

# LSTM Stock Predictor

Use deep learning recurrent neural networks to model bitcoin closing prices. One model uses the Crypto Fear and Greed Index (FNG) to predict the closing price while the other model uses a window of closing prices to predict the nth closing price.

**Please reference the "lstm\_stock\_predictor\_fng\_1\_10.ipynb" and "lstm\_stock\_predictor\_closing\_2\_2.ipynb" notebooks.**

## Preparing the data for training and testing

We:

1. Used the starter code as a guide to create a Jupyter Notebook for each RNN.
2. For the FNG model, we used the FNG values to try and predict the closing price using a function provided in the notebook to help with this.
3. For the closing price model, we used previous closing prices to try and predict the next closing price using the provided function.
4. Used 70% of the data for training and 30% of the data for testing.
5. Applied a MinMaxScaler to the X and y values to scale the data for the model.
6. Reshaped the X\_train and X\_test values to fit the model's requirement of samples, time steps, and features.

## Building and training custom LSTM RNNs

We:

1. Created the same custom LSTM RNN architecture in each Jupyter Notebook, using the FNG values to fit the data in one notebook while using the closing prices to fit the data in the other notebook.
2. Used the same parameters and training steps for each model to accurately compare the models.
3. Performed a series of iterations with different window and batch sizes to determine the optimal values for each model, both visually and numerically to minimize the loss amount.

## QUESTIONS ANSWERED (evaluating the performance of each model):

- Which model has a lower loss?

The Closing model had the lower loss for all window and batch sizes analyzed.

- Which model tracks the actual values better over time?

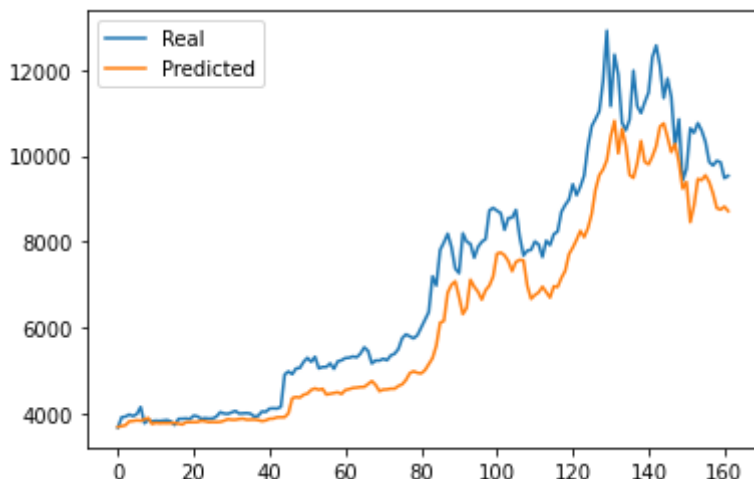
The Closing model tracked the actual values better over time (based on visual inspection of the plots as well as the amount of loss).

- Which window size works best for the model?

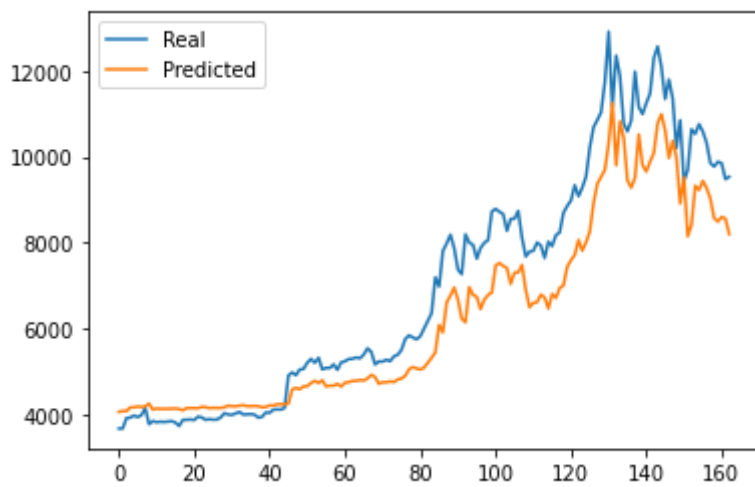
For the Closing model, we found the optimal parameters were a window of 2 and a batch size of 2. With these settings, loss was minimized at a value of 0.0111. It should be noted that *visually*, a window of 1 and batch size of 2 seems to provide a closer fit with less smoothing, however, the loss with these parameters is slightly higher at 0.0115.

