Predicting Bitcoin:
Time Stamped Results

Summary

TradeBot is software that predicts near term change in the price of cryptocurrencies. Using an ensemble of regressions, TradeBot can accurately issue a “buy” or “sell” command and consistently make profit. Since February 11, TradeBot has time stamped its predictions for 32 different strategy variants, which (as of time of writing, July 17) made an average return of 102%.

Methods and Verification

The predictions are numbers which usually range between 0 and 1, where greater than 1 means “buy” and less than 0 means “sell”. To verify the data in this memo independently, you need only to iterate through a given strategy’s predictions, record the buy and sell prices, and apply a 1% penalty for each transaction. This penalty is to account for illiquidity and actual transaction fees.

The time stamped files, as well as code to access and use them, are available at http://github.com/dhealy05/TimeStamp.

Strategy Variants

The strategy variants derive from different ways of pooling raw output. From our cohort of regressions, we partition 4 different time frames: short term, medium term, long term, and “full set”, which includes every regression. These time frames refer to the length of the period a given regression was trained on.

We also have 4 different prediction types: the raw prediction from the regression, a ‘normal’ prediction whereby the raw is adjusted to expected buy or sell thresholds, a ‘raw optimized’ prediction where we correct previous bias on a per regression basis for the raw prediction, and a ‘normal optimized’ prediction where we do the same for the normal. Note that these all come from the same value at any given moment, but the point at which they buy or sell may differ.

Lastly, we pool the predictions via either median or average. Hence, 4*4*2 = 32 variants.

The following chart shows the performance of each strategy; values show a wallet which started at 100. For context, a wallet which bought and held Bitcoin since the beginning of our data set would have a value of 283.

Performance By Time Frame and Prediction Type

Metric	Raw	Normal	Raw Optimized	Normal Optimized	Average
Short Term Average	198.19	181.1	204.13	273.74	214.29
Short Term Median	200.12	130.94	204.13	273.74	202.23
Medium Term Average	202.79	181.55	260.27	225.46	217.52
Medium Term Median	167.32	192.78	279.66	154.42	198.54
Long Term Average	161.02	234.73	218.23	226.1	210.02
Long Term Median	192.66	162.28	209.02	175.92	184.97
Full Set Average	200.3	286.94	260.05	265.31	253.15
Full Set Median	216.17	217.85	242.51	258.14	233.67
Total Average	192.32	198.52	234.75	231.6	214.3

A clear trend here is the significant outperformance of the Raw Optimized and Normal Optimized metrics versus their non-optimized counterparts, and of the Full Set Average and Median vs the other time frames.

Overall, the results are positive: we have made a significant average profit in a short period of time. However, most variants have lagged Bitcoin's parabolic advance. The most successful to date, Normal Full Set Average, has exceeded Bitcoin's price performance. Let's examine its trade history to get a sense of how the system trades successfully:

