How to predict the Stock market price trends with AI model

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Abstract
In this project, we want to predict the Stock Market Price. For predicting the stock price trends and trying to find out which machine learning architecture is the most accurate and similar to prediction. And wanted to figure out if this AI model works for predicting the stock trend. So we tried to find with LSTM, GRU, LSTM + GRU, Lasso, and MLP to see if it works

Keywords
Stock — Prices — Prediction

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1. Problem and Data Description

We are trying to find the correlation from the data set with the historical statistic data set and use the AI for predicting the stock price trends and trying to find out which machine learning architecture is the most accurate and similar to prediction. And wanted to figure out if this AI model works for predicting the stock trend. So we tried to find with LSTM, GRU, LSTM + GRU, Lasso, and MLP to see if it works

2. Data Preprocessing & Research Process

2.1 Checking Missing Values

Since research is about predicting the stock market prices, we decided to use the data set from Yahoo! Finance to train the model for the prediction. The data set we got did not have the missing values.

2.2 Research Process

From the given data set from Yahoo! Finance, it contains 7 columns: Date, Open, High, Low, Adj Close, Volume. And we tried to compare with the Open and Close columns. To find the best regression model, we tried several methods, Lasso, MLP, and LSTM.

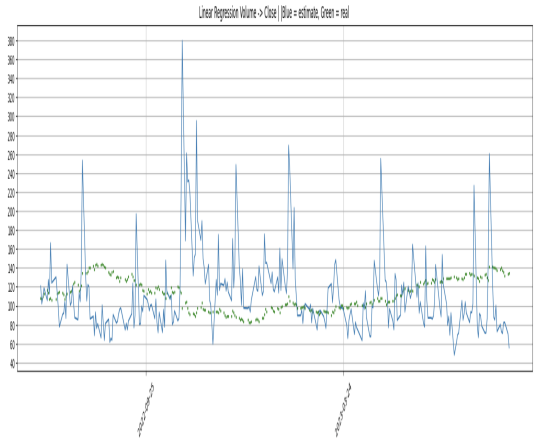

Figure 1. linear regression line with lasso Regression

The first linear graph shows that the Lasso regression technique is not working with the Volume.

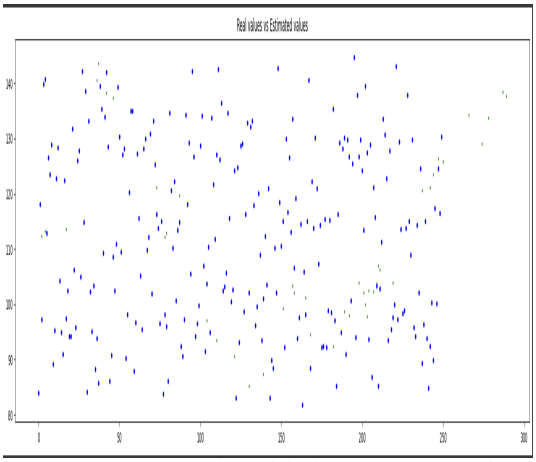

Figure 2. Scatter plot with the Lasso regression

The scatter plot, which shows the relationship between the Predicted price and the actual price, shows that this Lasso regression prediction might not work well.

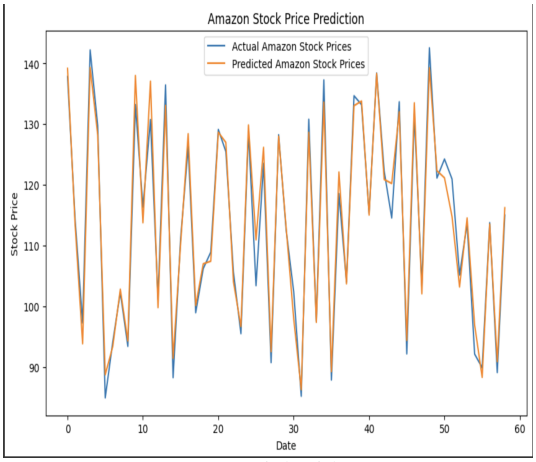

Figure 3. Trial with MLP

This graph shows that the MLP technique that Chima tried on with the Amazon Open stock was overfitted.

Figure 4. LSTM model with Tesla Open price

As this graph shows with predicted 20 days with the actual dates, we decided to pick Daeyeop's way for research. After Daeyeop's LSTM seems to work with the data, we started to make progress with the Close column with the LSTM.

