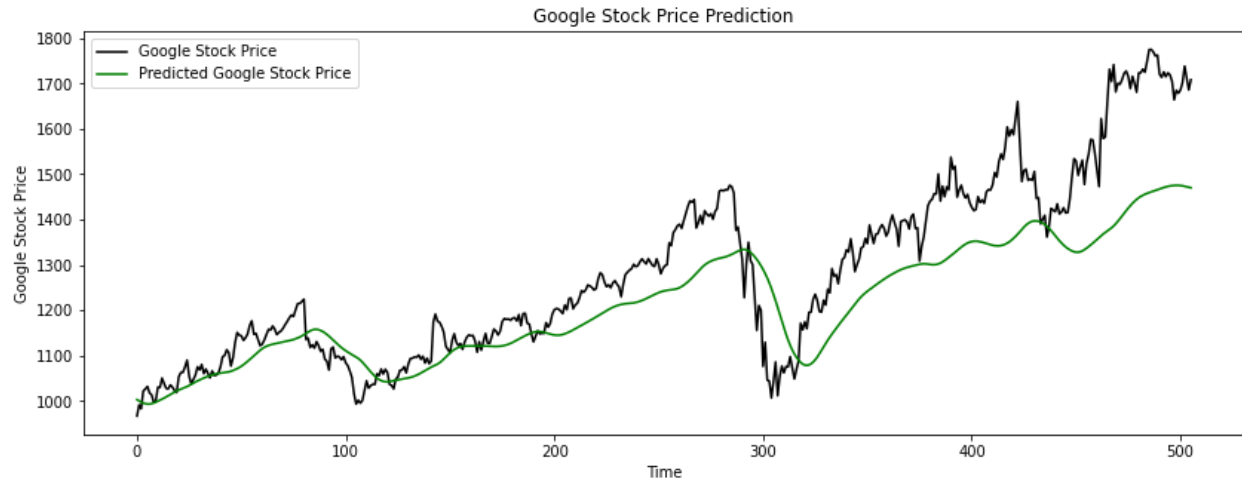
This model without any observable underitting / overitting gives only 6.59 % average error rate or **93.41% Accuracy result**.

Google Stock Price Prediction Error
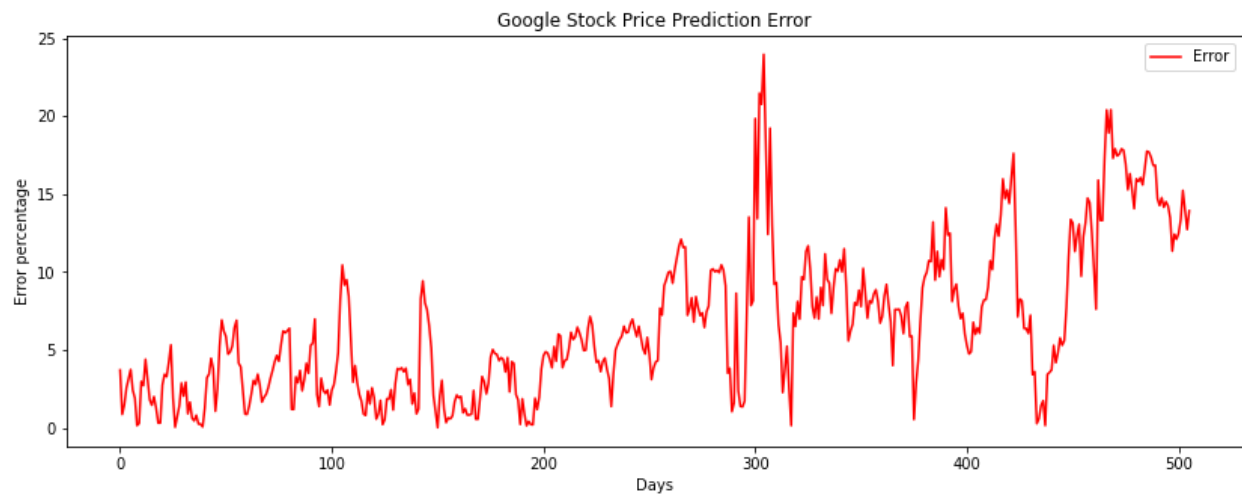
Therefore we were able to predict the stock prices with our model with the given accuracies.