Adding Momentum Factors to Predict Price Change: A New Cryptocurrency Ranking Methodology

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**Abstract.** The cryptocurrency market is in its infancy and highly volatile. Existing ranking sites such as [www.coinmarketcap.com](http://www.coinmarketcap.com) and [www.coincap.io](http://www.coincap.io) are insufficient for traders because they focus only on current statistics and do not provide ranking by predictive statistics. A new beta website, [www.coingecko.com](http://www.coingecko.com), adds additional factors such as developer, community, and public interest to create a new composite ranking. But, this too is insufficient for traders because you cannot sort for short term opportunities. We propose adding calculated momentum factors such as period moving averages and Commodity Selection Index to develop an ARIMA model to predict price change based on past changes. To predict future price changes, the pricing time series data must be visualized, stationarized, and plotted for optimal parameters to build an ARIMA model. Once fitted, the ARIMA model can be used to predict future price changes for different times periods. The trader may then sort the marketplace by desired time period to find opportunities.

# 1 Introduction

The cryptocurrency market started in 2009 with the bitcoin network and in 2010, the first bitcoin exchange opened. As of September 7, 2017, there are 5,475 cryptocurrency exchanges according to Coin Market Cap with a total market capitalization of $164 billion for 867 currencies for a 2017 growth rate of 12 fold. By comparison, this market capitalization represents 20% of Apple’s market cap.

The market is growing exponentially. For instance, the number two cryptocurrency in market capitalization, Ethereum, grew 4,100% in eight months in 2017. The Standard and Poor’s 500 Index which is made up of 500 of the most widely traded US stocks took over 40 years to achieve the same kind of growth. The cryptocurrency market is currently in its infancy and to enable it to grow into maturity will require solid tools by which investors can rely upon.

With so much growth in an industry, many people want to get involved in this emerging market. But, the challenges for investors is navigating this young, volatile new market with limited tools for researching, trading, and transacting. Investing can be daunting for new and current investors. Only recently has mainstream financial institutions like Fidelity [1] begun to give its customers the ability to add cryptocurrencies to their portfolios. Besides continual development of the cryptocurrency products, additional marketplace tools need to be developed to support this growing marketplace.

A good place for new investors to learn about cryptocurrencies is to visit [www.coinmarketcap.com](http://www.coinmarketcap.com) website to see a ranking of cryptocurrencies by market capitalization. Market capitalization is the price of the currency times the number of currencies in circulation. This metric gives an investor a relative size of the market, see Table 1 for an example ranking of cryptocurrencies by market capitalization.

**Table 1.** Coin Market Cap top five ranking as of September 16, 2017.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Rank | Name | Market Cap (million) | Price per Coin | Max Supply (million) |
| 1 | Bitcoin | $59,879 | $3,613.67 | 21,000 |
| 2 | Ethereum | $23,309 | $246.24 | - |
| 3 | Bitcoin Cash | $7,397 | $445.98 | 21,000 |
| 4 | Ripple | $6,856 | $0.18 | 100,000,000 |
| 5 | Litecoin | $2,5448 | $48.12 | 84,000 |

Investors researching currencies can only sort by backwards looking statistics. If you want to research future trends and momentum, you have to utilize a trading tool to analyze one currency at a time. In addition, traders will follow currencies on Twitter and Reddit to gauge user and developer sentiment adding this knowledge to collectively try and predict future pricing. This labor intensive research approach makes it difficult to survey more than a handful of currencies for buy and sell opportunities.

A beta website at [www.coingecko.com](http://www.coingecko.com) incorporates additional factors to market capitalization such as liquidity, developer, community, and public interest to determine ranking. By incorporating non-financial factors and applying a custom algorithm, a different ranking results for rank three through five compared to straight market capitalization, see Table 2. But this Total Score ranking is not clear on what it means for future results. Does a high score mean the price will go up or down in the next 30 days?

**Table 2.** Coin Gecko top five ranking as of September 16, 2017.

|  |  |  |  |
| --- | --- | --- | --- |
| Rank | Name | Total Score | Max Supply (million) |
| 1 | Bitcoin | 91% | 21,000 |
| 2 | Ethereum | 83% | - |
| 3 | Litecoin | 77% | 84,000 |
| 4 | Monero | 70% | - |
| 5 | Ripple | 70% | 100,000,000 |

# 2 Problem

Current ranking of cryptocurrencies in the marketplace do not address the needs of traders who are researching buy and sell opportunities. By adding momentum factors, a time series ARIMA model can be fitted to predict future price changes. The trader may then sort a list of cryptocurrencies by relative price change for different time periods to view aggregate investment opportunities.

# 3 Background

This section will be used to document scholarly research on the following items:

* equity price prediction,
* momentum factors predicting price movement,
* fitting ARIMA model to time series data.

# 4 Approach

The approach to solving the problem of providing a new ranking system for traders is to predict future price changes by period. Predicting future price changes will be made by a fitted ARIMA (autoregressive integrated moving average) model to time series data of past performance. Using a time series to model these data is common and analysts regularly use time series to discover trends and other patterns occurring in their data.

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st performance data will be composed of data obtained from websites and calculated data. Website data will include exchange and social media data from sites such as Coin Market Cap, Coin Cap, and Twitter. Calculated data will be made for new momentum factors.

Calculated data will come from coded momentum financial indicators. These new factors will be analyzed to determine their predictive effect. Calculators that provide low predictive power will be removed.