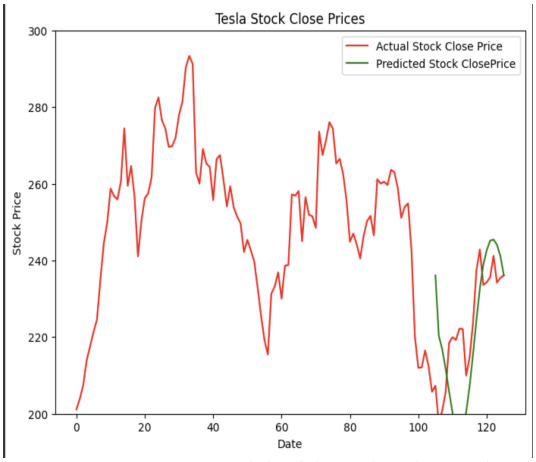

Figure 5. LSTM model with Tesla Close price

After we checked the LSTM model withe Open and Close columns, we wanted to compare it with the GRU model too. So these are the plots.

Figure 6. GRU model with Tesla Close price

Figure 7. GRU model with Tesla Close price

After we tried with the LSTM and GRU, Implemented the hybrid model with LSTM and GRU model.

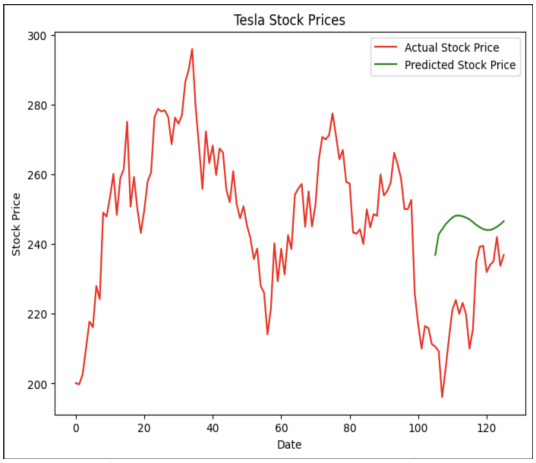

Figure 8. Hybrid model (LSTM + GRU) with Tesla Open price

Figure 9. Hybrid model(LSTM + GRU) with Tesla Close price

it gives different results compared with previous models, LSTM and GRU so we added one more model to compare to find the predicted model.

3. Algorithm and Methodology

For the Lasso and MLP, it might work for this prediction of the Stock price research but might need to implement a different way to learn. For predicting the stock prices, we used sequential data like stock historical data, we used LSTM, which excels at capturing long-term dependencies, making it ideal for sequence prediction tasks LSTM Adds another gate that GRU does not have which is named “forget Gate” (forget input and output get). LSTM has better stability compared to GRU.

Besides LSTM, we also used GRU. GRU is one of the networks after LSTM that handles recurrency by implementing 2 types of the Gate. But GRU has the Weaknesses which are short memory and, Exploding and vanishing gradients. (it goes infinite value or very high value which means it updates the weight with very small numbers) and GRU is difficult to implement the backpropagation.

Furthermore, we implemented the hybrid model with a mix LSTM and GRU, which could improve the performance and better accuracy. For the hybrid, we used LSTM and GRU twice for each step, which performs with the sequential data and gives the learned output that could improve compared with LSTM and GRU.

4. Experiments and Results

After we figured that Lasso, and MLP does not work at all we focused on the LSTM, GRU, and the hybrid model. From these 3 model we could compare the MSE from the learning models. MSE with the 3 different machine learning architectures: LSTM, GRU, and Hybrid.

Open and Close MSE with LSTM, GRU, and Hybrid by Telsa		
Model Name	Open MSE	Close MSE
LSTM	490.41	206.38
GRU	250.367	286.31
Hybrid(LSTM + GRU)	643.01	336.57

Out of all the models, GRU model performed the best with Open data set and MSE is 250.37. and LSTM model performed the best with the Close data set and MSE is 206.38. We were impressed with this different result with different columns: Open and Close. So we wanted to see if learning times for each model more time could change the result or not.

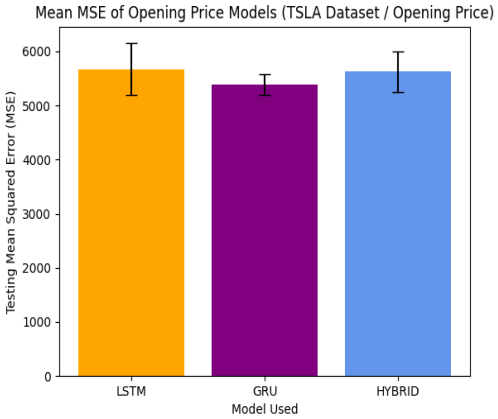

Figure 10. result 1 with the Open price by learning 10 times

The first bar graph shows that it has the MSE range is from 5000 to 6000 and it seems like GRU has the least MSE and standard deviation from Open dataset after learning the model 10 times.

