



Trading Team 2

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Ben belke, William Ho, Kai

1 Given information

1.1 Nature of the data

We have tried to visualise how different given time intervals (i.e., 1 minute, 15 minutes, 60 minutes) affect the volatility of the prices and compare them. Using Bollinger band for visualisation, we have realised for shorter intervals we will get to observe the volatility and outbreak more (since the training period is affected by the time interval) but there will also be more noise compared to longer intervals.

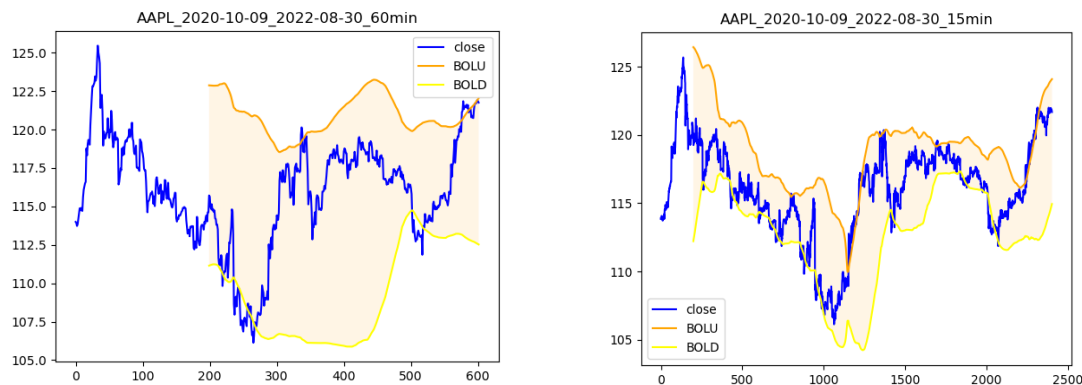


Figure 1 AAPL visualisation (15- and 60-minutes interval)

It is also known that the data will be tested on random stocks in top 500 American companies. Strategists in the latest Reuters poll expected the S&P 500 to continue to rise in 2023, and hit 4,408 by mid-year, according to the poll's median forecast. Therefore, we have an incentive to trade long more than short.

1.2 Base model

As a result, we have picked Larry Connors' %b Strategy (Bollinger Band) as our base model.

Reason for choosing this base model:

- Safety measurements – since we are only trading long, it eliminates the possibility that we will lose more than we have initially invested (\$5000) but also avoid the general safety measures that puts a limit to the trade once it hits a certain balance because we want to reach at least \$10,000 (since that's when the fees are charged less than 0.1%).
- Decent entry and closing consideration – we realised a lot of algorithm/method focus only on the entry positions but ignore the importance of when to close their positions, this base model is more balancing

2 Algorithm Development

2.1 Base model

Strategy

1. The close must be above the 200-day moving average.
2. The %b must be below 0 for the last two or three (consecutive) days.
3. If 1 and 2 are true, buy on the close.
4. Exit when the %b closes above 0.8.

2.2 Back-test base model

For the base model, out of the 14 stocks that have been tested, most of the stocks results lies between approximately -25% to 25% but lean towards losing money. The base model didn't beat buy and hold as the regression line is towards the Buy and Hold side. However, it performs better in 60 minutes compare to 15 minutes when compared to how much it loses to Buy and Hold.