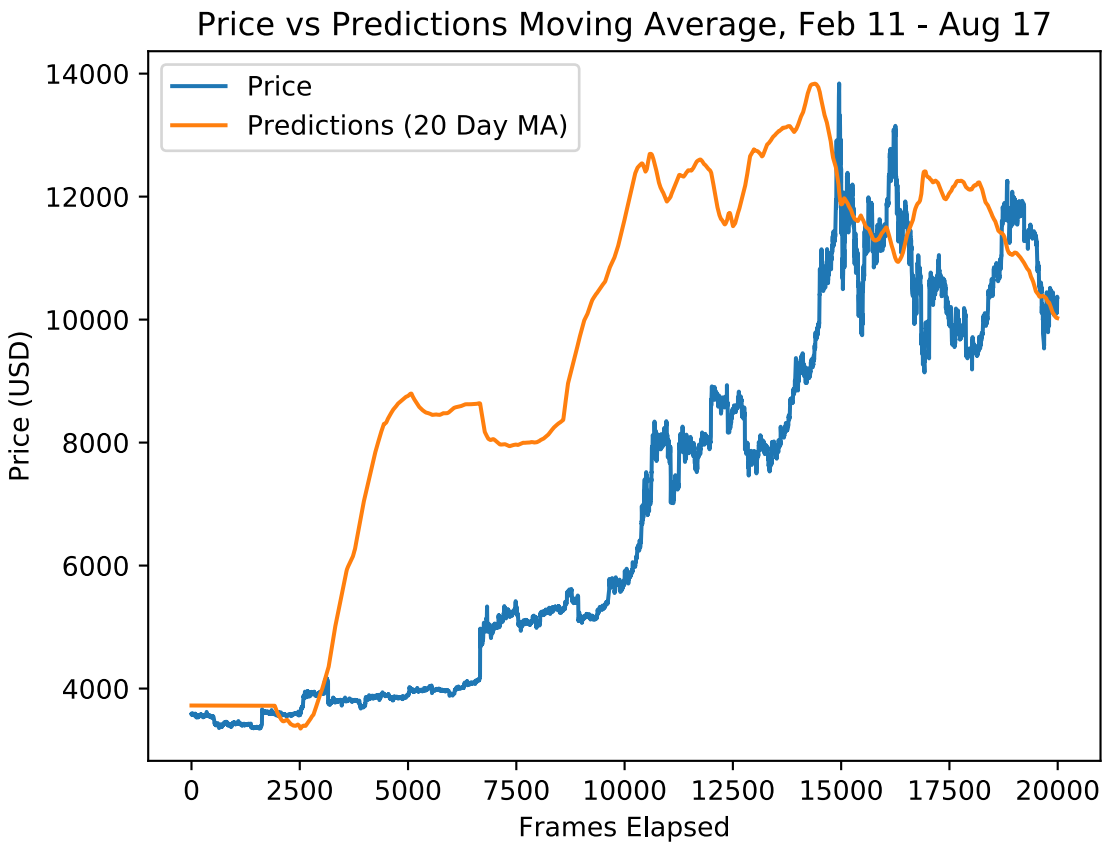
Trade	Price	Date
Buy	$3780	2/24
Sell	$4666	4/2
Buy	$5400	4/25
Sell	$6966	5/11
Buy	$7237	5/12
Sell	$7915	5/13
Buy	$7447	5/16

Trade	Price	Date
Sell	$8817	5/27
Buy	$7885	6/3
Sell	$11143	6/22
Buy	$11660	6/27
Sell	$12443	7/8
Buy	$9980	7/14
Sell	$10600	7/18

There is good and bad in the performance here; it missed some moves and bought higher after a sell several times, but consistently sold higher than it bought, and did not get trapped in a high buy before the recent crash. It's a good example of how the TradeBot system can produce patience and long term holds, and also fast, responsive trading, while maintaining a high level of profitability.

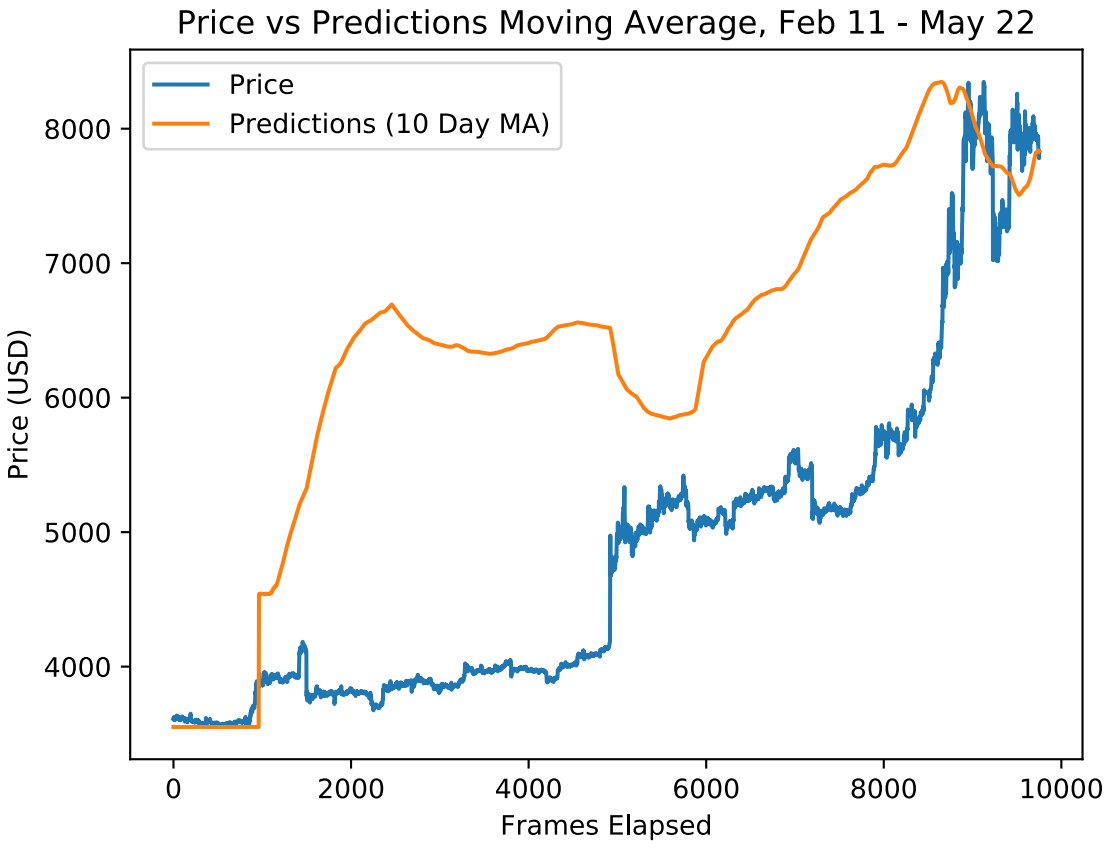
Prediction Moving Average—Drawing the Price Curve