For the inferior FNG model, we found the optimal parameters were a window of 1 and a batch size of 10. With these settings, loss was minimized at a value of 0.0823, however, visually the Predicted values approach a flat line as the batch size is increased. With a window of 1 and batch of 1, the plot is *visually* improved, better tracking the ups and downs of the real data, but with a higher loss of 0.0936.

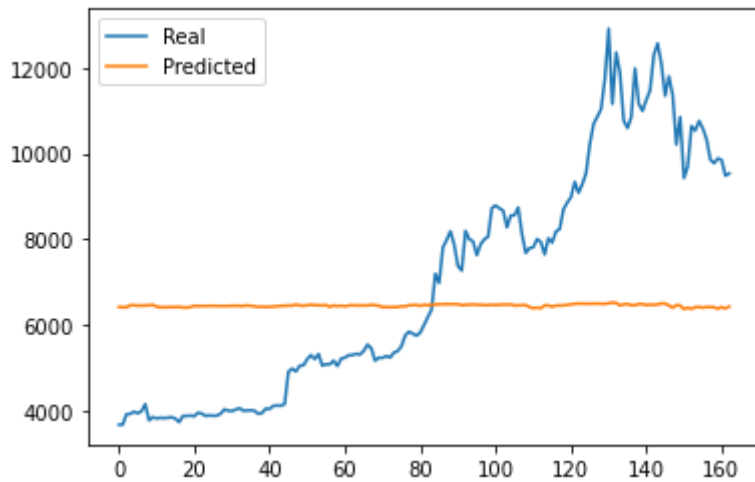
### Optimal (minimized Loss) Closing Model Output (Window=2, Batch=2, Loss=0.0111):



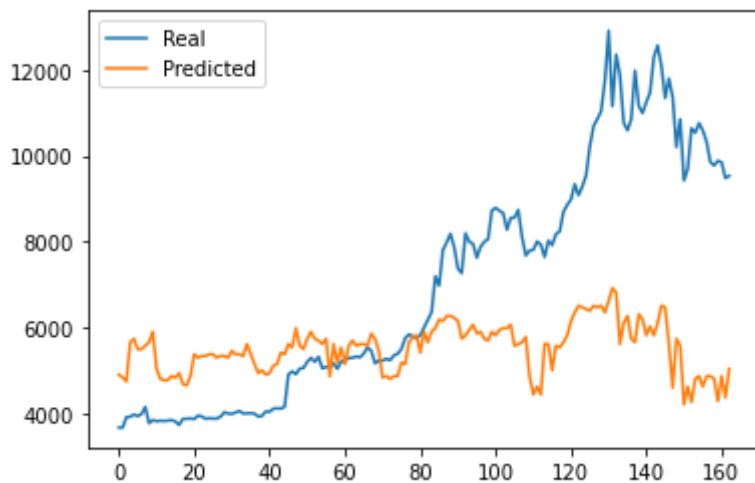
### Visually Improved Closing Model Output (Window=1, Batch=2, Loss=0.0115):



**Optimal (minimized Loss) FNG Model Output (Window=1, Batch=10, Loss=0.0823):**



**Visually Improved FNG Model Output (Window = 1, Batch = 1, Loss=0.0936):**



While the optimal plots are displayed in this document, please feel free to view the other iterations with various parameter values in the "Iterations" directory.

Loss Values for a Variety of Window and Batch Sizes:

Batch=1	FNG	Closing	Window=1	FNG	Closing	Batch=2	FNG	Closing
Window=1	0.0936	0.0163	Batch=1	0.0936	0.0163	Window=1	0.0901	0.0115
Window=2	0.0984	0.0237	Batch=2	0.0901	0.0115	Window=2		0.0111
Window=3	0.0983	0.0237	Batch=3	0.0876	0.0285	Window=3		0.0126
Window=4	0.0983	0.0279	Batch=4	0.0853	0.0441	Window=4		
Window=5	0.0997	0.0279	Batch=5	0.0841	0.0570	Window=5		
Window=6	0.0991	0.0328	Batch=6	0.0829		Window=6		
Window=7	0.1008	0.0367	Batch=7	0.0824		Window=7		
Window=8	0.1040	0.0370	Batch=8	0.0831		Window=8		
Window=9	0.1061	0.0432	Batch=9	0.0826		Window=9		
Window=10	0.1055	0.0428	Batch=10	0.0823		Window=10		
			Batch=11	0.0833				
			Batch=15	0.0845				
			Batch=20	0.0872				
			Batch=50	0.1447				
			Batch=100	0.1840				
min	0.0936	0.0163	min	0.0823	0.0115	min	0.0901	0.0111
max	0.1061	0.0432	max	0.0936	0.0570	max	0.0901	0.0126