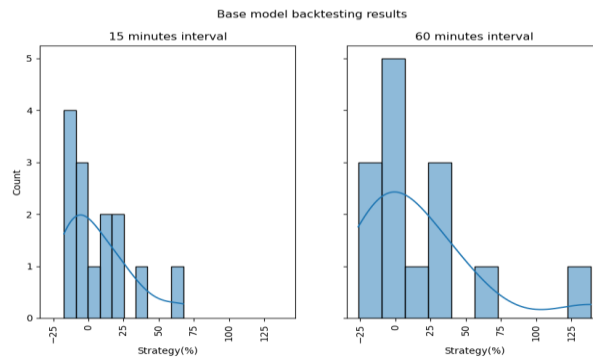


Figure 2 Base model back testing results

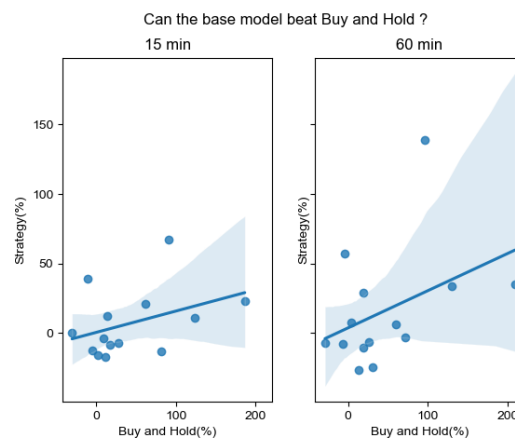


Figure 3 Did the base model beat Buy and Hold?

2.3 Implementing range trading

Since 60 mins perform better than 15 mins for our base model, we suspect that our model would trade better in low volatility environment. To improve the base model, we did some basic research to figure out what indicators can be best to distinguish ranging and trending market, we decided to use ADX.

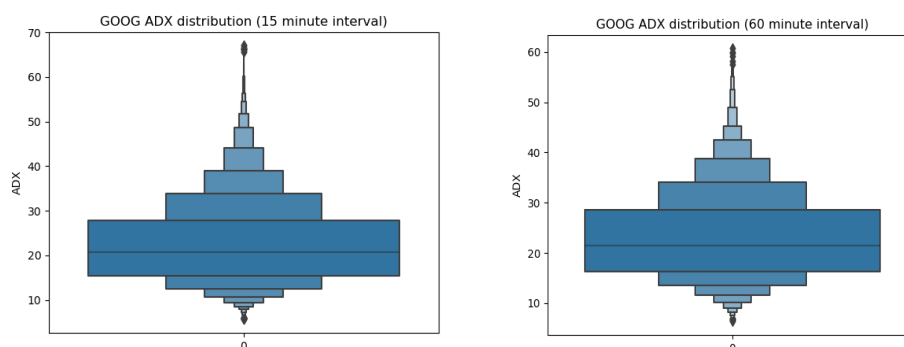


Figure 4 Distribution of ADX (GOOG)

After plotting out some graphs to show the distribution of ADX in stocks in general, we decided to use 20 as a threshold to distinguish between ranging and trending market and we only trade in ranging market since we are doing range trading.

2.4 Back-test adjusted model

The new model seems to be trading strangely for the 60 minutes interval. The stocks that profit in the 15 minutes interval seems to profit more than the stocks that profit in the 15 minutes interval in old model. Unfortunately, our new model didn't outperform the Buy and Hold Strategy.

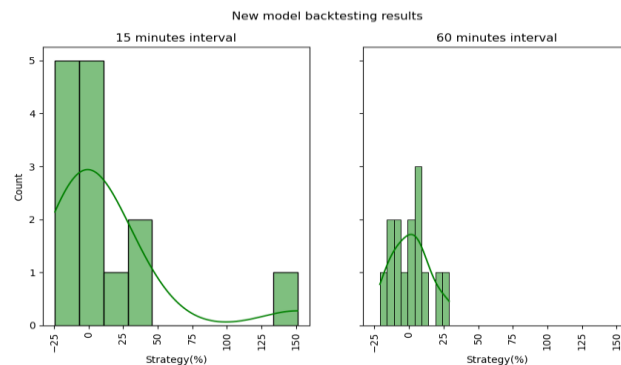


Figure 5 New model back testing results

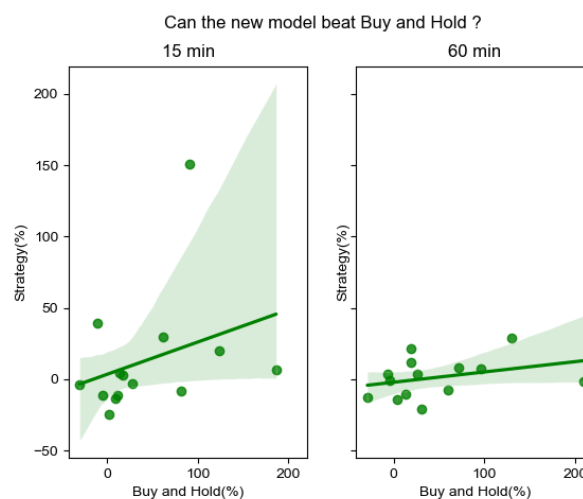


Figure 6 Did the new model beat Buy and Hold?