A more visually striking way to assess TradeBot's performance is to look at the moving average for some of our strategies. Below is the 20 day moving average for the full set of Raw predictions, with predictions normalized to price:

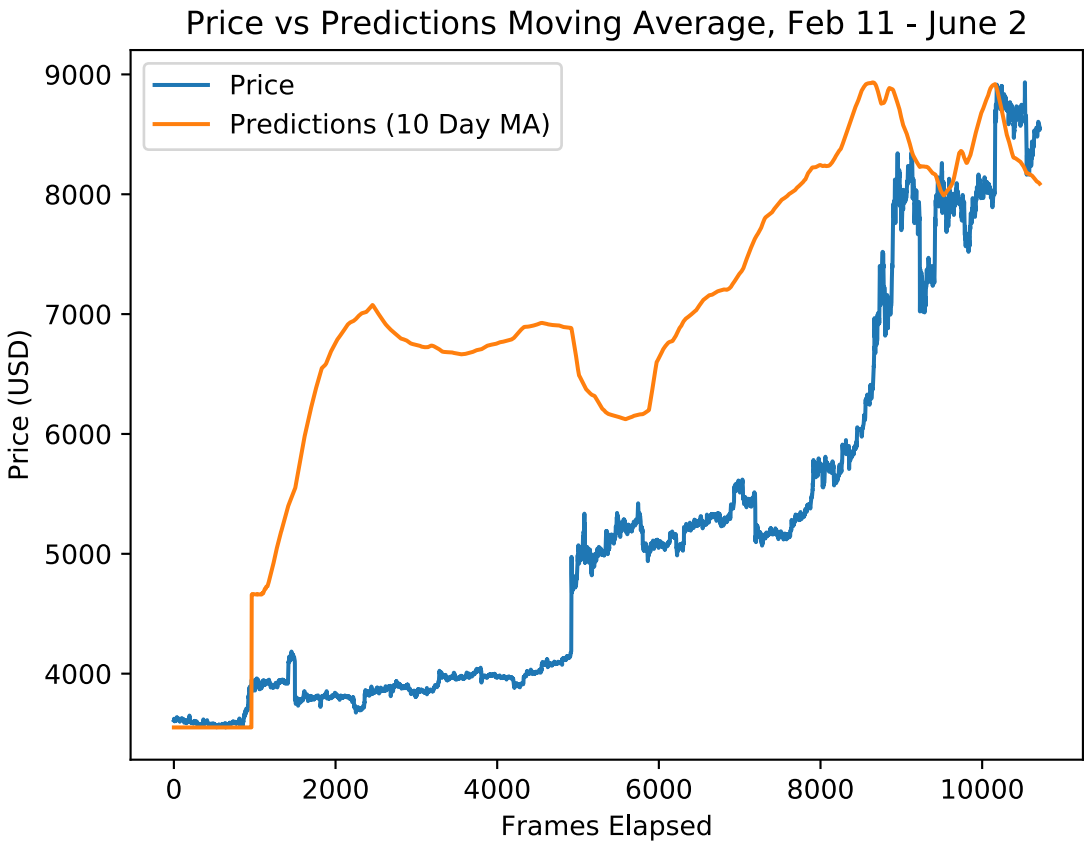


What we're looking for here as an indication of success is whether the direction of the moving average anticipates changes in the direction of price; the clear similarity between the curves is a good indicator that it does. The moving average peaks shortly before the first peak of the price, and begins rising before the second peak; it makes new highs before Bitcoin's price does the same and hits 13,800.