The scope of the problem will be limited at first to a short time period with only one currency. This approach allows for faster iteration on the problem to develop the right techniques to converge on a solution. Once a solution is discovered, then additional data will be incorporated and solution revised. Next, additional currencies will be analyzed until all currencies are incorporated.

The quantitative forecasting considers historical data of a variable to forecast future values of the variable. A five-step process will be utilized to predict changes in price.

1. Visualize the time series
2. Stationarize the time series
3. Plot ACF/PACF charts and find optimal parameters
4. Build the ARIMA model
5. Make predictions

A model will be trained on training data and then tested against test data to measure the mean squared errors (MSE). Adjustments to the algorithm will be made to lower the MSE. Once an optimal model is obtained, future price changes will be calculated. As future price changes are added for a collection of currencies, a ranking or ordering method will be created and evaluated. The price change prediction model will require retraining as new data is acquired and calculated.

The work to solve the problem will be performed with Python, R, and database tools along with machine learning toolkits such as Scikit-Learn. In addition, a console application will be developed to tease out a new ranking API. The ranking results will be analyzed by industry veterans for value. Feedback from the industry veterans will allow fine tuning of the ranking algorithm.

# 5 Ethics

While there is a lot of upside to the evolving concept of cryptocurrency there is also a good amount of downside. At the moment, there are numerous vulnerabilities and complex issues that must be addressed before the market will be welcomed by the vast majority. Most of these issue trace back to the pseudo, anonymous nature of their transactions. This feature by design, makes it very difficult for society to accept and govern. Due to this lack of governance, many believe cryptocurrencies will inevitably be abused.

The following questions will be addressed in our research:

* What are the positives and negatives of cryptocurrencies?
* What is the regulated landscape of cryptocurrencies?
* What are the risks of investing in this landscape?
* What are the risks of financial anonymity on society?
* What are the ethical obligations on the cryptocurrency community?

# 6 Analysis

Notes:

* Exploratory data analysis.
* Algorithm development

# 7 Results

Notes:

* Application of algorithm
* Feedback from community if appropriate

# 8 Future Work

Notes:

* Use new ranking methodology to determine cryptocurrencies that should be considered for various indices.

# References

1. Fidelity Labs Tests Digital Asset Wallet On Fidelity.com. August, 09, 2017. <https://www.fidelity.com/about-fidelity/corporate/fidelity-labs-tests-digital-asset-wallet-on-fidelity.com>

2. McNaly, Sean: Predicting the price of Bitcoin using Machine Learning. Naional College of Ireland (2016)

3. Soulas, Eleftherios, Shasha, Dennis: Online Machine Learning Algorithms For Currency Exchange Prediction: NYU CS Technical Report TR-2013-953 (2013)

# Appendix: Plan of Milestones

|  |  |  |
| --- | --- | --- |
| **Date** | **Event** | **Goal** |
| 31-Aug | Webinar |  |
| *15-Sep* | *1630 Call with Rob* | *Iniital meeting with 1st sponsor.* |
| 17-Sep | 1900 CST group call |  |
| 18-Sep | 1900 CST group call |  |
| *19-Sep* | *1630 Call with Matteo* | *Iniital meeting with 2nd sponsor.* |
| **20-Sep** | **Beta Draft due\*** |  |
| 24-Sep | 1900 CST group call |  |
| *26-Sep* | *Café Talk 1* | *Receive feedback from others in the* |
| *27-Sep* | *Café Talk 1* | *class regarding the beta draft. Must attend at* |
| *28-Sep* | *Café Talk 1* | *least one of the meetings* |
| *Early Oct* | *Meet with advisors* |  |
| 1-Oct | 1900 CST group call |  |
| 8-Oct | 1900 CST group call |  |
| *:ate Oct* | *Meet with advisors* |  |
| 15-Oct | 1900 CST group call | *Combine notes on 1st Draft* |
| 22-Oct | 1900 CST group call | *Compile the second draft ==> submit* |
| **25-Oct** | **1st Paper Draft Due** |  |
| 29-Oct | 1900 CST group call |  |
| *31-Oct* | *Café Talk 2* | *Receive feedback from others in the* |
| *1-Nov* | *Café Talk 3* | *class regarding the beta draft. Must attend at* |
| *2-Nov* | *Café Talk 4* | *least one of the meetings* |
| *Early Nov* | *Meet with advisors* |  |
| 5-Nov | 1900 CST group call |  |
| 21-Nov | 1900 CST group call |  |
| *Late Nov* | *Meet with advisors* |  |
| 19-Nov | 1900 CST group call |  |
| 26-Nov | 1900 CST group call |  |
| *Early Dec* | *Meet with advisors* |  |
| 2-Dec | 1900 CST group call | *Combine notes on 2nd Draft* |
| 10-Dec | 1900 CST group call | *Compile the second draft ==> submit* |
| 15-Dec | **Second Paper Draft Due** | *(points count towards Capstone B [5%]) 15-20 pages* |

# History of Feedback

### September 12, 2017

Comments on your proposal - first a formatting comment: please follow the format exactly.  Do not change it.  For example, there is no blank line between paragraphs.

Question on your proposal: What is the problem you are solving? In addition, how do you measure success? Why is it not trivial to create an index? Specifically, how would it be created?  How would it be used?

In writing, do not state your opinions…eg do not use “Our belief…” Write neutral.  This is not an opinion piece.

The concept is good, but it’s not clear why this is a capstone project.  Indexes are created all the time. Why is it hard? How is this more than a simple exercise? How do you assess success?   You are missing all of the problem details and measures of success.

Please add the problem and additional details.