2.5 Compare new and old model

Although we run out of time on improving our model, we should still examine the difference between the old and new model.

2.5.1 Profit

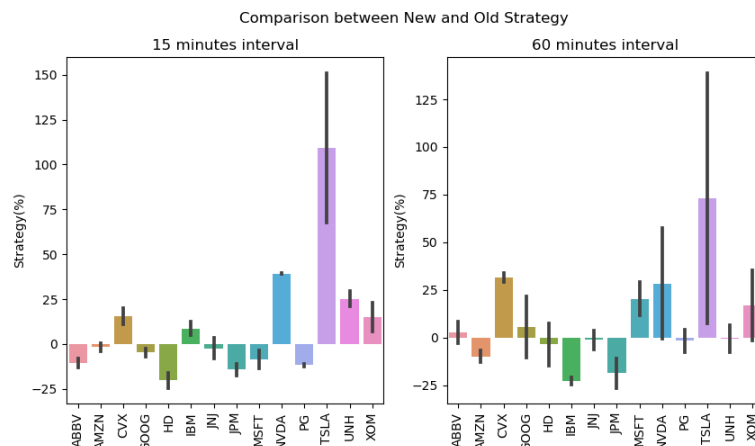


Figure 6 Comparison between new and old model's earning

First, we want to see the difference in profits between the old and new model. The black lines indicate the range between the new and old model and the bar indicates the mean between the 2 model. When comparing the graphs, CVX, JPM and NVDA got a similar positive mean result when comparing between 15 minutes interval and 60 minutes interval. In general, the new model doesn't have a significant impact on the trade in 15 minutes (interval) but do affect the 60 minutes (interval) a fair amount. The old model on 15 minutes median is -1.495, and the new median is 0.275. The old model on 60 minutes median is 1.815 but the new median is 1.495. Overall, New models perform better on 15 minutes but worse on 60 minutes, both models perform better in 60 minutes interval.

2.5.2 Sells

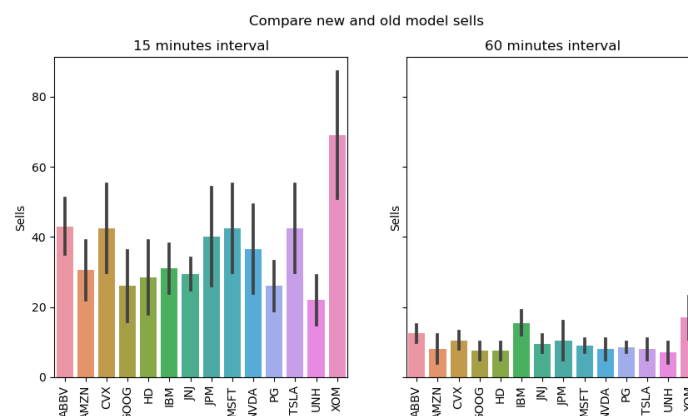


Figure 7 Comparison between new and old model's sells

We also want to look at how are sells and volatility related. This comparison shows that both models traded noticeably less in the 60 minutes interval and had little variance in comparison. More volatility more sells,

which is interesting consider our model only trade in ranging markets, this can be put into further investigation.