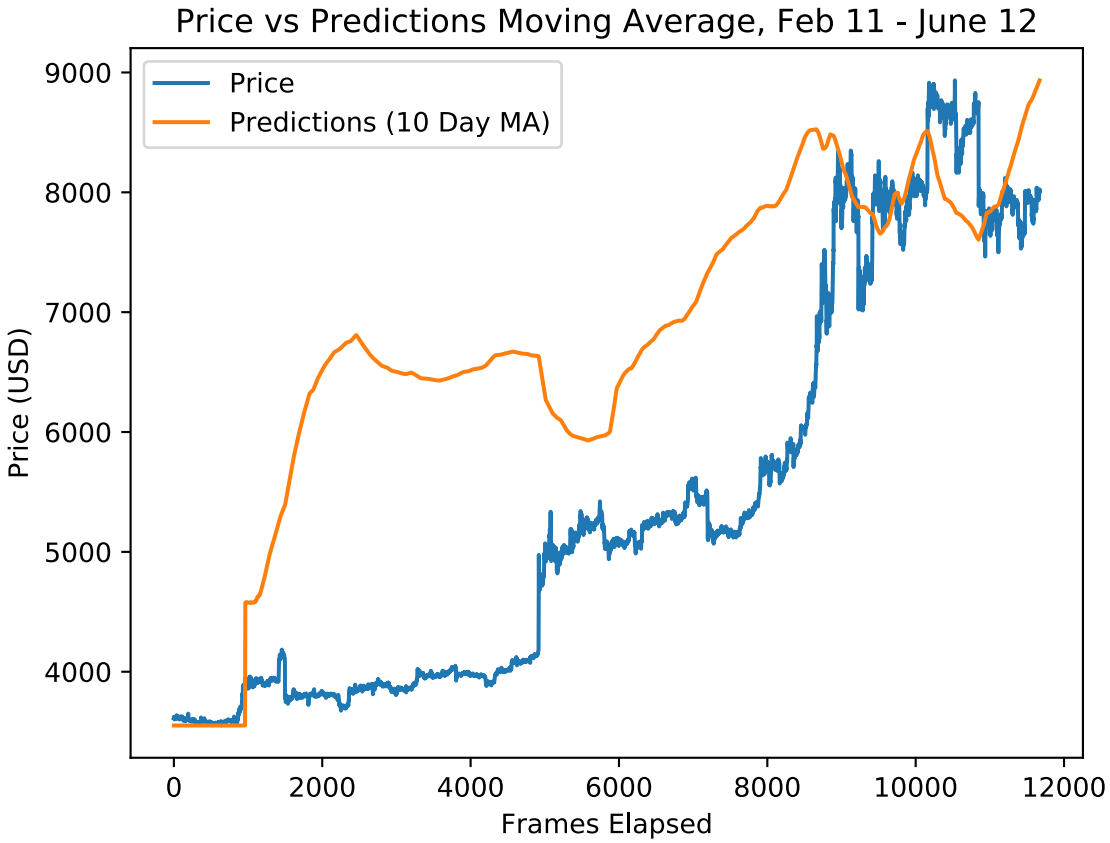
In the subsequent aftermath, the speed and intensity of the price movement makes it hard to see how effectively prediction is leading price. It is; but small movements up are followed by huge spikes in price, and small movements down by large troughs. That's because as we normalize the predictions to price, the graph can become distorted over time. Let's look at the evolution of a shorter, more descriptive moving average, the 10 day, over time; this will show us what the MA described at the time and then what actually happened:



As of May 22, MA was rising and price hovering…

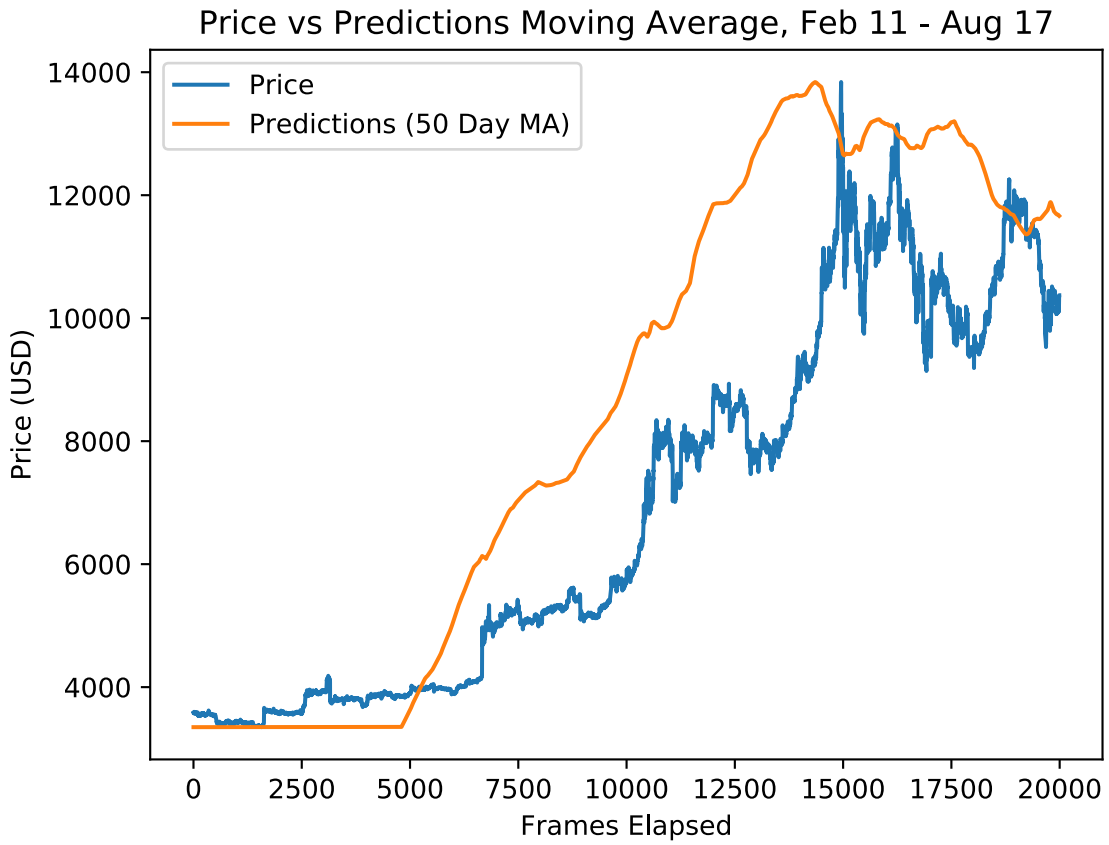


By June 2, 10 days later, price had shot up and predictions had correspondingly gone down. Would price follow?



Yes; price dropped to below 8000. At that point, MA began making new highs, which, as we now know, were followed by new highs in prices a few days later—first by going above 9000 and eventually all the way to 13800. To view a frame by frame progression of this sequence, use the “animate_ma” command in run_commands.py.

We’ve seen how 10 day and 20 day both give different descriptions; the final picture for 20 day is a clear prior approximation of price curve shape, and the progression of 10 day shows that price follows prediction. What about longer trends? Here’s the 50 day:



The 50 day, instead of showing various dips and rebounds along with price, progresses steadily upwards as price, ultimately, does too. It finally begins to peak as Bitcoin breaks 10,000; a few days later, Bitcoin peaks too. This would seem to validate the idea that longer moving averages make better long term trend indicators. It's particularly interesting that the 50 day makes a second, lower peak right before the price rebound to ~13000 and subsequent crash. It's not as descriptive of the smaller movements, but it predicted the "double top" structure accurately and in advance.

Subsequently, it rose a third and final time, corresponding to a small rise in price, before moving inversely to Bitcoin's price rise from 9,000 to 11,500. This inversion is two things: a failure, overall, to model the price rise, and an indication that the price rise was indeed overheated. Put differently: the model did not anticipate the strength of the move up, but correctly anticipated the strength of the move down. Exogenous shocks happening swiftly, namely the Yuan's recent devaluation against the dollar, may have rapidly changed the predicted outcome; but TradeBot responded appropriately to the change.

Conclusion

We have seen that TradeBot's time stamped variants accurately predicted the better part of Bitcoin's recent price movements; and their moving averages painted the Bitcoin price curve fairly well, in advance of it actually happening. These results speak to the validity of the TradeBot system.

There are two major areas of further research to pursue: prediction and action.

For predictions, we can do a deeper investigation of various control variables, until we have more clarity on what is driving Bitcoin's price and affecting our prediction results.

For actions, we have several possibilities. We can eliminate lower performing variants from the cohort; trade based on expected value of different prediction sets and regressions; and trade based on the rate change in moving averages.

This two sided approach will likely yield positive results for TradeBot in both short and long term.