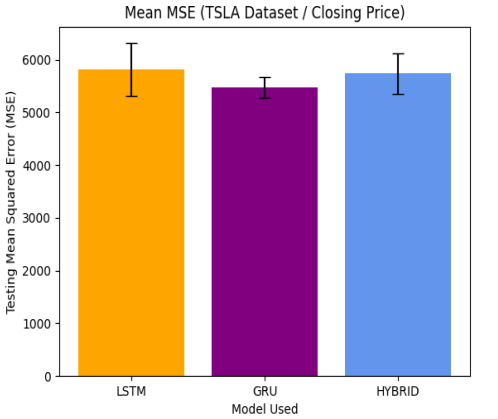

Figure 11. result 1 with the Close price by learning 10 times

The second bar graph shows that it has the MSE range is from 5000 to 6000 and it seems like GRU has the least MSE and standard deviation from Close dataset after learning the model 10 times.

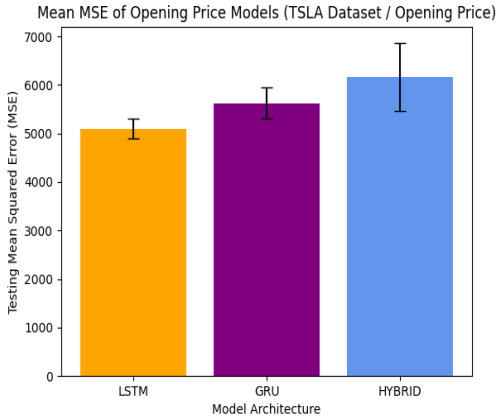

Figure 12. result 2 with the Open price by learning 10 times

The Third bar graph shows that it has the MSE range is from 5000 to 7000 and it seems like LSTM has the least MSE and standard deviation from Open dataset after learning the model 10 times.

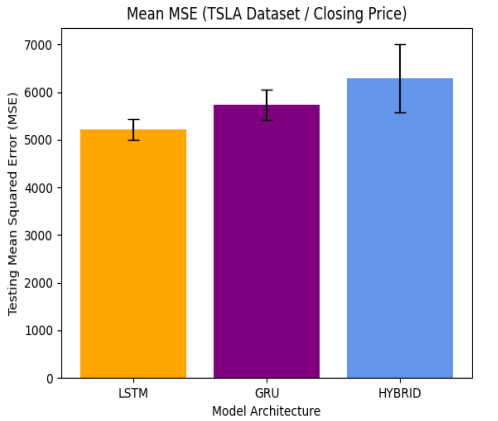

Figure 13. result 2 with the Close price by learning 10 times

The forth bar graph shows that it has the MSE range is from 5000 to 7000 and it seems like LSTM has the least MSE and standard deviation from Close dataset after learning the model 10 times.

As these two different result shows that we cannot pick one model is best for the best column. Even it seems that if MSE from Open and Close is similar, it shows that these 3 simple architectures need to increase the echo or increase the hyperparameters to decrease the MSE or give another question for improving to find another way to predict the stock price.

5. Summary and Conclusions

Our goal was to predict the trend of the stocks from open and close datasets. We aimed to find the best regression model for predicting the stock market price. We used the Yahoo! finance historical Statistics data to train different regression models (An LSTM and a GRU architecture, the Hybrid). Since we

tried the MLP and Lasso regression techniques, it was overfitted or not helpful for predicting the sequential data. We conclude that LSTM and GRU possess the strong ability to model sequential data. By checking which architecture is the best fit for predicting the stock price, we tried 10 times to learn the model and compare the MSE. When we compared with LSTM, GRU, and the Hybrid, GRU appears to have a stronger performance than LSTM or the Hybrid model at first result. When we compared with LSTM, GRU, and the Hybrid, LSTM appears to have a stronger performance than LSTM or the Hybrid model in the second result. In this study, we found that simple architects like LSTM and GRU, or hybrid need to be improved to predict stock price. But one of results shows that GRU has the best MSE which could say that it has better performance than others. From our research, We might also need to train with different features and different stock and Models were very sensitive to hyperparameters.

6. Reference

LSTM Definition:
https://www.analyticsvidhya.com/blog/2021/03/introduction-to-long-short-ter m-memory-lstm/

Explanation for the GRU:
https://datascience.stackexchange.com/questions/14581/when-to-use-gru-ov er-lstm