2.5.3 Standard deviation

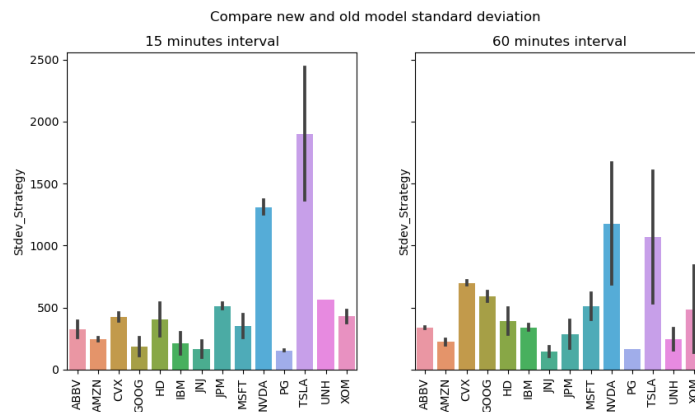


Figure 8 Comparison between new and old model's standard deviation

To interpret this graph, we are making the simple assumption that larger standard deviation means more volatility. Looking at CVX, JPM, NVDA and TSLA (stocks that earn profit significantly), we realised that they tend to have a larger standard deviation compared to other stocks especially for NVDA and TSLA, which means both models then to profit more when trading with stocks with more volatility.

2.5.4 Compare both models to Buy and Hold

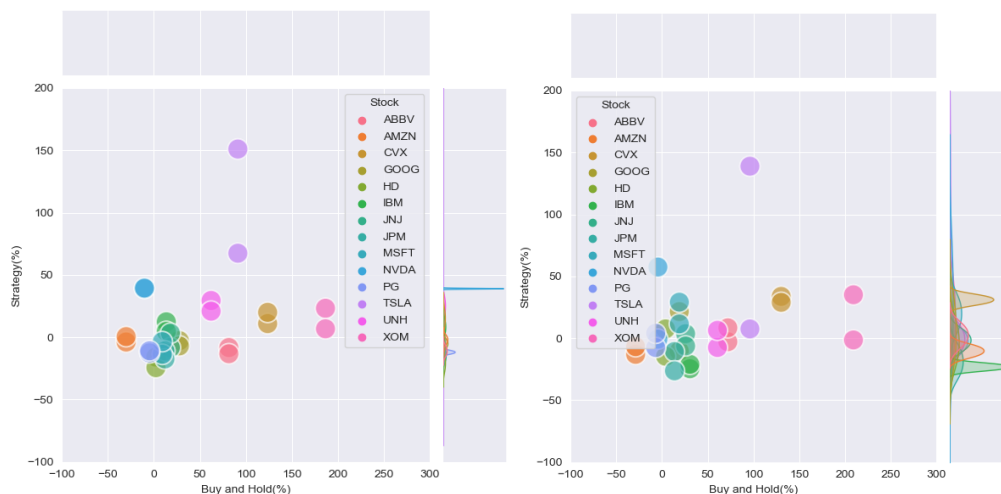


Figure 9 Overall stocks performance (Left: 15-minutes, right = 60-minutes)

Figure 8 shows that most stocks lie in between the $\pm 50\%$ area when include the Buy and Hold results (and by adjusting the dots' size). For a few stocks the difference between the old and new model is not significant (represented by a normal distribution).

In conclusion, our new model doesn't really make much of a difference besides affecting the 60 minutes profit and a higher variance in 15 minutes sells. If given more time we will do more analysis. Overall, we did not beat the Buy and Hold method, as the regression line is tilt towards Buy and Hold than our Strategies. It is worth notice that the difference between 15- and 60-minute regression line is quite similar.

