Predicting Cryptocurrency Price Change Direction from Supply-Side Factors via Machine Learning Methods

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Abstract

Cryptocurrency prices are highly variable. Predicting changes in cryptocurrency price is a hugely important topic to investors and researchers, with much existing research on demand-side factors. The goal of this research project is to design and implement machine learning models to predict future cryptocurrency price change direction based primarily on supply-side factors. Different unsupervised machine learning techniques are used to build the predictive models. These techniques include K Nearest Neighbors (KNN), Artificial Neural Networks (ANN), Support Vector Machines (SVM), Naïve Bayesian Classifier, and Random Forest Classifier. A dataset of 10 daily supply-side metrics for three prominent cryptocurrencies (Bitcoin, Ethereum, and Litecoin) at four different time horizons (ranging from one day to 30 days) are used to build and test the machine learning models. The outputs of these models indicate the predicted direction of the price movement over the time horizon (i.e., whether the price would go up or down), not the magnitude of the movement. Experimental results show that predictions were very unreliable for the shorter time spans but very reliable for the longest time spans. The Artificial Neural Network and Random Forest classifiers consistently outperformed the other techniques and achieved a prediction accuracy of over 90% in most models and over 95% in the best models. Experimental results show also that there is no significant difference in predictability between the three prominent cryptocurrencies.

Introduction and Related Work

- Cryptocurrency prices are very volatile. They are worth over a trillion dollars total, and anyone who can predict when they will rise and when they will fall stands to make a lot of money.
- Many people have used machine learning techniques to try and predict the future movements of cryptocurrency prices, with varying degrees of success.
- Most prior research has focused on analyzing the price in a vacuum [1], correlating the price to other assets like the stock market [2], or trying to analyze demand [3].
- We propose instead to focus on supply-side factors. Cryptocurrencies are created in a process called “mining,” and the rate of success of the worldwide mining operation determines how many new coins are created. This has a direct effect on the price of the cryptocurrency, in classic supply/demand fashion.
- We intend to use several machine learning modeling techniques to see which ones are best suited to the problem.

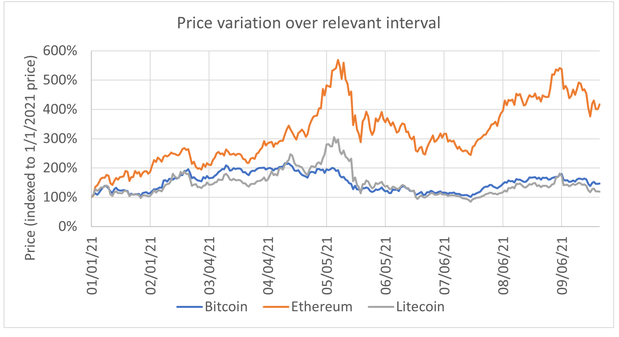
Proposed Methodology

Our methodology is:

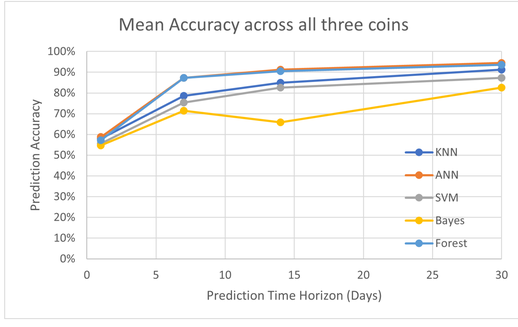
1. Collect several months-worth of daily price and supply data for a few different cryptocurrencies.
2. For each day, determine whether the price increased or decreased over the next several days.
3. Train classification models using different machine learning techniques to predict whether the price went up or down over the given number of days.
4. Evaluate each of the models.

- We chose ten different metrics to track, including daily price, and got 9 months of historical data from Coin Metrics [4].
- We chose three cryptocurrencies: Bitcoin, Ethereum, and Litecoin.
- We chose four different prediction intervals: 1 day, 7 days, 14 days, and 30 days.
- We chose five different machine learning techniques: K-Nearest Neighbors, Naïve Bayesian, Support Vector Machine, Random Forest, and Artificial Neural Net.
- In all, that gave us 60 (3*4*5=60) classifiers to create, train, and evaluate.

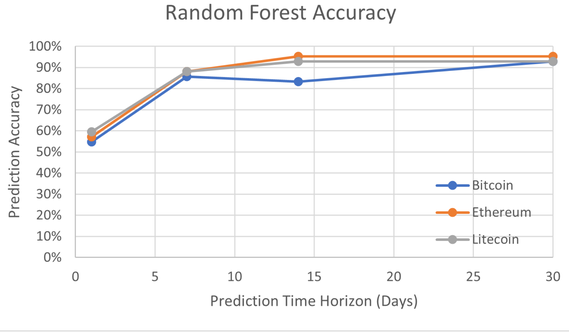
Experimental Results

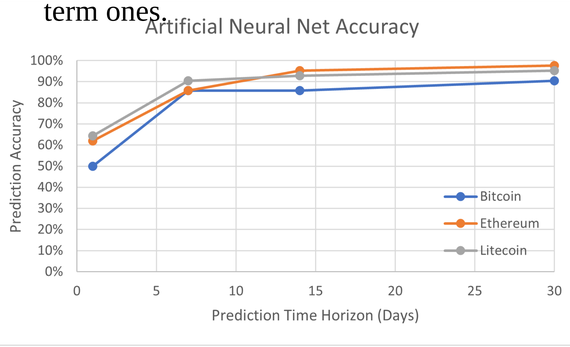


Over the months we were collecting data, Ethereum’s price fluctuated significantly. Bitcoin and Litecoin also fluctuated quite a bit.



Naïve Bayes Classifier was very weak. All classifiers were much better at predicting long-term trends than short-term ones.





Random Forest and Artificial Neural Net were the strongest classifiers, making correct predictions about the future direction of price change over 90% of the time in many cases.

Conclusion and Future Work

We conclude that

- It is possible to predict the future direction of cryptocurrency price in the medium-term with high confidence.
- Longer term predictions can be made much more confidently than shorter term ones.
- Artificial Neural Net and Random Forest techniques are well-suited to this problem space.

Ideas for future work include

- Predicting the magnitude of the price change, not just the direction
- Extending the prediction timespan
- Performing feature selection to determine which of the data features are most predictive.

References

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Acknowledgements

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