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**Stock Price Projection Report**

**About:**

Project intention was to create a model capable of accurately predicting the stock price of ticker $BUD using historical stock price data. Success in this endeavor would yield insight into forward-looking guidance for current and prospective investors. This report is intended to serve as a summer project to fulfill the requirements for an applied machine learning course the author is enrolled in. The report is written as if it were to be presented to a decision maker in industry.

**Data Used:**

The data used from this project is coming from the stock’s historical opening, high price, low price, closing, and volume records. Data are being collected from the python library pynance. From the closing price, Relative Strength, Exponential Moving Averages, and Simple Moving Averages were calculated over a period of 50 days.

**Independent Variables Explain:**

**Volume** – Variable is showing how much activity is taking place with this asset daily, volume = total number of buys and sells of stock

**RSI50** – shows the relative strength of price movement over a period of 50 days

**EMA50** – showing an exponential moving average of the stock closing price over a period of 50 days

**SMA50** – showing a simple moving average of the stock closing price over a period of 50 days

**Delta** – The change between open and close price of the stock

**High** – Daily price high

**Low** – Daily price low

**Methods:**

Three Recurrent Neural Network models were built and tested for comparison purposes. These models included the usage of Long Short-Term Memory, Bi-Directional Long Short-Term Memory, and Gated Recurrent Units algorithms. Each model was trained on 70% of all available historical price data from the years of 2010 to the present. Both a weekly and a daily version of these models were prepared and tested.

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Figure 1. Training and Testing Data Used

**Model Assessments:**

When assessing model performance, training and validation loss were examined as well for each of the three models to aid in final model selection. Model performance metrics used were mean absolute error and root mean absolute error. The results for each model are as follows:

***Bi-Directional LSTM Models Training and Validation Loss:***

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Figure 2. Training and Validation Loss for Bi-Directional LSTM – Daily Version. The validation set used in training the model is suspected to be easier to explain the training set, as such these are not easily comparable.

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Figure 3. Training and Validation Loss for Bi-Directional LSTM – Weekly Version. The validation set used in training the model is suspected to be easier to explain the training set.

***LSTM Models Training and Validation Loss:***

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Figure 4. Training and Validation Loss for LSTM - Daily Version. Curves indicate the model is a good fit.

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Figure 5. Training and Validation Loss for LSTM - Weekly Version. Curves indicate the model is a good fit.

***GRU Models Training and Validation Loss:***

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Figure 6. Training and Validation Loss for GRU - Daily Version. Curves indicate the model is a good fit, but the validation set used in training appears to have been easily explained and not easily compared to the training set.

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Figure 7. Training and Validation Loss for GRU - Weekly Version. Curves indicate the model is a good fit.

***Model Results – Daily Version:***

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Figure 8. Results for Bi-Directional LSTM Model; MAE: 1.7998 RMSE: 2.4390

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Figure 9. Results for LSTM Model; MAE: 1.7092 RMSE: 2.2291

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Figure 10. Results for GRU Model; MAE: 1.8896 RMSE: 2.2042

***Model Results – Weekly Version:***

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Figure 11. Results for Bi-Directional LSTM Model; MAE: 3.8002 RMSE: 4.9371

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Figure 12. Results for LSTM Model; MAE: 3.2828 RMSE: 4.0796

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Figure 13. Results for GRU Model; MAE: 2.4570 RMSE: 3.1016

***Model Selection:***

For model selection, the daily versions results indicate that using the LSTM model is best while the weekly versions results indicate that the GRU model is best.

***Future Work and Conclusions:***

In the future it is recommended to work with a finance subject domain expert to better identify and understand suitable independent variables. RNN’s show a lot of promise for forecasting future price values, with the caveat that they only work as well as the historical data fed into them. For unprecedented socioeconomic factors, the impacts on stock price will not be forecasted correctly.