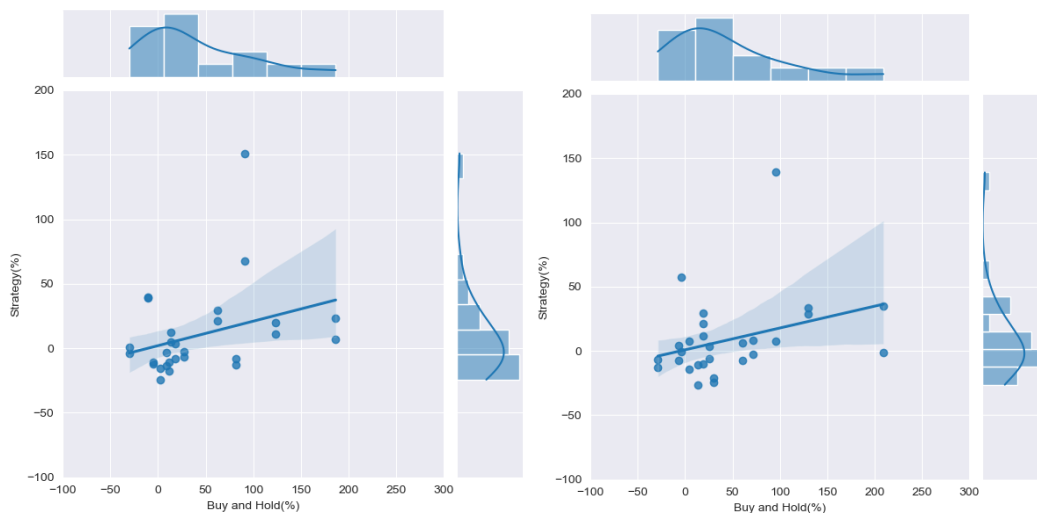


Figure 10 Overall performance against Buy and Hold (Left: 15-minutes, right = 60-minutes)

2.6 Improvement/Future Investigation

In general, our algorithm is still too simple. We might try Average True Range (ATR) and other indicators. We should also test on more sample stocks to verify our measurements.

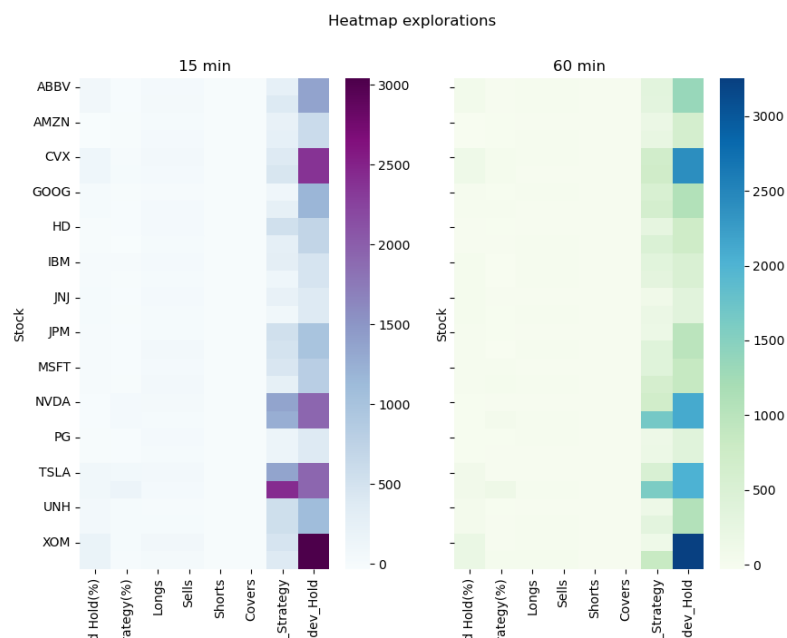


Figure 5 Heatmap exploration

Using heatmap, we can immediately spot any correlation between any parameters given in the back testing results. The possible areas that may be worth investigating are the relationships between standard deviation for Buy and Hold and the specific stocks CVX, XOM, NVDA, TSLA.

3 Limitations and Future investigation

3.1 Limitation - Time for running the algorithm/Crashes

Due to the enormous amount of data being stored in the 1-minute dataset, crashes are not uncommon. Due to the limitations of our machine/laptop, this limitation does stop us from further testing much larger dataset for our algorithm besides 15 minutes or 60 minutes interval.

3.2 Challenge – Backup model for previous failed machine learning model

This algorithm is a backup algorithm for a machine learning algorithm that failed to work. Unfortunately, we put a lot of time on that model, so we end up rushing this model to submit by deadline. More research and analysis can be done for improving the old model and have more detailed research on the adjustment.

4 References

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